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INTRODUCTION

THE RESPONSE to the original edition of *The B.B.C. Naturalist* book has encouraged me to prepare this second volume as a companion to the first. Clearly there were many viewers and listeners who wanted to have, in permanent form, a souvenir of some of our broadcasts; and to meet their desires I have again tried to make as wide and varied a selection as possible. To do so has made additional demands on my naturalist and scientist friends, whose lives are already full—and sometimes over full—with field-work and research and broadcasting, and I must begin by thanking them for their contributions. I sincerely hope the pleasure they give will compensate for my importunity.

The previous *B.B.C. Naturalist* confined itself to the wild life of the United Kingdom. In this volume I have followed the present tendency of our broadcast programmes and strayed much further afield. Nowadays we are all armchair travellers; at the flick of a switch we can join Armand and Michaela Denis in Africa, or dive beneath the Indian Ocean with Hans and Lotte Hass, or follow in the footsteps of Darwin with Peter Scott and visit the remote Galapagos Islands, and on our return to the South American mainland find David Attenborough waiting there to show us new marvels. Against the problems and difficulties of our time we must set this wonderful gift of conjuring up the riches of the whole natural world for our enjoyment. And I have tried to reflect that wealth, in its abundance and diversity, in this book; here are corncrakes and coral, hedgehogs and ladybirds, squids and bats and elephants, and many more, caught for us in the words and pictures of those who have taught us to admire and understand something of the wild life that, by its magic, draws men to long journeys and patient vigils and lifelong study. We can all be naturalists in some degree and our reward is no mean one. I hope this book will add to the pleasures that many have already discovered for themselves, and will point the way for those who still have the first exciting discovery to make.

Desmond Hawkins.

Crowned cranes in the Belgian Congo



*Hans and Lotte Hass – diving to adventure
Each shark has its own territory in the reef*

Adventure Under The Sea *Hans Hass*

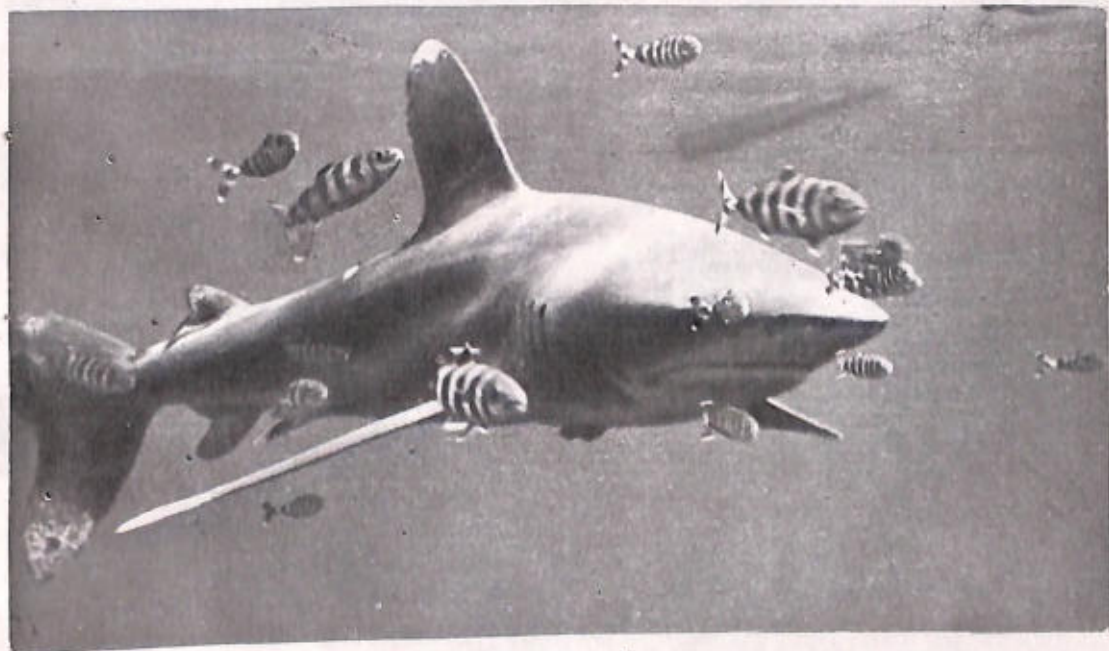
A CORAL REEF is certainly one of the world's great wonders. It is a flower garden of stone growing like a wall or like a tower from the depths, and filled with the most bewildering and most colourful varieties of life.

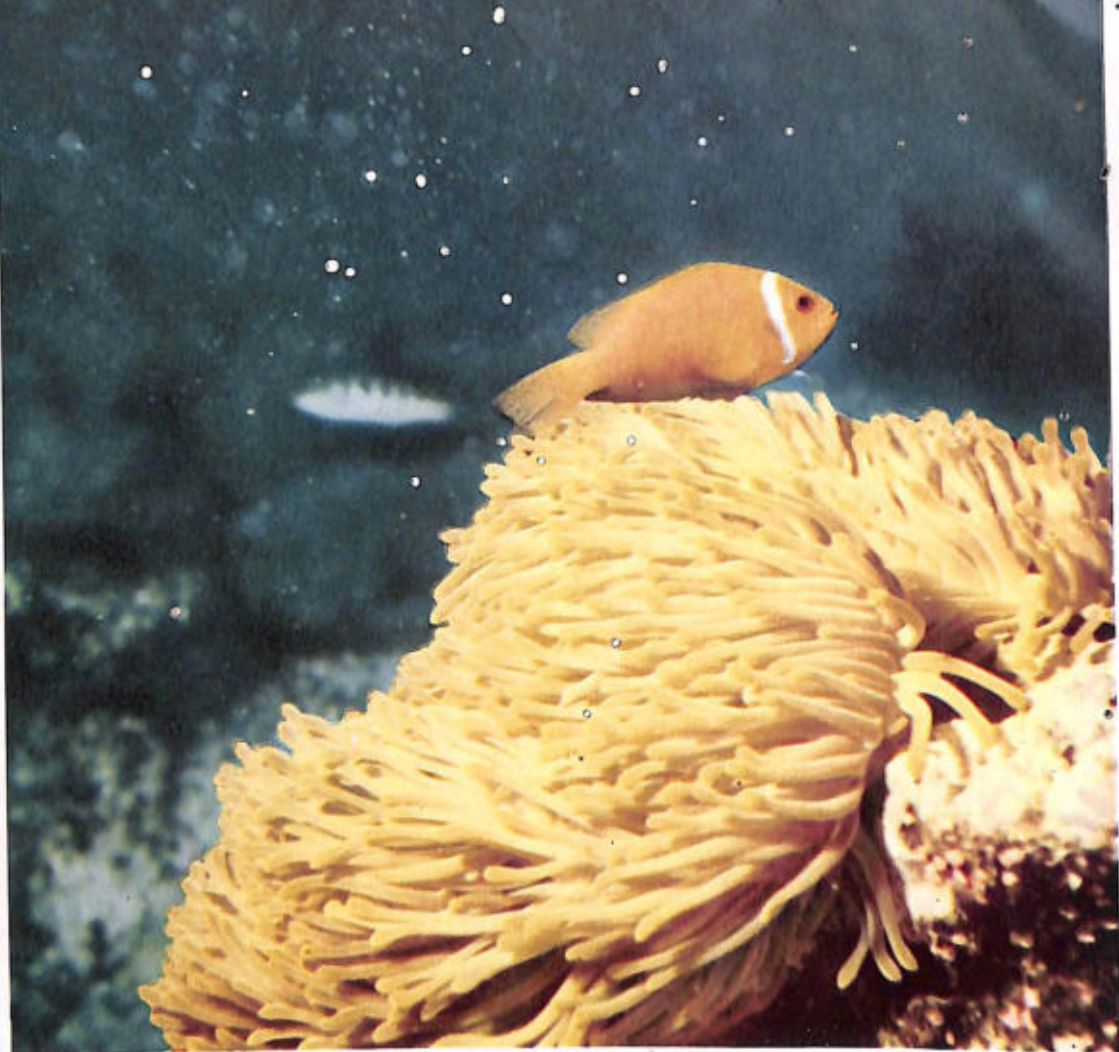
In a coral reef you find ample proof of the rule that in the tropics you may more easily encounter at a place ten different species than ten individuals of the same species. Living conditions are very favourable, and so many forms are able to develop and survive in their struggle for existence.

The colours of a coral reef are very beautiful, especially in the shallow region down to sixty feet, where still some of the red and yellow light of the sun's rays penetrate. However, the red as a colour is rare. Most corals are greenish, brown, bluish or yellow. But some of the coral fish – swimming among the corals like butterflies – do show very bright red patterns. If you dive deeper the appearance of the reef becomes more and more blue. This is because the water filters the sunlight. If you take down lamps and put artificial light on a reef the colours get even brighter the deeper you go. In about 120 feet most of the coral growth stops, and further down there is a certain similarity to the sea bottom in the colder seas.

People often ask, 'What sounds do you get down there? Do you hear underwater noises from fish, or perhaps crayfish?'

I think our human ear is not too well adapted to hear all the many mechanical vibrations under water. Some fish emit sounds which we *can* hear, and we can hear





The clown fish can live unharmed among the tentacles of an anemone

some of the *movements* of the fish as well. If a fish swarm is scared and all the fish dart away at the same time, this is clearly audible under water. We believe, however, that fish can sense many of these water vibrations. This applies also, and especially, to sharks. If, for example, we go under water and explore a new reef in the way I have been describing, it is only a very short time before the sharks turn up. I am convinced they can sense the movements or noises of a diver from a distance of at least 1,000 feet – probably even more.

During our work in the Indian Ocean we have seen more sharks than ever before. They always turned up in the first two minutes of our dives. They're like the police! They come and inspect you first and then they lose interest.

I have made sharks a main subject of my study during the last twenty years, and I have encountered most of the really dangerous varieties. I have learned to be cautious and never to take anything for granted under the sea. There is always a certain risk. But in general sharks are much less dangerous than people think. The important

thing is to know how to behave when you meet them. One must not show fear or dart away sharply when sharks come into view. That would only attract them – just as a cat is attracted by something being pulled along on a string. You must keep quiet and if the shark really heads towards you – then you can scare him off by swimming *towards* him yourself. He is not used to such a procedure, and turns and is frightened off! Also, of course, we carry a stick with us – about the size of a broomstick, with an iron point. This is a handy weapon in case a shark gets really fresh, which happens only once in a hundred cases. You see, each shark has its own territory in the reef, and if you invade its territory it may try to frighten you off.

The great value of aqualung diving for the naturalist is that he can watch and collect on the spot. He can even experiment on the sea bottom itself. In my research ship, the *Xarifa*, I always have a number of distinguished scientists, who join our ship for a period in order to conduct the particular experiments in which they are interested. For example Dr. Irenaeus Eibl-Eibesfeld from the Max Planck Institut carried out several interesting experiments underwater when the *Xarifa* was in the Nicobar Islands. He studied the relation of a kind of small fish, called Pomacentrids, or clown fish, to sea anemones. These fish live among the tentacles of the anemone, and are not harmed, although all other fish are devoured by it. In the Nicobars we found several different kinds of anemones, each with a special species of clown fish living with it. Now Eibl was interested in how its own anemone and the fish can recognise each other. So he carried out experiments by exchanging fish right on the sea bottom. He also studied the behaviour of a group of fish which he called mouth-cleaners, or cleaner fish, which clean the mouths and bodies of other fish by eating scraps of lodged food and parasites. He found out that these cleaner fish reside at a

Our home, our diving base and our research laboratory – the Xarifa





A visit to the small cleaner-fish - gills open invitingly



Flower garden of stone - a coral reef

certain coral reef and that fish which want to be cleaned will visit them there and will invite their attention by a special movement. For instance, they will open their gills, and in response the cleaner fish will dart out from the coral and start to clean these fish of parasites. If the cleaners are inside the big fish's mouth, and the fish wants suddenly to swim away for some reason, he will first give a signal by a mouth movement, allowing the cleaners to leave quickly, and only after that will he shut his mouth.

Gradually, by such close and patient study, we are persuading the ocean to give up some of its secrets. But do not forget that two-thirds of our planet are under water and our knowledge of marine life is only at the beginning. That is why each dive I make is for me a fascinating adventure into a world of unsolved mysteries.

By Heather Tracks *Walter Flesher*

OF ALL the different kinds of country there are for man's delight – the fields, the woodlands, the riverside – my favourite is away up on the tops of the uncultivated moorlands where the only signs of the hand of man that you are likely to see are the miles of dry-stone walls built anything over a hundred years ago, or maybe a row of grouse shooting butts built in more recent years.

I spend most of my time on Rombalds Moor in Yorkshire, for I am a gamekeeper there. It is a typical Yorkshire Dales grouse moor and forms part of the watershed line between Wharfedale and Airedale, with a varying contour of a thousand to twelve hundred and fifty feet, and with a number of deep ravines down which the moorland streams go tinkling merrily to the river in the valley bottom. And what a grand feeling it is to be over a thousand feet up and looking down to where the river Wharfe winds its hurried way down the dale, whilst above you skylarks sing cheerily as they soar heavenwards.

Hen grouse are very close sitters





Moorland streams go tinkling merrily to the river

Now, I tramp this moor every day all through the year, in the depth of winter when the gales lash you like a flail and toss you about like a sailing-boat on an angry sea, in spring and summer when the elements are more placid, and I never lose my love of it in any of its moods; but perhaps on a sunny autumn day, with the brown, bronze and gold of the fading bracken, the pale purple of the waning heather bloom and the vivid greens of the mosses and ferns all blending together in a delightful colour scheme – perhaps then it is more satisfying and rewarding than at any other time, and I often sit and enjoy these autumn evenings with the breeze blowing in my face and through my hair, a breeze that is clean, fresh, invigorating and as satisfying as good wine.

Rombalds Moor has much to offer to the nature lover. All through the year the sturdy red grouse are to be seen and heard on every hand, the cocks all the while bidding you to go-bak! go-bak! go-bak! and away they go, sweeping over the heather if you approach too close!

At different times of the year over thirty other species of birds are to be met with, some of them quite common, others rarer and perhaps more interesting.



The plaintive call of the curlew echoes the solitude of the high fells

The nightjar rests on the bare ground at the end of a bracken patch, where it squats all day perfectly camouflaged; then, in the dusk of evening, it starts its aerial evolutions, taking its fill of the night-flying insects on which it lives, and uttering its churring call which has a peculiarity all its own.

The short eared owls make their rude nests in any patch of big rough heather. Unlike the other species of owls the short eared owls hunt for a living in daylight and take heavy toll of voles, field mice and rats, especially when they have a family of four or five hungry nestlings to feed. They start incubation from the laying of the first egg. Thus, by the time the last egg has hatched out, the eldest chick may be ten or twelve days old.

Our smallest hawk, the merlin, also nests in rough heather. This high-spirited little falcon is a beautiful bird. It feeds mainly on small birds, like pipits, finches, and thrushes, which are taken on the wing. During the period of incubation the hen sits very close whilst the cock does all the foraging for food, and he generally feathers his kills on one particular stone or mound before calling his mate for her feed with his rasping quce-quce-quce-quce-quce call. All around this plucking stone I find



The cock merlin does all the foraging for food

quite an accumulation of feathers, beaks and legs. I once watched a merlin fly a jack snipe down in the twistiest, most amazing piece of bird flight I have ever seen; a truly thrilling sight.

On a ledge high up a crag-side the kestrel nests, and the foot of the crag is littered with pellets or castings composed of beetle-wing castings and the fur and bones of small rodents, the undigested portion of the kestrel's food. I never cease to marvel at the ability of these wind-hover hawks to hang motionless in mid-air in the strongest winds, a really wonderful power.

In March the curlews return to the moors from their winter quarters on the estuaries. Great favourites of mine, these curlews. What a joy it is to hear their plaintive call which somehow seems so appropriate to the solitude of the high fells. Every year thirty to forty pairs nest on this moor, and with them comes another of my special favourites – the golden plover, in about the same numbers.

In early April come the first of our spring migrants from overseas, wheatears, to nest in the wall bottoms or in disused rabbit burrows, and ring ouzels which build their nests amongst the rocky outcrops of millstone grit. Before the end of the month several other species arrive, amongst which are the cuckoos. On the moors the chief victim of the parasitic cuckoo is the meadow pipit. I once found nine meadow pipit's nests in the space of some two hundred yards on a bank side, each with a cuckoo's egg in it, and I have also found many a cuckoo egg, or young one, in the nests of hedge sparrows, chaffinches and linnets in the gorse bushes along the edges of the moor.

On the higher ground there are two or three swampy patches quick with all manner of swamp life; snails, water-beetles, newts and the like. In these swamps the frogs come to hibernate for the winter, and when they emerge in spring they spawn in the small ponds. Dunlin, snipe and the noisy redshank make their nests around

these boggy places, and occasionally a pair of sandpipers. For the botanist these swamps are happy hunting grounds with their variety of mosses, ferns, and water plants. The two that interest me most are sundew, and butterwort, both of them insectivorous.

In a fold of the hills there is a dam, or tarn, where teal, widgeon, mallard and other wildfowl love to sport in the sunshine. The mallard drakes are full of colour with their bright yellow beaks, glossy green heads and necks, with a ring of white, and the body a mixture of deep chestnut, greenish purple and greyish white. Above them gaily coloured dragonflies dart about like fairy aeroplanes; sheer beauty in such a setting.

The drier stretches of the moor are of course mainly covered with common ling – or heather – intersected with patches of bell heather, cranberry, bilberry and bracken. Rabbits like the bracken patches as they afford good cover. Hares too, often make their forms in the bracken, and I often put them up from rush-beds as well.

The most anxious months for a moorland gamekeeper are April and May, for these are the months in which grouse breed. Hen grouse are very close sitters during incubation, and a few years ago when some careless picnickers started a big fire on the moor in mid-May several were roasted alive on their eggs, so tight do they sit. On the other hand, they react badly to sudden disturbance and if flushed suddenly by a prowling dog or being almost walked on by careless ramblers, they invariably desert the eggs; but once the young are hatched they are devoted parents and very bold in protection of the young.

Whilst sitting they are easy picking for stoats and weasels, so the good keeper has to see that his moor is kept as clear as possible of both these bloodthirsty little creatures.

A bigger menace still at nesting time are foxes, and although Reynard is given no respite on a grouse moor, sometimes a breed will move in overnight from some other area and, unless they are immediately dealt with, many hen grouse and their clutches of eggs will be ravaged and eaten. Crafty and cunning, these hill foxes are terrible killers when they have a litter of cubs to feed. So as a keeper I am more on the alert than ever for fires, foxes, and folks during grouse nesting time.

Some of the town-folks who come to the moors at week-ends are a bit of a problem. Egg-collecting schoolboys have to be firmly dealt with and discouraged. I am reminded of a mixed party of adults and children that I once met crossing the moor: four of the children were each carrying a grouse chick whilst one of the womenfolk had four or five in a paper carrier bag.

'We've found 'em, Mister, what are they?' piped one small boy. I told him they were grouse chicks and that we must go back and put them down near to where they had picked them up, and then the old birds would find them again. They were reluctant to do this, but I persuaded them, although there were tears from two of the children as they saw the chicks scuttle away into the heather. They apparently thought they could take them home and rear them on breadcrumbs and scraps although neither the grown-ups nor the children had the slightest idea what they were.



Another of my special favourites – the golden plover



Look along the dry-stone walls of the moors for an early spring visitor – the wheatear

Ignorance is often cruel where it attempts to be kind. I tried to give them a short nature lesson as I walked with them for a while, and I think they learned a little from it. I suggested that if they wanted to collect things they should start with wild flowers or moths and butterflies and I caught for them a couple of oak eggars and an Emperor moth as well as two or three little green hair-streak butterflies, for we get quite a variety of moths and butterflies, even on the moor tops. And when I showed them a couple of brown lizards sunning themselves on a rock they were spellbound.

There I left them, and over a shoulder of the hill I met an elderly farmer friend looking to his sheep. I knew lambing time had not been so good and I was offering sympathy, but he would have none of it, for he is of the cheerful type and wasn't moaning. 'We can't always have it good,' he said. 'Maybe it will be a bumper crop of lambs next year.' That is typical of the outlook of these hardy dalesmen, who grind a living out of the small farms which are perched along the moor edge. Living in these wild but delectable places tends to brighten their outlook not to sour it, and as they tramp the fells tending their sheep and cattle they seem to me to find their own secret crock of gold.

As for myself, I love my moor at high summer, in the depth of winter, and at all times between the two. Sometimes on a wild wintry day, as I come over the moor-top covered in snow and meet up with a party of lovely little snow buntings being tossed about in the wind like outsize snowflakes, I feel eternally grateful that I was born a countryman and am able to live my life so close to the wild life and wonders of nature that the high moors have to offer; and I ask for nothing more than that for many years to come I can continue to roam 'by heather tracks, wi' heaven in their wiles.'

Hedgehogs *Maurice Burton*

SHOULD YOU hear something crashing through the bushes at night like – well, perhaps not quite like a leopard or a tiger, they walk silently – look out for a hedgehog. It quite disregards the need for concealment and makes no attempt to move quietly. Why should it do otherwise? It carries its own defences, ready to come into action in a split-second. Yet only the more nervous hedgehogs roll up when danger threatens, in spite of what is usually said of them. Most of them merely stop dead in their tracks – they freeze as we call it – and raise their spines. First those over the head come up, and then those on the back. When the danger is more immediate, then the hedgehog rolls up, and as it does so the spines, up till now merely raised, begin to bristle so that they point in all directions.

It is this instinctive reliance on split-second timing that must be the cause of such heavy casualties on the roads. Hedgehogs probably do not see a car approaching. They will hear it, and for them a strange noise is a menace, and they respond by freezing. A hedgehog has what some people are fond of calling a bright beady eye. In fact, its eyes are not much use to it. Put a frog under a glass cover and the hedgehog will run past it. If the frog croaks, however, it will come back at the double, because a frog spells food.

Suddenly switching on a bright light will not disturb a hedgehog. Its eye can detect movement but not shape.

Tests made on tame hedgehogs suggest they cannot distinguish form or colour, or shades of colour. For example, well-trained hedgehogs will answer to a name. It takes patience, but it can be done. A trained hedgehog, when called, will go towards its owner but may stop and beg for food in front of any large object.

Young hedgehog about to self-anoint among apples, chewing something (possibly a slug) as a stimulant





Young hedgehog self-anointing, shows its long tongue

When its hearing is tested this is what we find: At a distance of less than three feet the animal will come straight to its owner when called. At more than three yards it will come forward, not quite in the right direction, and then stop, as if uncertain where the sound came from. When its name is repeated, it sets off again, still not quite in the right direction. So it goes on, tacking from one side to another until it reaches its goal.

This lack of direction-finding by hearing contrasts strongly with the lightning response to small sharp sounds. The click of a camera-shutter will make the animal jump and a photograph taken at less than one-hundredth of a second is likely to show movement, if only a slight movement in the spines. Evidently some noises are intolerable to hedgehogs. One of the most successful trainers used noises as punishment to teach his pets. Slight sucking or clicking noises, or low chirping, made them half roll up, as if they could not bear the sounds. Even a sleeping hedgehog will half raise its spines at a slight click that would pass almost unnoticed by the human ear, and it will do this without making any other movement. So an approaching car may mean an unbearable noise to such sensitive ears.

The sense of smell must undoubtedly be the most valuable to a hedgehog. A damp nose is a fairly good sign of a keen sense of smell, as in a dog. If we use this criterion a hedgehog's sense of smell must be much more sensitive than that of a dog, wonderful though that be by comparison with our own, for a hedgehog on the prowl drips at the nose as if it had a terrible cold. There is confirmation for this in experiments made with a highly sensitive instrument for picking up electric



The self-anointing proceeds

impulses in the brain. When aromatic substances were passed under the nose of a sleeping hedgehog the instrument showed that two-thirds of the brain came into action when the aroma reached the nostrils.

We are still very much in the dark about many aspects of the private lives of hedgehogs. We know very little about how far one of them will wander in a night's foraging but it must be a considerable distance; yet it will find its way back to the sleeping place, which is usually a hole in the ground, under a bank or in a hollow at the base of a large tree, well supplied with leaves. The animal itself collects these, by the hundred, to keep itself warm. How it manages to tuck itself in and arrange the leaves neatly around itself is quite a feat. A hedgehog in a greenhouse, supplied with torn newspaper, will wrap the pieces around itself as it does leaves in the wild.

How it finds its way back has not been investigated. A marked hedgehog is known to have found its way back to the same spot when taken a quarter of a mile away, and also from half a mile, but failed to return from a mile distance. Probably in the normal wanderings it follows its own scent-trail, because in the dark even keen eyes are not much use, let alone the poor eyesight it possesses. It may even find its way by memory of a smell-pattern, as we use a visual pattern of a landscape. That, at least, seems the only way to explain the homing of a hedgehog deliberately set down at a distance.

It is also possible that hedgehogs follow regular paths. This much seems possible from what happened on a farm. A square hole was dug in the ground as a sump for drainage from a manure heap. During the course of the summer a dozen hedgehogs



In its excitement it rolls over on the apples

drowned in this, although the drainage hole was little more than a yard square.

Hedgehogs can swim, but in this case the sides of the sump must have been too steep to allow them to climb out, for they will climb. They have been seen climbing trees and wire fences, and there was an occasion when a rat and a hedgehog fought a battle and ended it well up in the ivy running up the side of a house. The hedgehog lost in this instance, but in fights between these two animals the odds seem to be balanced: sometimes the rat wins, but as often the hedgehog wins, and such fights are usually to the death. Indeed, except for badgers and foxes, and some of the more audacious domesticated dogs, hedgehogs have few enemies to worry about. They can master adders, and although doubt is sometimes cast on stories of fights between these two, at least one hedgehog to my knowledge fought and killed an adder.

The snake is at a disadvantage for hedgehogs are singularly immune to poisons. Only three are known to take effect with them, and the doses, tested experimentally, needed to be ten times greater than the dose needed to kill a guinea-pig.

The stories of fights between adders and hedgehogs are not the only ones that have been treated with scepticism. There are those about hedgehogs seen impaling apples on their spines. Many people, and for hundreds of years, have testified to having seen this happen. And nobody has believed them. The truth is that it can happen, as I have been able to satisfy myself. But first let us talk about hedgehogs that go into convulsions and foam at the mouth.

A number of people have written to me telling of a pet hedgehog going into



Upright again with an apple impaled on its spines

convulsions. The truth is that they have seen it self-anointing. A hedgehog may take a fancy to licking something, a dead leaf, bare soil, a piece of wood, or, if the animal is indoors, it may lick the carpet, a piece of furniture, a shoe. In fact, almost anything may be used.

The hedgehog, having selected something to lick, will continue to do so for anything up to half-a-minute, while a foamy saliva accumulates in the mouth. Then, raising itself on its forelegs, it throws the head round and, with the tongue, deposits flecks of foam on the spines. As it does so the body is thrown into contortions. This may be repeated again and again. Some hedgehogs do it often, others do it only occasionally, while some seem never to do it. Wild hedgehogs have never been actually seen doing this, but from the fact that the dried foam can be seen on their spines we can assume they, also, are given to the habit.

There is no satisfactory explanation of this habit. It seems to have nothing to do with ridding the skin of parasites. Rather, it seems to be an action that induces a form of intoxication. One interesting aspect of it is that it may explain the legend of hedgehogs rolling on apples. Last year I tried an experiment. A hedgehog that habitually self-anointed by licking dead leaves was placed under a crab-apple tree when the apples had dropped. It self-anointed with a dried leaf, and as it turned its head to put the saliva on to its spines it leaned heavily to one side and it did impale the apples on its spines. Moreover it did this a number of times. So there is some substance at any rate in what has for long been ridiculed as an old wives' tale.

Hidemanship *David Attenborough*

IN MY DREAMS I visit a perfect hide. It is large and airy. I seat myself on a small canvas stool – it would be expecting too much to have a comfortable chair – and look out through the peep-hole. Just beyond is the nest of a rare and beautiful bird. It is not extremely close, because if it were, the bird might be frightened of the hide; but neither is it very far away, and merely by swinging the lens-turret of the camera we can change from a wide-angle view, which shows the whole of the nest and something of the surrounding countryside, to an extreme and detailed close-up of the nest. Furthermore, as I sit there, I know with absolute certainty that the bird itself will arrive within a very few minutes and that when it does it will perform some fascinating activity which has never been filmed before.

That is my dream, and I must admit that throughout four separate filming expeditions in the tropics, Charles Lagus and I had never really managed to sit in such a hide. When we set out for Paraguay on our fifth trip together, I was determined that at last we would do so. One of the first things that we did after we landed in Asuncion, the capital of Paraguay, was to buy a long length of hessian. This was to serve as the main part of the hide. We could improvise supports for it when we got down to work.

The rheas allowed us to drive quite close to them



We began filming in the tropical forests in the northern part of Paraguay and there we became fascinated by the wonderful clouds of butterflies that carpeted the sandspits and beaches of the river up which we travelled. For over a week we concentrated on filming them in detail and our hessian lay neglected.

Then in a hole in a tall, dead tree I found the nest of a toucan. The tree stood in the middle of a patch of ground which had been cleared in the forest by Indians who had planted their maize and cassava there. I thumped the trunk with my fist and heard an answering chorus of chirps from inside. There were chicks in the nest.

We unpacked the hessian and that evening took it down to the cassava patch to build our first hide of the expedition. We stuck four long poles into the ground in a line, in front of a large bush which grew at the edge of the forest. We tied the hessian to the poles and cut a peep-hole in it through which we could poke the lens of our camera. The bush behind us concealed us very effectively from the rear and so we could use the hessian merely to screen us from the front. As a result the hide was not in the least stuffy or hot and we had plenty of room in which to make ourselves comfortable. Then we draped some branches over the front to break up the outline of the hide and conceal the colour of the hessian. It seemed perfect. We flattered ourselves that we had camouflaged it so well that it was almost undetectable. It was; and, oddly, that was our downfall.

We decided to start filming early the next morning, for then the sun would be behind us and shining directly on the tree, and the toucan would be coming to the nest to feed its chicks. We went back there well before dawn so that we entered the hide while it was still dark and minimised the chances of the parent toucans seeing us and being frightened.

We set up the cameras, made ourselves comfortable and settled down to wait. Slowly the forest around us began to wake up. A flock of parrots flew noisily above us on their way to find some fruit-bearing tree which would provide them with their first meal of the day. A splendid fruit-crow with a scarlet chest came and settled on the tree above us. We kept absolutely quiet. Obviously our hide was being the greatest success for none of the wild creatures were aware of our presence. An hour passed. The toucan must surely come soon. And then I noticed coming up the path from the Indian village, two pretty girls with baskets on their backs. Charles and I had a whispered consultation. We decided to sit quietly in the hope that they would go past us. They didn't. They set their baskets down within three feet of the hide and, chattering and laughing, began to dig up the cassava roots. This was infuriating and it was more than Charles could stand. He stuck his bearded head round the corner of the hessian and, enunciating his words very carefully, shouted 'GO AWAY'. The girls grabbed their baskets and fled down the path with screams of terror. It effectively put an end to our filming activities for that day.

In the afternoon we took the precaution of visiting our Indian friends in the village and explained to them what we had been doing in their cassava plantation. They agreed that no-one should visit it the next day so that we might try once again to film the toucan.



Egg-laying on the grand scale - a rhea's nest



This oven-bird, engrossed in building his extraordinary dome-shaped nest, completely ignored our presence

We returned the following morning. After two hours' wait, the toucan arrived. Charles filmed it as it flew back and forth to its hole carrying berries to its ravenous youngsters. It was a most extraordinary bird. Its huge bill was bright yellow, edged at top and bottom with scarlet, and the pictures Charles took of it were delightful. But still, we had taken two days to film what we should really have done in one. We could not claim that it was a perfect example of Hidemanship.

The next few weeks of our expedition we spent down on the open grassy plains of northern Argentina. Here, we had an unforeseen problem in hide-making. It is very important to set up your hide some time before you want to use it, in order to allow the birds to become accustomed to it. But great numbers of cattle roamed over the plains. If we built the hide and left it overnight, sticking up and painfully obtrusive in the middle of the treeless plain, the cattle would undoubtedly knock it over and trample it.

There were two creatures in particular we wanted to film: rheas, the South American relations of the ostrich, and oven-birds.

We tackled the rheas first. The generous manager of the estancia lent us his estate car and we drove over the plains, looking for the rheas. They were not uncommon and would let us drive quite close to them without taking fright. Yet as soon as Charles got out of the car to set up his camera, they fled away at great speed. They clearly found a man on foot very frightening but they had grown accustomed to seeing the car moving around the estancia and took no notice of it.

This solved our problem for us. When we found the nest of a rhea, we drove up slowly towards it. Charles got out on the side away from the bird, so that the car hid him from its sight. Surreptitiously he set up his tripod and then carefully placed the camera so it peered over the bonnet. Using this trick we managed to film all the laying activities of rhea.



Jabiru stork with chick

* We employed the same technique to film the oven-bird. This enchanting little creature makes an extraordinary dome-shaped nest of mud and we wanted particularly to get close-up pictures of it building. We found a half-finished nest on top of an old fence post only about four feet above the ground. We drove the car to within fifteen yards of it and started work. The bird seemed quite unperturbed by our presence. Charles wanted to move closer in order to get really detailed pictures. As the bird seemed so bold, he slowly walked round the front of the car, and, a step at a time, advanced towards the nest. The little bird continued to plaster beakfuls of mud on to the walls of its unfinished nest. Charles got closer and closer, and still the bird went on working industriously. Finally, Charles set the camera down within three yards of the nest. Through his lens, he could get a head-and-shoulders close-up of the oven-bird and still the bird did not take fright. Never before had we filmed a bird which was less disturbed by our presence.

Then we returned to Paraguay for the last part of our expedition – a journey into the wild desolate area in the west of the country, the Gran Chaco.

For six months of the year, torrential rains flooding down from the Andes turn the Chaco into a gigantic swamp. During the rest of the year, it is a barren desolate parched desert. We visited it towards the end of this dry season when the few remaining lagoons attract large numbers of waders and water-birds. We discovered one such swamp to which every morning came one of the most magnificent assemblies of waterfowl that I have ever been lucky enough to see. There were Brazilian teal, black ibis, great white herons, jacanas, stilts, snowy egrets and, most beautiful of all, large numbers of roseate spoonbills.

We returned in the early morning, under cover of darkness. Charles set up the camera and focused it ready for the arrival of the birds. As the sun rose, they came sailing in, squadron by squadron, to begin dabbling in the water and probing the

mud for the vegetation or insects that provided them with their food. Wonderful though this sight was, we were far from comfortable in our hide, for in our anxiety to get detailed pictures we had set it up on ground that really was not firm enough to stand us. As a result, every minute we stayed in the hide, the camera tripod sank lower and lower and we ourselves found it increasingly difficult to free our feet from the sticky smelling mud into which we were sinking. To add to our discomfort we were pestered unremittingly by hordes of mosquitoes. Our rewards, however, were great for the spoonbills, wonderful birds with flamingo pink feathers, were feeding within a few feet of us, and though we sank deeper and deeper, we were reluctant to leave while there were such magnificent subjects so close to us.

It was right at the end of our Chaco trip that we at last found the site for what I hoped was to be the perfect hide. We had been riding for several days over the Chaco, our equipment in an ox-cart trundling behind us, when we saw on the horizon an isolated patch of bush and cactus. In the middle of it stood a single tall tree, and in its topmost branches I saw, through my binoculars, a vast nest. When we got closer we found that this was the nest of a jabiru stork. On it, looking rather disconsolate, stood a large, almost fully-fledged chick. We decided to camp that night in the bush close by and to try and make a film about the home life of the jabiru stork. Once again, we took out our hessian and erected it beneath a bush.

We sat in that hide for two whole days. The parents came repeatedly to the nest, soaring magnificently across the sky. Each time they came, Charles put his eye to his film camera, I to my still camera and we filmed and photographed as the parent landed. Yet one thing was missing. We never saw the chick being fed. We became really quite sorry for the young bird. To us it seemed miserable and hungry. When its parents were not there, it stood about in a bored way, sometimes beating its wings to exercise them in preparation for the moment when it had to fly away. When its parents came, it clopped its bill noisily and begged. Yet no food seemed to be forthcoming.

Anxious though we were to see it feeding and complete our film sequence we had eventually to leave, for our own food supplies were running very low.

A month later, Charles and I were back in London. We sat in a film theatre in the Television Studios looking for the first time at all the film we had shot during our four months in South America. A picture of the jabiru stork came on the screen. Charles groaned. The sequence was incomplete without the feeding shots. We might not even be able to use it at all. And then, as we watched, an adult stork came flying towards the nest. It landed and very quickly it lowered its head and regurgitated three eels. Quick as a flash, the chick put its bill down and gobbled them up. In our anxiety over filming and photographing, neither of us had seen it occur at the time. We were tremendously surprised and overjoyed.

Our hessian in the cactus had, after all, been completely successful. The storks had played their parts faultlessly. It was we, who in our anxiety to photograph, had fallen short of perfection. We had, perforce, flouted the first law of Hideman-ship - Keep Your Eye on the Bird!

Along The River *Frank Sawyer*

WATER AND FISH hold a peculiar fascination for most of us, but I am more fortunate than many for I am a river keeper and I look after part of the Avon river which runs through the heart of Salisbury Plain in Wiltshire. A lovely river this Avon, one which meanders down the charming valley from its sources in the Pewsey Vale to the sea at Christchurch in Hampshire. It is a river famed for its trout and salmon and one which has become a kind of Mecca for those whose sport is in catching coarse fish.

All fishermen are lovers of Nature; though undoubtedly fishing is the magnet which draws us to the riverside, this alone would quickly lose its influence were it not for all there is to see and to hear. As we fish we also learn to watch and listen – to ‘stand and stare’ if you like – until a sense of contentment enters into one’s very soul; for everything around us is in harmony.

The Avon Valley, especially in the upper reaches with its withies and trees of many kinds, is a paradise for birds and a haven for a variety of animals. The clear bright waters of the river, rippling gently over the clean gravel and through the green weed-beds, winds away in the midst of fertile meadows which spread away on each side to the rising ground, and on to the vast tracts of downland beyond. Here in this lovely valley, with its living river, much of my life has been spent. More than half a century has passed since I first heard the music of the water on its way to the sea. And so, many times, I have seen the valley during its sleep and its awakening; in the full glory of early summer, and the fading of autumn. And I have learned the ways of wild life and can enjoy the pleasures which Nature gives. A different page

In every run and eddy the trout are waiting





The cooing of the wood pigeon – the countryman's ring dove – is a familiar sound to the angler

of her great book is turned each day, and no page can be a repetition of a former one. This for me is the great attraction, that something will happen today or tomorrow which I have not seen before.

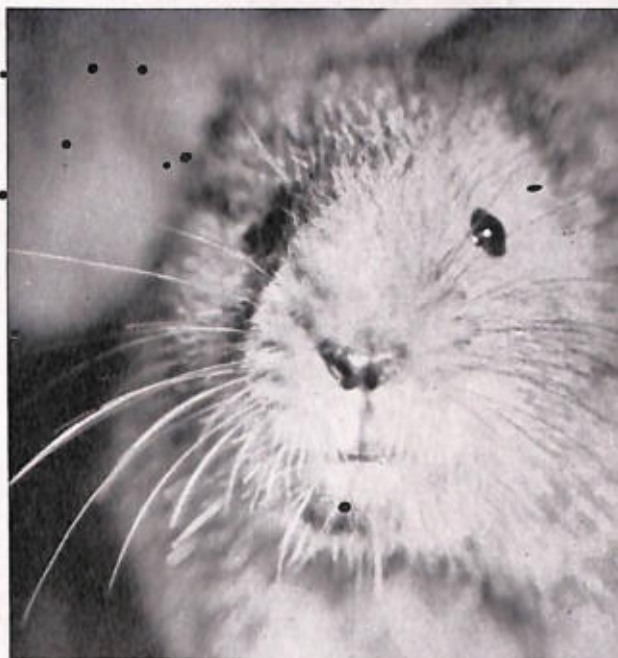
People often ask me which part of the year I find most enjoyable. It is a question I find rather hard to answer. All months have their own special significance, their own individuality. But I love the early spring, the time when the whole world of Nature is most active and most friendly. River valleys are the first to be visited by the migrants. I like to go home and tell my wife I have seen the first warbler, a chiff-chaff perhaps or a blackcap; and then, later on, the first swallow or martin. I like to see the whole kingdom of the birds become busy in preparation for nesting and to hear their music spreading and increasing in volume as each adds a note, migrants merging with the natives, the cuckoo with the ring dove. And my own mood lightens too. Often in spring I feel like singing as well, and why not? But I don't. I feel shy, too shy to let the songs in my heart come warbling from my throat to swell the valley chorus.

But I know I am not alone in this lightness of spirit. I have joy in meeting the fishermen coming into this grand theatre for the first time perhaps this year, men and women escaping for a short time from the monotony of everyday life in the towns, whose work is in the world of the human. I see the light of pleasure in their eyes, the look of anticipation, and a sincere greeting passes between us. I leave them to enjoy themselves, knowing just what they may see and hear.

It is the time for the mayflies, for this Avon of mine is a mayfly river. And poised



At home by the riverside - a yellow wagtail



The water vole sits at the mouth of its burrow

in every run and eddy, in every glide and swirl, the trout are waiting to take part of this feast in spring. Excitement grips these watchers beneath the surface, even as it does those in the world above, for many of the birds enjoy this feast as well. The cheeky cock sparrow and the chaffinch compete with the swift and the swallow, the jenny wren with the wagtail. Mother duck watches her clutch of babies busy on the weed-beds, while a moorhen or a coot pauses for a time at the edge of a patch of dried rush which conceals his nesting mate. The vole sits and nibbles a long strand of water weed at the mouth of his burrow and the water shrew pops up from where he has been searching for caddis on the stream bed.

High overhead, cawing as they go, the rooks and jackdaws fly in steady procession to the rookery to try and still the clamour of their hungry nestlings with the pouches of food they have gathered beyond the valley. Old Stalky the heron flaps lazily along to his stance on a dead tree from where he can view the country around, while the kingfisher speeds like an arrow to his nest in the old sand pit in the hill. On the hillsides the hawthorns are in bloom, great splashes of white amidst the fresh green of the grass and the young leaves of beeches and sycamore, with the meadows below a carpet of gold where the dainty petals of marigold and buttercup raise their faces to the sun.

Indeed a joy for the fisherman. There he waits at the riverside, hoping to see the big head of the three-pound trout beneath the bank in the pool at the bend, while a snipe sideslips and drums in the sky above him and a woodpecker answers from the wood. He looks into the clear water on the shallows at his side. There clean



Often heard but seldom seen, the green woodpecker, whose laughing call is the typical voice of the woods

heaps of gravel, the nests of the trout, still showing where the spawning fish were active in the winter, have become the playground of a horde of minnows, while the larger stones are the hiding places of loaches, bullheads, crayfish and a multitude of others. A plop and widening rings in the pool of the big trout makes him alert. He tenses, then smiles as the cause shows a second time and a dabchick pops once more beneath the water. His glance switches to the deep eddy on the far side of the river. It is the home of a school of roach and dace. And perhaps, lurking beneath the rush fringe, is the long deadly form of a pike, waiting, even as he himself is waiting, until the time is right to get his prey.

Here and there fast moving tails give away the positions of small trout and grayling in the runs where the weed-beds are patches of emerald on the silvery gravel. Then comes a change. Widening rings show where a fish has risen, then others and still more, until the whole surface of the stream is continually being broken. The flies are hatching. Those big mayflies, whose two-year existence beneath water has ended, are appearing to conclude their life cycle. Excitement grips the heart of the fisherman. He forgets the world of Nature around him as a mayfly sinks into a dimple beneath the bank at the bend pool. Another and another are taken by the big trout. He takes up his rod. The chance for which he has waited has come.

But as later on he gazes at the catch of trout and grayling in his bag, and the time draws near for his return home, a little sadness comes to his heart. Gone is a day which can never return. What he has seen and enjoyed during his stay on the river, must for ever after remain as a gradually fading photograph in the big album of memory.



Boreray, St. Kilda, the fulmar's British stronghold

Fulmars *James Fisher*

(From Wesleyville, east coast of Newfoundland)

YESTERDAY we were cruising between this fishing harbour and the lonely and seldom-visited Funk Island. Funk Island is the first-and last-known breeding-place of the great auk in the New World, and the site of a thriving and increasing gannetry, which is why we are here, for 1959 is a world census year for gannets; it is also a 'fulmar year'.

Every ten years – every year ending in nine – marine ornithologists all over the North Atlantic co-operate to see how the numbers of gannets and fulmars have changed. Both have been steadily increasing, the gannet by degrees for the last sixty years, the fulmar prodigiously for the last two hundred.

It was thrilling for me to see the white-headed race of the Atlantic fulmar here on the Newfoundland coast. It does not breed within two thousand miles of here, but every summer birds are present, on the caplin grounds, feeding with the Tristan great shearwaters and sooty shearwaters (that summer here eight thousand miles and more away from their breeding-grounds in the South Atlantic). These summer fulmars of Newfoundland may include a few adults that have failed on their breeding; but most of them are young birds. The fulmar probably does not visit a breeding-place until it is about four years old, and does not breed until it is seven.

Ringling has shown that these Newfoundland waters, great feeding-grounds for sea-birds, are nurseries for young fulmars from West Greenland and Britain (probably from Iceland and the Faeroes, too, I am sure). The first evidence of this came ten years ago. On 27 October 1948 a bird was caught off this coast that had been ringed



The fulmar has only one young a year

as a nestling on a West Greenland cliff less than two months previously. Less than a fortnight later – on 9 November 1948 – another fulmar was recovered off Newfoundland: I had ringed it myself as a half-grown youngster, on 17 July of the same year, in a nest on St. Kilda, westernmost of the Hebrides in Scotland. Since then several other Greenland and British fulmars have been recovered in Newfoundland.

That a 'nursery' for young birds should be two thousand miles from their nearest breeding home is only one of the curiosities in the curious history of the fulmar. More odd, or at least more remarkable still, is the extraordinary spread of this lovely member of the petrel order, the nearest thing to an albatross we have nesting in the North Atlantic.

The spread of the fulmar started in Iceland. In the Westmann Islands, off the south coast of Iceland, an excellent naturalist, Gizur Petursson, was clergyman from 1687 to 1713. So accurate was he that we can be sure the list of breeding birds he made would have contained the fulmar had it been among them; it did not. But we know that a lawyer, Eggert Olafsson, who visited the islands in about 1753, found the fulmar nesting there. The fulmar spread for the first time to south Iceland, then, a little over 200 years ago. Up to then the Atlantic fulmar had an almost completely arctic breeding range. Its nearest nesting place was on Grimsey, an island off north Iceland, and it bred nowhere south of the arctic circle save at one traditional outpost colony in Britain, on St. Kilda, which appears to be as old as history.

Since then it has spread steadily. It has colonised the whole of the coast of Iceland, and is now nesting on crags there as much as eleven miles from the open sea. Some



Fulmars probably do not breed until they are seven years old

time between 1816 and 1839 it reached the Faeroe Islands, and it has now colonised the whole of their steep cliffy coast.

In 1878, from the Faeroe Islands, it colonised Shetland, and it has now spread, as a nesting bird, to the sea-cliffs of most of Scotland, Ireland, Wales and England. In the nineteen twenties it colonised central Norway; in the nineteen-fifties northern Norway; and now this extraordinary bird has been seen in the nesting-season prospecting the cliffs of the Channel Islands and Brittany.

Across seas, and along coasts, it has spread over two thousand five hundred miles in a hundred years. It took just seventy years for the colonising streams to meet round the coasts of our own British islands.

If by stations we mean places where fulmars are occupying sites on land in the nesting-season, whether they lay eggs or not, then there was one, St. Kilda, before 1878. It is still the biggest, with about forty thousand nests. In 1879, Foula in Shetland was colonised; that made two. In 1889 the number had doubled, to four. Ten years later *that* number had multiplied by $3\frac{1}{2}$, to 14; ten years later *that* had nearly trebled, to 39; ten years later, by 1919, *that* had more than doubled, to 93; by 1929 there were 149; by 1939, 323; by 1949, 577. What the score is, now in 1959, is what the British Trust for Ornithology wants to find out.

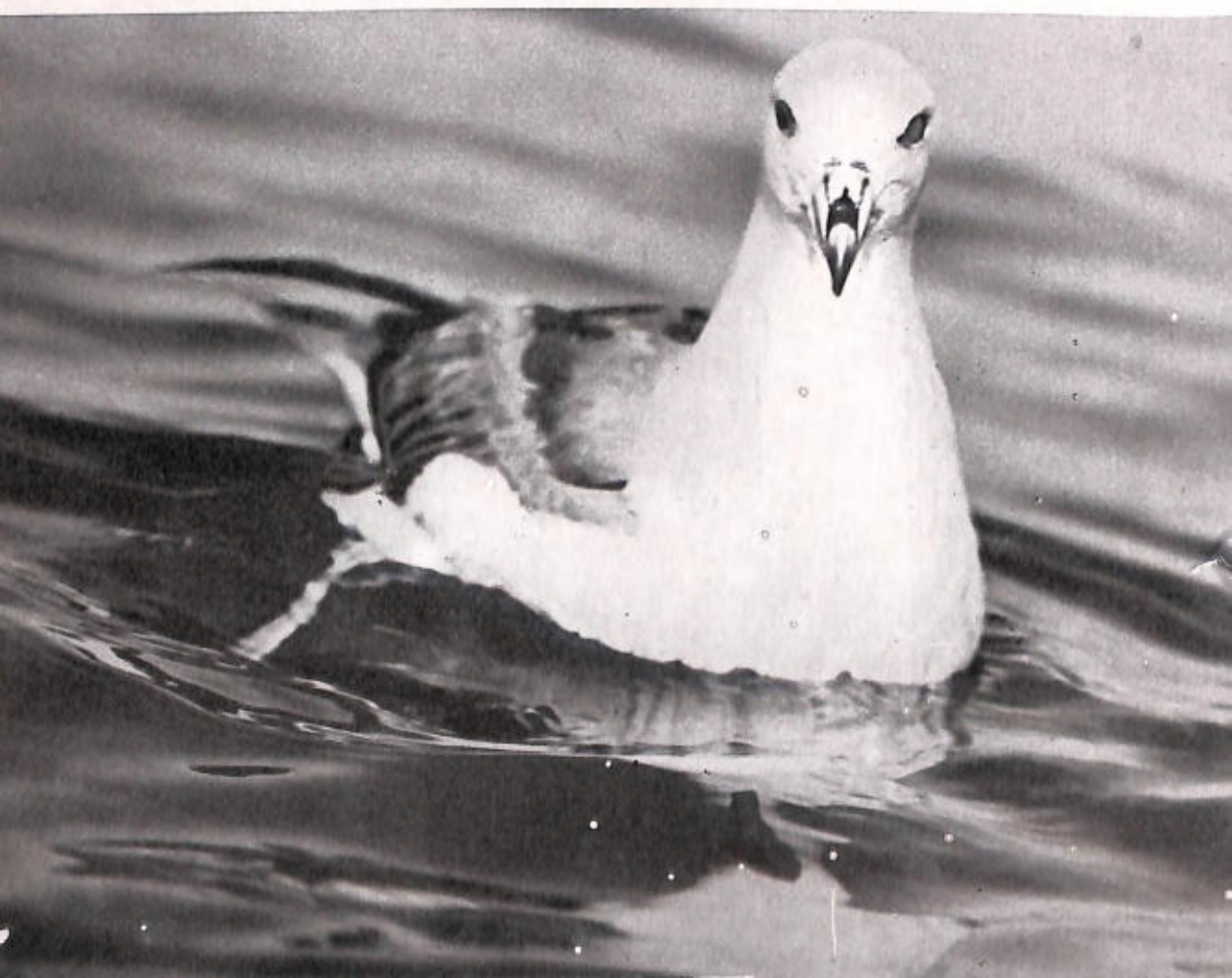
Outside St. Kilda the actual number of fulmar nests has increased from nothing, to something of the order of seventy thousand in 1949. The increase was at about 18 per cent *compound interest* till about 1914, and at over 7 per cent *compound interest* since then. The fulmar has only one young a year and (as we have seen) probably

does not lay or fertilise an egg until it is seven years' old, so this increase is extraordinary. A great deal of it must still be due to continued colonisation of Britain by birds from the Faeroes and Iceland.

However, though I fully expect the numbers of the nesting fulmars in Britain nearly to double again in twenty years – because there is no sign that the spread is stopping – I do not expect the number of new colonies established to rise so quickly as it has been rising. One reason is that in many parts of our coast fulmars are running out of new cliffs to colonise, and sometimes two adjoining colonies spread towards each other to unite and form one continuous one. All the same, it looks as if about twenty new stations are being established every year.

I have been studying this spread of the fulmar for twenty-five years now – and a few years ago I wrote a book about it that is nearly as long as any bird book I know of (and perhaps longer than any bird book ought to be). There is a big history behind this soaring ocean-bird, this rather ghostly-looking glider of the rough seas, this little albatross. Superficially about the same build and colour as a gull, it has the tubular nostrils of its order, and stiff, unangled wings which, with its effortless mode of flight, distinguish it from a gull at once.

About the same build and colour as a gull, the fulmar has distinctive tubular nostrils





Effortless flight of the fulmar

Few wild animals have had such a history of continuous increase as the fulmar. The probable reason for it is that the fulmar eats fatty offal very readily, and has been supplied with free meals in the North Atlantic for the last two hundred years, at first by whalers, and afterwards by trawlers. However, today trawlers are beginning to consume their own fish-offal and convert it into meal and fertiliser. Perhaps this will slow up the fulmar increase. That is one of the reasons why, in 1959, the British Trust for Ornithology tried to plot the fulmar colonies of Britain all over again, and estimate their size.

As organiser of this inquiry I cannot even begin to predict its results. They will take many months to work up, and—as I write—have only just begun to come in. And in these days of enlightened natural history there is so much *to* come in, for close on a thousand people are taking part, many of them listeners to, or viewers of our B.B.C. programmes, *Naturalists' Notebook*, *Birds in Britain* and *Look*. On all these the story of the fulmar has been told: but it is so changing and fascinating a story that I am sure it bears telling again.

Our British Frogs and Toads *Maxwell Knight*

THERE ARE about three thousand different species of frogs and toads in the world, and yet in Britain we have only three frogs – two of them introduced here from Europe – and two native toads. You might think from this that the few we have would have been very thoroughly studied by naturalists. However, there are several features about the lives and habits of frogs and toads which we do not thoroughly understand, and, of course, that is what makes these animals such stimulating creatures to study.

You might think that everyone knows what our common frog and common toad look like, but it is surprising how many people – even those living in the country – cannot distinguish a frog from a toad; while many more have no idea how to tell the tadpoles of frogs from those of toads, nor what the spawn (the eggs) look like before those tadpoles hatch out.

All our frogs and toads are *amphibians*, and this means that they spend certain periods of their lives in water and other periods on land. It does *not* mean that they divide their lives equally between land and water. Amphibians start their lives in water as eggs – usually referred to as ‘spawn’; and this means that adult frogs and toads have to go to the water each spring for the purpose of breeding. Little is known about the exact way in which frogs and toads journey from their winter quarters to their spawning place. One theory is that it is the smell of the microscopic vegetation in certain ponds which tells the frogs and toads that such ponds are good breeding

A female common frog





Is this how the toadstool got its name?

grounds, and this scent is also said to guide them to the ponds. However, this has yet to be fully proved.

The eggs they deposit then eventually hatch into tadpoles which, after undergoing various changes (including the absorption of their tails and the development of their legs) leave the water in the summer as froglets and toadlets. They spend the next few months on land feeding on very small insects, worms, slugs and other soft bodied creatures, and then about October they go into hibernation for the winter. Frogs usually hibernate in the mud at the bottom of ponds, while toads spend this time of rest on land tucked away in some sheltered spot.

Let me tell you as briefly as possible how to distinguish frogs from toads. All our three frogs – like other species of frogs – have damp skins, are very agile and hop quickly. They have teeth in their upper jaws, and their feet are strongly webbed.

Toads are rougher and have much drier skins, the skin being covered with tiny wart-like growths which secrete a poisonous liquid, which is merely a means of defence – few dogs will tackle a toad twice! Toads also have two large glands on either side of the 'neck' which contain a creamy substance, more poisonous than the other kind. This, we think, is probably only used in great emergencies. Neither of these poisons can harm us when handling a toad, so long as we are gentle. The



As a grass snake approaches, this toad adopts a posture of defence

mouth of the toad is toothless; only their hind feet are webbed; and they are much less agile – they either hop rather ponderously or walk in a slow clumsy fashion. Frogs may breed as early as late January in the extreme South-Western counties, but late February and March are more normal. As one goes farther north the date of breeding becomes a little later. The common toad usually spawns in March but the natterjack has an extended breeding period and may be found spawning from April until June. Frog spawn is found in clumps; that of toads in chains threaded among the water plants.

The tadpoles of frogs are a dark brownish-olive in colour and have tiny yellow or golden specks on the body. Toad tadpoles are darker and without markings and, age for age, are smaller than those of frogs. In both frogs and toads the females are larger than the males.

Of course the three frogs we have and our two toads differ from one another in colour and general appearance. The common frog is almost too familiar to call for any detailed description, but it is worth while mentioning that quite marked changes in colour can be seen in frogs that are found in widely differing situations. One found in a field will be yellowish or yellowish-brown, while one from a shady flower bed in the garden will be much darker – brownish or dark greeny-brown. If you were to switch over the places of two frogs such as these there would be a fairly rapid colour change to suit the surroundings. One very distinctive feature of our common frog lies in the two dark brown patches on the sides of the head.

Both the Edible and the Marsh frogs are introductions to this country from Europe. The edible frog has been here roughly one hundred years, but it has had an up and down career and colonies seem to come and go, often for no very obvious reason. At the present time this frog is confined to a few places in the Home Counties and in East Anglia. The edible frog is larger than the common frog and is normally some shade of green in colour with a yellowish stripe running down the centre



Marsh frog, showing the air sacs deflated



The inflated sacs produce a loud call

of its back. It is very active and can jump several feet if disturbed. It is aquatic in habit and is never found farther from water than the distance it can cover in one or two leaps.

The Marsh frog is a much more recent importation and was first introduced into the Romney Marsh area in Kent in 1935, when an amateur naturalist obtained a few pairs to keep in his garden pond. They soon escaped; and by the end of the last war, in 1945, they had spread all over the Marsh – their loud croaking causing some of the inhabitants to complain of the noise! This frog is larger than the edible frog and a big female has been known to measure a little over five inches.

The colouring is normally a greyish buff with almost square dark brown spots on the legs; but when the sun shines and the frogs bask on the banks of the canals and dykes they assume a lovely shade of green. Unlike the edible frog the marsh frog does not *usually* have a stripe down its back, but very occasionally I have seen one which has this marking. Like its near relation, the marsh frog is never far from water and it is a tremendous leaper.

Both the edible and marsh frogs take quite large prey as well as smaller insects. They will capture water beetles under the surface and also dragonfly larvae, newts, small fish and tadpoles – including those of their own kind; and I myself have actually seen a very large female catch and swallow a young frog of her own species!

And now to our toads. The common toad, like the common frog, hardly requires a detailed description but it differs from the frog in that it is a lover of dry places when on land and will only be found in water or in damp situations at breeding time. The Natterjack toad, however, is much less well known. In fact I doubt if many people except naturalists ever see one unless by accident. The natterjack is a smaller toad and is much more agile. It runs along like a mouse, but in short bursts. It seldom goes far from ponds and it is only found very locally in certain sandy areas in this country and in South-West Ireland. It is greenish-brown in colour and the



The dark brown patch on the side of the head is a distinctive feature of the common frog

little warts on its back are usually a coppery red. It has a distinctive yellow stripe running down its back and it is capable of a certain amount of colour change according to its exact surroundings. Of all our amphibians I think it makes the best pet, for it not only becomes quickly tame but its quaint gait and its burrowing powers make it an interesting creature to observe in captivity.

Frogs are not so suitable as pets, as they require more room and, in the case of the edible and marsh frogs, they must have plenty of water. However, a great deal about their habits and behaviour can be learned by observing them in the wild, and a few tadpoles kept in a well planted tank are fascinating to watch as they gradually develop and turn into froglets or toadlets. If you succeed in achieving this stage let the youngsters go free in your garden or in a field; you cannot get enough tiny insects to feed them yourself at this stage. After all, some of them will survive and do good in the garden, while you can always get some more spawn or tadpoles the following year.

Filming in the Belgian Congo *Heinz Sielmann*

THE OPPORTUNITIES that film gives us for showing aspects of nature which only very few people can actually see personally in the wild, offer the film-biologist an almost inexhaustible field of investigation, even within the boundaries of his own country. I believe there is no more enthralling task than the capture of the lives of our European animals in really eventful pictures – eventful and meaningful because the camera allows us to see things that are denied to the human eye.

For example, in my film about woodpeckers, we saw what went on in nests right inside the hollow trees, and followed the tongue of the woodpecker as it searched out food from the holes bored by insects. The hamster film took us into underground nurseries; the squirrel film showed us the squirrel's dreys – their nests – in the tops of trees; and in my film study of a summer meadow I gave a detailed picture of the community-life of bumble-bees in abandoned mole-hills.

Expeditions of this kind at home are just as rewarding and interesting as expeditions to other countries; but it is understandable, I think, to feel a growing desire for opportunities of getting to know other continents, to study new species of animals in different surroundings and to use techniques which have been worked out at home in order to record the natural history of foreign countries on film.

I had a particularly attractive opportunity to do this when I was entrusted by King Leopold III of Belgium with the preparation of a full-length documentary film called 'Lord of the Forest', which was designed to show the interaction between men and animals in the Belgian Congo. The Congo is extremely interesting territory from a biological point of view, before the evidence which still exists is swept away by the ever-increasing break-in of civilisation.

Three-horned chameleon – the biggest African species





Giant Pangolin – a nocturnal insect eater

Our theatre of operations was firstly the Virunija volcano area, where the earth is still disturbed by the eruption of active volcanoes. From there we travelled to the glaciers of Ruwenzori, the Mountains of the Moon, where the peaks are over five thousand feet high and seldom free from clouds. From eternal ice at the Equator we moved on through curious layers of vegetation away to the plain, to the Savannah, and then finally to the tropical rain-forest, the primeval forest of the Congo, with its continuous dampness, where Nature wallows in orgies of shapes, colours and appearances, just as if it were a giant hot-house.

The unusual feature of our task was that, in this extraordinarily various territory, we proposed to show typical representatives of the animal world in their own special environments, and that we were going to do this, for the first time, with Cinemascope lenses. Usually, when filming animals in the wild, one uses a lens of up to 1,000 millimetres, so as to get shy animals in a natural and undisturbed way. In the Congo, however, for technical reasons connected with the Cinemascope lens, our largest size was 200 m.m. In practice that meant that we had to work about five times closer to the animals than is normal – a great disadvantage, especially with aggressive big game!

I remember one particular occasion at the beginning of our expedition, when we were filming the gathering of water-birds on Lake Edward. My companions had built themselves a small hide, simply from sticks and twigs – an adequate screen against

the eyes of birds. While they were concentrating on the camera a single bull-elephant suddenly appeared. It was such a complete surprise that there was no chance of getting away in time. The elephant went straight up to the hide and quickly started to tear away the twigs with his trunk and eat them. It was an unpleasant situation, because we knew that in a few minutes he was bound to discover the men cowering underneath; and a suddenly surprised and frightened elephant, discovering danger at only the length of his trunk away, would certainly attack. Realising this, my friends did a daring thing. They started to talk to the elephant, at first very softly, then gradually louder and louder, and in this way they managed to save themselves. The elephant stumbled, drew back a few steps and then lumbered away through the bush, with his trunk high and his ears spread.

Female hornbill with its single youngster (behind)





Female peacock – one of the most remarkable Congo birds, first identified in 1932

We were certain that similar dangers would occur with lions and hippos, and especially with gorillas, which we were particularly anxious to film in their family life; we, therefore, went to a good deal of trouble to build protective cages out of iron tubes and bars. The cages were not meant for the animals, though – our plan was quite the opposite to a zoo. While we were filming in Africa we went with our cameras into these strongly anchored and impregnable cages, while the animals continued to enjoy their freedom.

The placing of each of these hides was decided after careful observation in advance. Every animal patrols its territory in a fairly rigid daily pattern. We drew up a plan of their resting places and the points where they ate and drank, until we got to know the spots where we should wait, where something was likely to happen as close as possible to the camera. The increased amount of time we had to wait, until these cautious wild creatures would allow themselves to be filmed unconcerned, meant that we had to spend nearly twenty months completing our task. Even so, we certainly should not have succeeded if we had not had our European experience behind us. Just as we had spied on the black woodpecker deep in his nursery at home in Germany, so in Africa we probed into the tree hollows of the great rhinoceros-bird who walls up his mate in a forest tree for nearly four months, to hatch and rear her young. The wonders of Africa are, perhaps, inexhaustible, but she has yielded some of them to the patient camera.



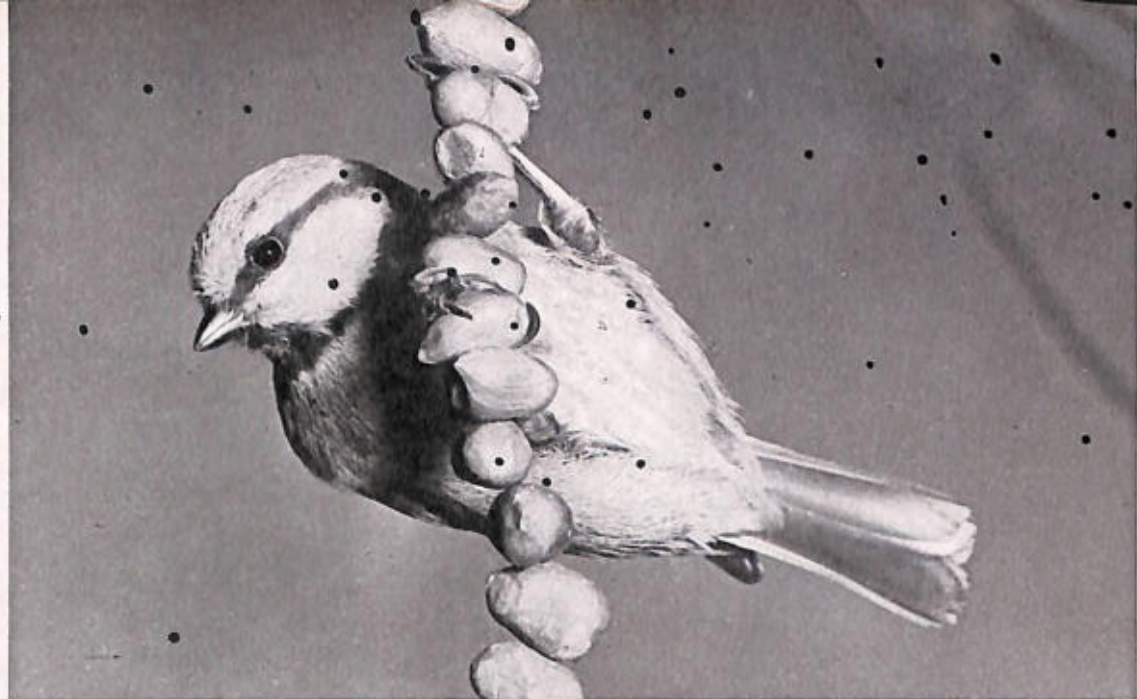
The Scarlet Grosbeak, uncommon in Britain, is more at home in Scandinavia, where this scene was photographed

Bird Watching at Home *Bruce Campbell*

I DREAMED one night not long ago that I was operating a nylon mist-net, which in the past few years has become the bird-ringer's best friend. I had evidently found a wonderful spot, because the birds kept flying in and I kept whipping them out – which you can do in a few seconds with practice – and ringing them. But one bird really made me gasp; it had a greenish back, shading into a rich plummy blue crown. Its throat was a beautiful salmon pink and its bill was thin and curved like a tree-creeper's. I took it out of the net and walked over to my companions in triumph, calling: 'Another new one for Europe!'

My dream shows how impregnated bird-watchers are with the lure of the rarity, and I'm sure it's the hope of finding something sensational that keeps so many people on the watch at the seasons of migration. This is in many ways a good thing, because their enthusiasm has enabled us in the British Isles to forge a chain of coastal bird observatories far stronger than that of any other country; and these observatories collect a mass of valuable information, not just about rarities, but about the whole field of bird migration.

All the same, I believe there is some danger a generation may grow up who think birds only matter at bird observatories and other favoured spots and that bird-watching is something we do on holidays or at week-ends, away from the places in which we spend most of our lives.



The study of bird behaviour can begin outside your kitchen window

It's rather as though sociologists only studied the human species at Crewe and other large junctions. Very instructive, of course, to count the average luggage load of each traveller, or to work out his mean intake of coffee and the traditional railway sandwich, but just the least bit partial as regards the whole range of human activities.

In the same way birds on migration are living in a special way. They seldom sing; they are probably not eating typical food; above all, they aren't in typical habitats. For example, the British habitat of the scarlet grosbeak could, from the published records, be truthfully described as 'along wire fences on remote islands.' But that isn't where we found them in Finland when I visited it for the International Ornithological Congress held there.

Sometimes this attitude arises from a sort of modesty. The novice bird-watcher believes that only where expert guidance is available, as it is at many bird observatories, and where a planned study is being made, can he make a contribution to the scientific side of ornithology. But in most large towns and counties in England there are now flourishing bird clubs or natural history societies, and the beginner – of whatever age – will be unlucky if he can't find an experienced observer to help him. If he really is too far from any society to join or can't get to meetings regularly, there is, at the national level, the British Trust for Ornithology which exists for just this purpose: to encourage and promote field studies by the leisure-time bird-watcher.

Let's suppose then that you have become keen on birds, that you want to do more than admire them on holidays and week-end trips, and that you want to know what sort of problems you can tackle at home.

The most obvious study is of distribution and status: how birds are spread over the land and in what numbers. This is something you can contribute to at all sorts

of odd moments, on your way to and from work, on evening strolls and, if you are a good riser, on early morning walks.

But, because of its apparent simplicity, some people seem to think distribution is not worth studying. In fact, the distribution of any animal is the present end-point in its process of evolution. We believe that, broadly speaking, the animals now in the world are not capable of any further physical evolution; what is of interest is to see how far, with their various degrees of specialisation, they can adapt themselves to the conditions of their environment which are, of course, always changing. Some changes are climatic and so slow that we are hardly aware of them; others, brought about by man, are so rapid that we can hardly keep pace with them. And in few countries are they more rapid than in Britain. So it is tremendously important to keep a record of the distribution and numbers of the commonest birds here and now, in your own town, suburb or village.

These changes have always been going on. What would we give to know the distribution and status of our birds before, for example, the great enclosures of land began? And if only Julius Caesar had been an ornithologist! Shakespeare tells us incidentally quite a lot about the birds that were common in his day. It's curious,

The B.B.C.'s 36-inch parabolic reflector is set up preparatory to making bird song recordings





A typical garden bird – this starling makes vigorous use of a bird-bath

as my friend Kenneth Ashton pointed out some years ago, that he doesn't mention the corncrake, whose rarity we bemoan now but which was common and well-known, at least from its voice, in the last century. Perhaps a scarcity of corncrakes is another bond between the first and second Elizabethan eras.

Once you begin studying the environment in which our birds live, what naturalists call their habitat, you are up against a peculiarly British difficulty, the fact that we live in a small, highly-cultivated, highly urbanised island.

To go back to my visit to Scandinavia in 1958; I was amazed by the all round ability, as naturalists, of the young Finns and Swedes that we met. They not only knew the birds – by the correct English and scientific names, too, I may add – and their songs and could find their nests; they knew the names of the plants, the trees, the insects and the mammals that we saw as well.

Habitats are, I agree, easier to comprehend in Scandinavia than in Britain; there is far less cultivated land and it's fairly uniform; there are virtually no hedgerows. All around is the conifer forest, interspersed by rivers, lakes and arms of the Baltic, by bogs and moorland, each with well-defined characters and distinctive plants. In addition, young people in Finland and Sweden get more field instruction in school than is the case in this country, even today.

On the other hand, in the more accessible parts of Britain we have a complex environment, as if a great net of hedges had been thrown over the countryside; and in one space there's a corn field, in another a grass ley, in the third a potato crop and so on. Where the netting crosses, at the knots, so to speak, there may be a farm-house, a group of stacks, a pond, a spinney or a cross-roads. Throw in conifer shelter-belts, orchards, rivers, streams and bits of marsh not worth draining, add a rash of ribbon development and a few derelict army camps and you've got a bird habitat that seems to baffle analysis.

But if you know the principal trees, shrubs and herbaceous plants, including the

commoner grasses, and if you make a practice of writing down descriptions of the places in which you find each bird, then in time it will begin to make sense and you'll begin to realise what our muddled landscape must look like to a bird and how some birds are learning to adapt themselves more quickly than others to new conditions. Blackbirds, for example, seem to be more successful urban colonists than song thrushes: this is something you can test if you live in the heart of a great city. I shall never forget the dawn chorus of blackbirds in the squares of Edinburgh.

As your knowledge of birds and their present habitats grows, you begin to wonder where they have come from. Many of our common garden birds are recognisably woodland species – you can see them in their original setting in the scrub woods of Scotland and Wales or in the forest areas of France and Germany. But what about the greenfinch and the goldfinch, the hedge sparrow and the house sparrow? And if Julius Caesar had been a bird-watcher, would he have found starlings and rooks and woodpigeons in their present numbers in our island?

Some birds are successful today, because they have adapted themselves to a new and plentiful food supply. The gulls are a good example. We read that kites scavenged the streets of medieval towns. Now it is the herring-gulls and black-headed gulls that haunt the great rubbish dumps of our hygienic modern cities.

So your original interest in distribution, status and habitats may lead you on to study the food of birds. Or you may be fascinated, as many highly intellectual and not necessarily musical people have been, by their songs. Today there are splendid published collections of recorded songs and calls to help you, and the tape-recorder is opening a new world to the student of bird voice. Then there is roosting, the cinderella of bird-watching. I don't mean the study of great colonial roosts of starlings and rooks, but the individual roosting sites of the birds in your garden. Finally, and all-embracing, is the study of bird behaviour – and that can begin on the bird table outside your kitchen window and does not even need a pair of binoculars for its pursuit.

Black-headed gulls haunt the great rubbish dumps of our cities





No bull has ever seen the redness of red

Their World *E. W. Swinton*

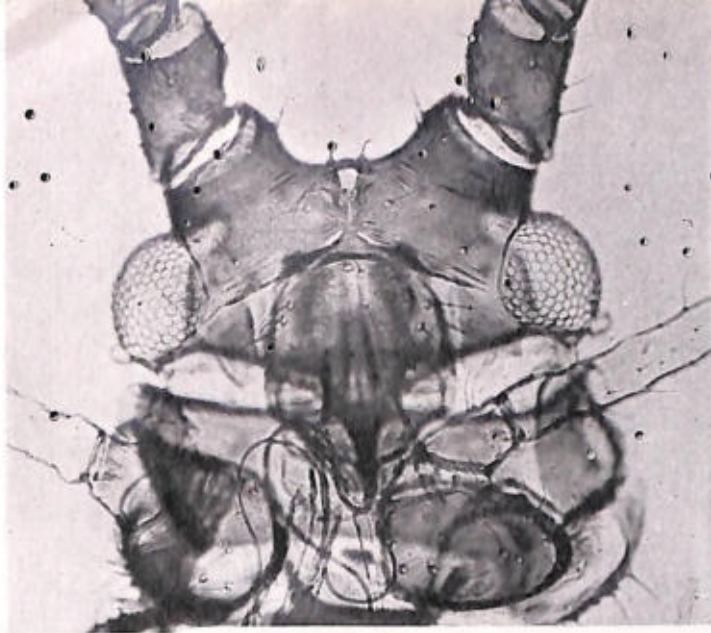
DOES A RED RAG upset a bull? Is a deaf man really 'as deaf as an adder'? Have crickets and grasshoppers got vocal chords? Do elephants hear exceptionally well because of their large ears? When we try to enter Their World, the world of animals, these are some of the questions that confront us. Are we even sure that all animals have five senses like ours?

There are, in fact, something like thirty different 'sensory receptor reactions', as they are called, that might be classed as senses, but I am going to deal simply with the ordinary five senses – with sight, with hearing, with taste and smell, and with touch and location. Grouping them in that way is not arbitrary but is based on the nature of the stimuli concerned.

Sight is neither the oldest nor the most general of the senses but it is one of considerable importance. In human life it is associated with a pair of eyes, with overlapping fields of view, resulting in stereoscopic vision, and with the ability to see colour. In each of these important characters it is not typical of many other animals. Insects have often, as in the locust, five eyes; many others, such as the bee and many of the flies, have compound eyes in which there may be as many as a hundred separate eyes, each with its own lens, producing a composite picture that may be likened to the effect of enlarging a newspaper photograph by means of a magnifying glass.

Some ancient animals, like the fossil amphibians, had three eyes, the normal side eyes being supplemented by a third or 'pineal' eye, on top of the head, whose function is still uncertain. The modern lizard-like Tuatara (*Sphenodon*) is a living example of such a three-eyed animal. Was there ever a one-eyed animal? You may think at once of the one-eyed Cyclops of the ancient legends, but it probably owes its origin to the discovery, in Mediterranean islands, of fossil elephant skulls in which the nose cavity was mistaken for a central eye.

Not only are there thus many assortments of eyes, but some, like those of the flat



The compound eyes of the greenfly

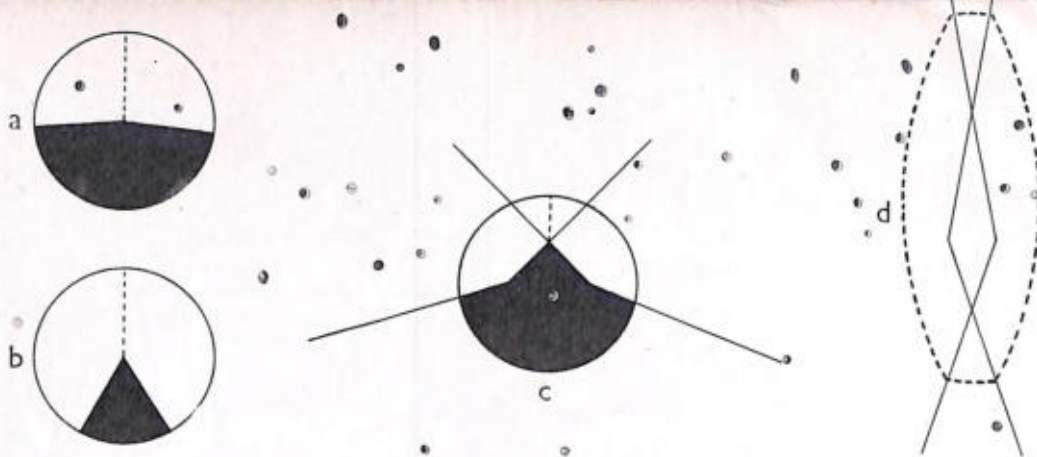
fish, change their position during life. The young fish has an eye at each side of the head but when maturity is reached and the fish comes to lie on its side, one of the eyes actually moves through the head and comes to lie with its fellow on the other side.

The structure of the eye itself is curiously like that of a simple camera. The whole eye is an ovoid structure, mainly filled with fluid under a certain amount of pressure that ensures elasticity of the whole. In front there is a circular coloured structure, the iris, capable of expansion and contraction, so that its central aperture, the pupil, appears to enlarge or diminish. Behind this pupil, surrounded by muscles is a circular lens which receives the vibrations of light, inverts them as does the camera, and projects the inverted image upon the retina, a series of cells known, in accordance with their shape, as rods and cones.

In the human being and in the higher vertebrates the light passes through the eye into the cavity, on to the cells of the retinal lining, on through the rods and cones and then *back again* to the outer side of the rods and cones until the nerve fibres converge together and form the strands that lead to the optic nerve, the pathway of the impressions to the brain. In this relatively complicated way vibrations of light are transmitted and transformed into the sensory impulses that mean so much to the animal concerned.

There are, in the different classes of animals and man, several ways in which the position of the shape of the lens is altered so that near and far objects can be viewed. This ability is known as the power of accommodation and is of great value in the appreciation of the external world. When we are tired or when age slows down the muscles, this power becomes weakened, and the human being can resort to glasses, but there is no such relief in animals and the defects in vision are often quite noticeable in dogs, for example.

The power of sight is of paramount importance in birds, especially in those which must detect their prey from a height and then, by means of a sudden swoop, attack



Visual fields: a. Man's outlook. b. Field of vision of fishes. c. The owl - a hunting bird. d. The woodcock, a hunted bird, with a complete field of vision and binocular vision in front and behind. The dark areas are those with no vision

and capture their food. Many of these birds have acute forward sight, with overlapping fields of vision to aid this acuity.

The field of vision is equally of immense importance, and hunting animals tend to have well-defined fields of forward vision while the hunted (like the rabbit and the non-carnivorous birds) have a wide field of view to the side and even including a backward angle. This is illustrated in the diagram. Acuteness of vision is difficult to define, but if we were endowed with the eyesight of a kestrel, we would be able to read a newspaper at a range of twenty-five yards.

Colour vision can be detected in several ways; by series of experiments, usually concerned with the provision of food in receptacles of various colours, designed to find out if the colour or the food have separate meanings to the animal involved. The structures in the retina, especially the cones, are associated with ranges of colour reception, and, finally, the ability of the brain itself can be investigated. All these yield interesting results. Many insects, cuttlefishes and fishes can see in colours; amphibians and some reptiles, such as turtles and lizards, and all birds, can see in colour. Indeed there is an evolutionary series running through the vertebrates in which this ability can be determined. Yet, apart from man and the great apes, most mammals live their lives in a world of differing tones of grey, in which brightness rather than colour is important. The cat, which many people think can see in colour, has, in fact, a good series of cones in the retina but investigations are said to have established that its mental apparatus is deficient in receiving the colour messages. The bull does not respond to colour and it is the movement of the bull fighters and matadors rather than the colours that they use that are enraging. No bull has ever seen the *redness* of a red rag.

If much of this colour-theory seems unreasonable in an animal world of camouflage and colour, it must be remembered how little we sometimes miss colour in television and how much that is different can be wrested from the combinations of black and white, of light and shade.

As with sight, the sense of hearing depends upon the reception and transmission of vibrations in the air. Thus, it is wrong to say that we hear noises. We take in



Forward vision of the kestrel

vibrations, which are transformed by the middle and inner ear into a series of impulses that affect the innermost region of the ear system and are then passed on by the auditory nerve to be 'translated' in the brain. But the vibrations differ greatly in several ways, such as loudness, pitch and quality. If one takes a tuning fork and strikes it, the loudness will be greatest when the vibration movement is greatest, whereas the pitch will depend on the number of vibrations per second. Musical quality depends upon a certain arithmetical progression in the succession of sets of vibrations, whereas discontinuity and sets of music not in this arithmetical ratio produce what is called noise.

Animals hear a higher pitch than men can and this fact is made use of in the ultra-sonic whistle used for dogs. This is of a frequency of some 13,000 vibrations or more per minute and the sound is not normally heard by adult human beings. Children and adolescents can, however, often hear it and it is easily perceived by dogs and cats.

Many birds have acute hearing as well as acute sight, and the kestrel, for example, relies upon this to locate the slightest sound from the ground, that indicates a movement of a field mouse or other prey. Once heard, the site of the noise is fixed by the eyes and the swoop to the ground begins.

The mechanism of the vertebrate ear is comparatively simple. Sounds reach the outer ear, pass down the meatus or 'ear hole' and impinge upon the ear drum. The actual blow of the vibration sets in motion three connected bones – the hammer, the anvil and the stirrup bones of the middle ear and the last named therefore transmits the amplified blow to the oval window of the cochlea in the inner ear. Now the cochlea is a shell-like structure filled with a fluid under pressure, so that the vibration is passed on elastically to the auditory nerve which bears off the impulses to the *opposite* side of the brain where they are translated into something of meaning.

Such a structure is quite typical of the mammals and man. Yet the size of the outer ear is not necessarily a sign of good hearing. The dog and the donkey both have upstanding ears that are noise collectors, but the large ears of the elephant are mainly used as radiators to cool the blood passing through them and as fans.

Only mammals have these external ears, for, of course, birds have none. The ear-like projections of the owls are ear tufts, feathery covers for the large openings of owl ears which have a very special ability to hear partly in a vertical plane as well as the more usual horizontal plane. Sound collecting is also aided in birds and reptiles generally by turning the head. Reptiles differ further from mammals in that the ear-drum is just below the surface and the ear is, therefore, less complicated than in the mammal. But some reptiles, such as the snakes, which are highly adapted for their crawling mode of life are virtually deaf so far as direct sound vibrations are concerned, and they pick up vibrations from the ground through their lower jaws. This fact is of interest for it robs the familiar snake-charming scene of much of its musical emphasis. The snake is really following the movements of the charmer's hands and pipes; it is, in fact, being 'conducted'.

Many of the insects have hearing and sound-producing organs of much interest. The familiar cricket, and its relations the grasshoppers and the locusts, make sounds by rapidly vibrating horny plates about their shoulders. The sounds are primarily, as in most animals, either for mutual recognition or for calling their mates. Many experiments have been made upon the frequency and attraction of these noises, with the result that man-made whistles can be used to produce notes of the same frequency and attract the females from long distances. Although constantly deceived, the deluded females persist in following the noise, and the practical application of this may yet be that female locusts in great numbers may be misled by mechanical means and destroyed by chemical means.

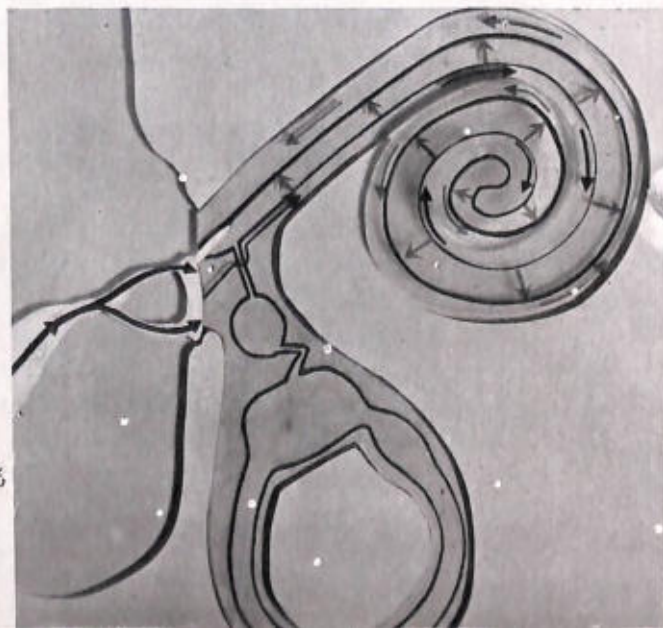
Sight and hearing are both mechanical senses in that they depend upon the receipt of physical vibrations that can be transformed into nerve impulses for transmission to the brain. On the other hand, smell and taste are both chemical senses in which the material or chemical must be borne in solution or as a gas over certain sensory cells.

Smell is done in the higher animals and man by the nose, although only a com-

The middle ear, showing action of ear drum



The inner ear, with coiled cochlea and balancing canals above



paratively small part of that organ is involved. Taste is analysed by certain cells or buds scattered around the tongue, cheek, palate, or throat, according to the kind of animal involved.

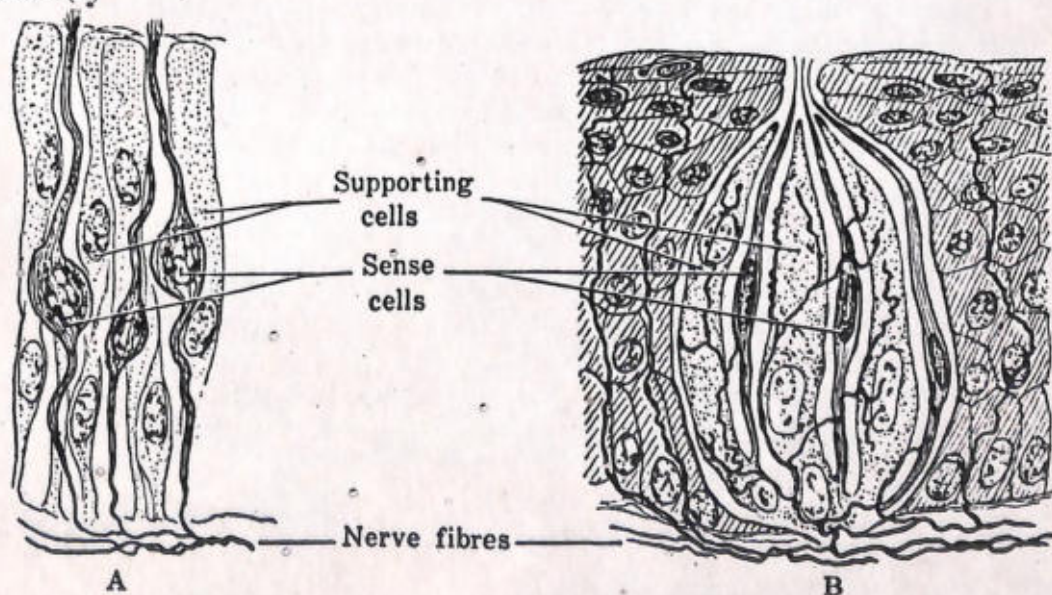
At first sight the two processes seem different, but if we look at the cells of smell (diagram below) we see that they bear an extremely close resemblance to the cells of taste, except that the latter are grouped together into groups or 'buds'. Once again there is a marked difference in the power of smell in animals according to their role in the environment; that is, whether they are hunters or hunted. If we look at the diagrams showing sections of the skulls of the dog, the deer and a human being we see that while the olfactory region (the smelling region) of the human nose is comparatively large, it is nothing like so important relative to the brain as in the case of the deer. And in this can be borne out by experience. The dog lives in a world of smell. It recognises its food and its friends by sniffing. Even the comparatively good eyesight of the dog is discarded when it becomes alarmed; if it thinks it has lost its master in the crowded street, it runs sniffing at the feet of passers by. The deer's whole life depends on its detection of enemies by scent borne on the slightest breeze, so that it may be expected that its smell region in the nose should be large.

Man is largely degenerate so far as the senses are concerned, for civilization has reduced man from the hunter to the spectator, so that his ability to smell danger is greatly disused and the square inch or so of each olfactory region is in marked contrast to the vastly greater area occupied by the brain.

Birds have little use for smell, though I am constantly in doubt of this when I see how readily the sea gulls gather in my garden in winter whenever I put out fat as compared with their indifference to the bread that I put out for other birds.

Reptiles have an additional or confirmatory sense organ - what might be called a nose within a nose. This is a median-placed organ in a little cavity between the roof of the mouth and the nose and connected to the mouth by a little passage. The structure is known as Jacobson's organ. Into it the darting tongue of the snake,

Smell and taste cells are essentially the same. (A) Cells from 'smell-region' of the nose compared with taste bud cells (B)



for example, can introduce itself bearing some sample, solid or liquid of the external world. Smell in the animal world is principally used for finding food or in seeking a mate. The dog, as we have said, the wood mouse, the hedgehog, the pig, rooting around for acorns or other tasty things, are all engaged in the never ending hunt for sustenance. No animal is quite sure of where the *next* meal is coming from. Among the insects smell may also be used for recognition, as in the case of the bees, where members of the same community are recognised by their scent and where intruders are at once known and ejected. In such insects as the Emperor Moth, the female exudes a scent which is fanned around by her wings, and this odour seems to be so penetrating that males are not only attracted in considerable numbers but from distances up to a mile away—no mean feat in a species that is not particularly common. Birds are discriminating and, using their colour vision as well as their considerable power of smell, they are able to choose the tit-bits they like and certainly ravage fruit trees and flower beds methodically.

Touch is the fifth sense; and is perhaps universal in the animal kingdom. This is likely because all primitive animals are sensitive in their surrounding membrane or cuticle, and since the vertebrate sense organs and nerve channels are really dermal in origin, originating from a fold in the skin, it would seem to be the precursor of all other forms of sensitivity. There are many animals in which this all-over sense of touch is well developed. Earwigs will crawl into a cranny (or into a glass tube in the laboratory) so that they have the sensation of touch all over their body. Insects, such as locusts, have touch well developed in their feet and this, too, can easily be demonstrated by setting a locust to rest upon a sheet of paper or on a rod. It will fold its wings and rest, but as soon as there is the slightest sensation in the feet of the removal of the support the wings come into action. Obviously in flying creatures it is urgently necessary that there should be co-ordination between the organs of flight and the structures upon which the animals take off and land.

Antennae, of course, provide the classic examples of organs of touch in insects and other invertebrates. Yet, although they are important in the Hermit Crab, for instance, the hinder part of the body is very touch-sensitive and is probably the determinant in choosing the shell in which this particular crab takes up its home.

Amongst mammals and the higher vertebrates, fingers and toes, the whiskers of the cats, and the general surface of the skin give the necessary responses, and although we, as human beings, cover up most of our bodies, the sensations are never lost, despite this lack of intimate contact between skin and the outer world. Only when there is damage to the brain or central nervous system is there loss of touch and 'feeling'. But there are sense responses that are easily demonstrated but are not, at least as yet, explicable.

Homing pigeons, it is said, have to learn their job, and are only successful after some training by means of short flights from their home. This is obviously far from the whole truth. The pigeons have some sense of navigation that depends on recognition by several senses that can only be summed up as location. The great migratory journeys of the swallows, that cross Europe, the Mediterranean, the

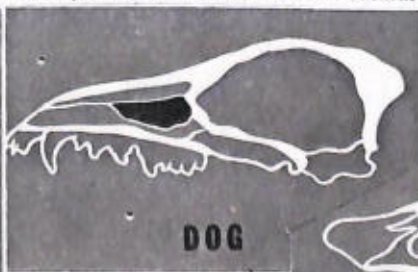
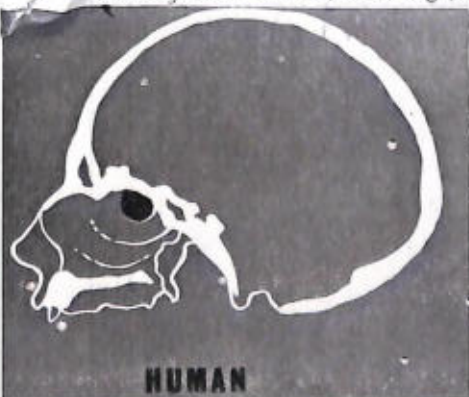
Sahara and much of Africa in their 7,000-mile flights are other quite inexplicable examples. How do the young birds know? It is true that they seem to use the position of the sun by day (as the bees do to indicate to fellow members of the hive where the food is) but most bird migration is done at night because the birds must feed during the day. Stars give the guidance, but what teaches the birds the stars? How is it that the Greater Shearwater, that breeds in lonely Tristan da Cunha, manages to return over a distance of nearly 10,000 miles, during which a navigational error of just over one degree would be fatal? If these are problems whose solution is still awaited, there are simpler journeys that are equally misunderstood. Dogs, cats, and horses are often taken away, given away or sold to new masters. Yet they manage to return to the old homes, only to be led away and to return again sometimes. A few of these movements have been traced and the extraordinary thing is that the journeys, when repeated, are simplified. This would not be remarkable if the route taken were always the same, but often it is quite different, yet shorter, more economical of the animal's time and energy. The mechanism of recognition and of thought in these excursions is not known and much work must yet be done to give even a basis for argument.

Amongst the animal navigators, the bats are well known for they use a system of high frequency sound and its echo to locate objects of all kinds. Blindfolded, they fly without the slightest difficulty, even in a confined space criss-crossed with tapes. If, however, the ears are stuffed temporarily with cotton wool, the bats lose their sense of location and blunder into the tapes. Echo-location can only be done in animals with acute sense of hearing and with a well developed brain. There is no time for cogitation and hesitancy if disasters are to be avoided.

The study of animals clearly shows that their senses are far from being feeble imitations of those of man. On the contrary, many are much better equipped than their human counterparts and indeed they must be, for the world of Nature is an urgent and relentless environment where vigilance is necessary and where carelessness, old age, and diminution of sensibility, means death.

Remarkable as are the discoveries that have been made by zoologists and physiologists, there is still a wide range of subjects for investigation by the behaviourist, and though much of the work that should be done is obviously a matter for the specialist, perhaps I have said enough to show that the amateur observer, the animal lover, can contribute quite generously to the sum of knowledge that must be gained before we really have much understanding of Their World.

Areas of smell in Man, in the dog (a hunter), and in the deer, a hunted animal



The Vanishing Corncrake *C. A. Norris*

SIXTY YEARS AGO almost every countryman in the British Isles knew well the sound of the Corncrake; today only a very small number of people have ever heard it, for this bird, which was once so common, has now been reduced in numbers almost to vanishing point in England and Wales, whilst in Scotland it has become a rarity and only in the West of Ireland are any numbers to be found.

To most people the Corncrake is a sound in the night, for I suspect that of every 100 people who have heard it only one or two will have seen a live bird. It is a most shy and retiring creature and, as it lives out in the fields of long and luxuriant grass and, when disturbed, would much rather run than fly, it really is extremely hard to see.

The first thing about the Corncrake then is its voice, for it is by this that it is identified in 99 cases out of 100. If you hold a hair comb in one hand and a wooden foot ruler in the other and then scrape the edge of the ruler over the coarse teeth of the comb, you can produce a good resemblance of the call. The call is repeated, 'crake-crake', at about the same tempo as an automatic telephone bell. The remarkable thing about the call is that it can go on and on almost indefinitely and, as the principal 'song' periods are at dusk, through the night, and again at dawn, it can become a considerable nuisance if a calling male bird takes up residence near to a house; the call is loud, discordant and has great carrying power. On a still early summer's evening, when the noises of the day have quietened down, the crake's call seems to vibrate through the meadows and if there are two or three birds in the neighbourhood it will sound as if they are competing against one another.

When you try to discover the bird itself another problem arises. At first it might seem that to find a noisy bird calling regularly from a field of luxuriant hay would not be difficult, but when standing listening you quickly discover that it is far from easy to decide exactly where the bird is. The bird, by turning its head as it calls, seems to be able to throw its voice first in one direction and then in another so that when you walk – or even run – to the place where you think the bird is, nothing happens. There is silence for a few minutes and then the 'crake-crake' starts again in another corner of the field. The ventriloquist has crept away, unseen, through the grass.

Corncrakes are not always difficult to see, however, and I have on three occasions seen them walking about in the open; but the conditions for this are exceptional. The bird is a summer migrant, arriving in this country in May. Generally the mowing hay or rank grass, which is its usual habitat, is well grown by the time the birds arrive, but in some years and in some exposed areas this is not so and individuals will turn up in their regular resorts before the grass has reached any height. It is when they first arrive that they are easiest to see; the birds seem more bold and can be watched moving about in a rather hesitant manner feeding as they go, in some ways reminding one of a Moorhen though their colour is more that of a Partridge. The overall colouring is of greyish-brown, but this is made drab by contrast with the rich chestnut colour of the sides and flanks.



The rasping call of the corncrake is becoming increasingly rare in Britain

The Corncrake has aroused a great deal of interest among countrymen and naturalists, not only in this country but in Northern Europe, because of the dramatic way in which it has died out in the last fifty to sixty years. Generally, big changes in bird numbers and distribution take place rather slowly and it is not often that it is possible for naturalists to study a significant change of this sort whilst it is actually taking place; however, the Corncrake is the exception and for many years people have been trying to discover something of the causes which have been responsible for such a remarkable change.

In 1938 and 1939 I organised a national investigation, under the auspices of the British Trust for Ornithology, and over 3,200 replies were received to my enquiries. All sorts of possible reasons for decrease were put forward and were examined, but again and again the same sort of story was reported – a story that referred to a fundamental change that has taken place in agricultural methods. Up to about 1850, and in most places very much later, the hay crop was mown almost entirely by hand; in many areas large numbers of Irish labourers were used for the purpose. The invention of the agricultural mowing machine, and its commercial development which got under way in the 1850's in the south-eastern counties, completely altered agricultural practice. In the old days a gang of men would cut the hay by scythe, working slowly in a line, from one end of a field to the other; the new machine, drawn at first by a horse, and later by a tractor, circled a field at a far greater speed, gradually working from the perimeter in to the centre. As one correspondent put it: 'It was in the years 1892-95 at Chelsham, Surrey, that I saw how the Landrails began to be destroyed. It was the advent of the mowing-machine that wrought destruction in their ranks. I saw whole nests of youngsters cut to pieces in the meadows where they nested. Before that, all our meadows were cut by gangs of men with scythes'.



Corncrake with dark-plumaged chick

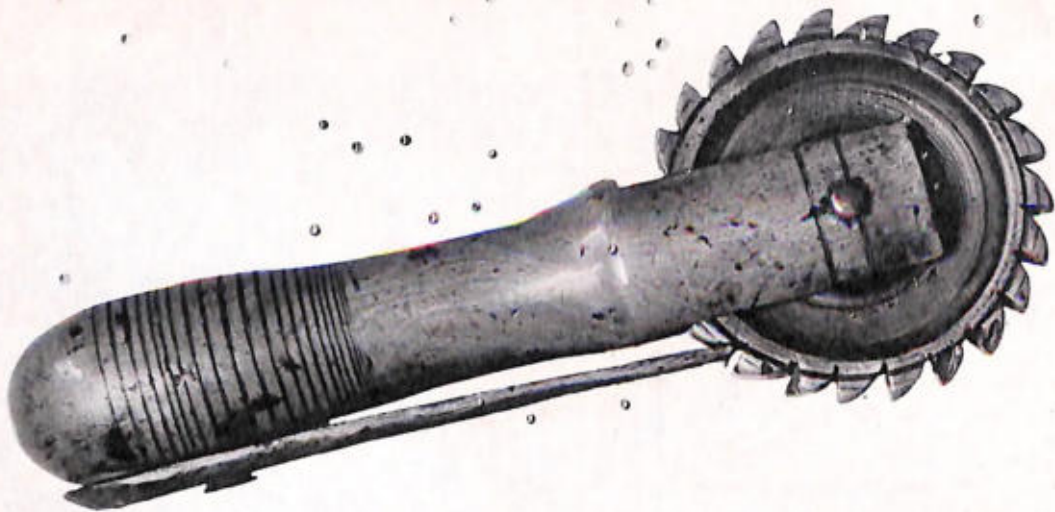
A more specific account, which again was typical of many, came from Co. Meath in Ireland, where mowing machines became a problem shortly before the Second World War. 'In the year referred to we saw a different sight. There were seven or eight Corncrakes' nests in a six-acre field of meadow being mowed (for the first time). Not one escaped. Chicks, recently hatched out and too young to run from danger, were butchered wholesale, whilst in a few cases eggs not yet hatched out were crushed by the cutter-bar of the mower'.

The arrival of the mowing machine was not the only factor, for two other developments coincided with it; the first was the increased growing of rotation grass and the second a change in the date of the hay harvest. The extended use of annual grasses is,



A corncrake performs its courtship display to a dummy

for the Corncrake, particularly tragic, for the luxuriant growth has often been responsible for luring the bird from adjacent and less luxuriant permanent meadow. The annual rotation grasses are, however, frequently cut first with inevitable casualties to the crakes. The change of date has also been for the worse. Realisation of the fact that early mowing produces hay with a higher nutritional value, which is more important than sheer bulk, has brought back the average date by an average of at least a week and, perhaps more in some parts of the country. (The actual dates vary considerably according to the district.) The final tragic result is that the hay harvest, when cut by machine, now coincides almost exactly with the breeding season of the birds and everywhere eggs and very young chicks are in mortal peril.



A corncrake rattle – now in Gloucester Museum – used in the last century for decoying the birds

When the British enquiry took place in 1938 and 1939, Corncrakes were still abundant in many parts of Northern Europe and in those parts of Ireland and north-west Scotland where mowing machines were absent or few and far between. Twenty years of increased mechanisation in agriculture – and in particular the development of the small and easily adaptable tractor – have produced a further dramatic change for the worse.

In 1958, Dr. Haartman produced a report on the present position in Finland and found very much the same set of circumstances that had been found in Britain, with the luckless Corncrake decreasing to vanishing point in many cases.

In a bird which chooses to nest out in the meadows and which lays up to a dozen eggs, the power of the species to recover its former numbers would be very considerable if only the nests were left in peace. This has been discovered on several occasions when pairs have been successful in restricted areas where, for one reason or another, mowing is very late or non-existent. In such areas a reservoir of birds has soon been built up and in a short time the neighbouring meadows have again become populated. This has happened many times in river valleys where the luxuriance of meadow grass, long left rank, proves particularly inviting. The Severn and Avon valleys above Tewkesbury are good examples; but once outside the sanctuary area the annual massacre of nests and eggs goes on and the voice of the Corncrake is seldom heard for more than a year or two.

The future of the whole species must be in some danger, though just how serious this is, is hard to assess. Any species which chooses as a first preference to nest in a certain death trap, is bound to perish in time. That time will come when all mowing grass is cut by machinery in the breeding season. Today in many parts of Northern Europe, mowing machines are still unknown, and the Corncrake flourishes, but agricultural mechanisation is spreading fast, and only a fundamental change of husbandry can reverse the present trend. Will the Corncrake vanish altogether? I hope not, but the danger is a real one.

Fish-Watching *Peter Scott*

FOR AS LONG AS I can remember I have been preoccupied with the study of living animals. My special interest has been centred in one family of birds—the wildfowl—the ducks, geese and swans of the world. Two hundred and forty-seven different kinds of them are known to science, and as soon as you begin to look carefully at the characters which separate these kinds one from another you cannot fail to wonder why and how the differentiation came to exist and you find yourself pondering upon the mysterious processes of evolution. This study was at one time largely the province of the museum worker who examined and compared the preserved specimens of the different kinds. But more recently the great importance of the differences in the behaviour of animals has been realised, and so the naturalist and his more scientific colleague, the ethologist—the students of living animals and their behaviour patterns—have come into their own.

At Christmas time in 1956 my wife and I were in the neighbourhood of the Great Barrier Reef off the north-east coast of Australia. A few months before, the distinguished pioneer of ethology, Dr. Konrad Lorenz, had told me, 'If you have not yet swum with a mask over a coral reef it is one thing which you positively must do

Peter Scott and Tony Soper prepare to film under water in the British Virgin Islands





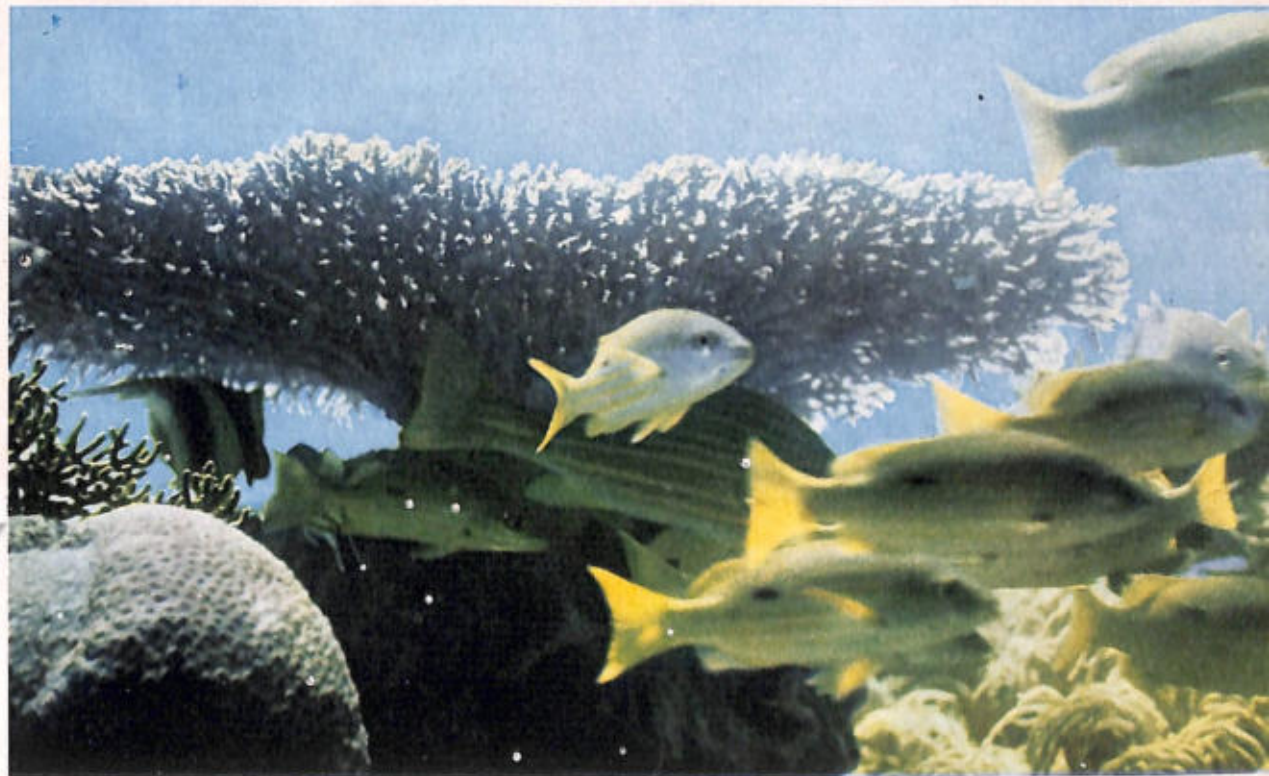
In the clear sunlit water I could see at one glance perhaps two hundred fishes

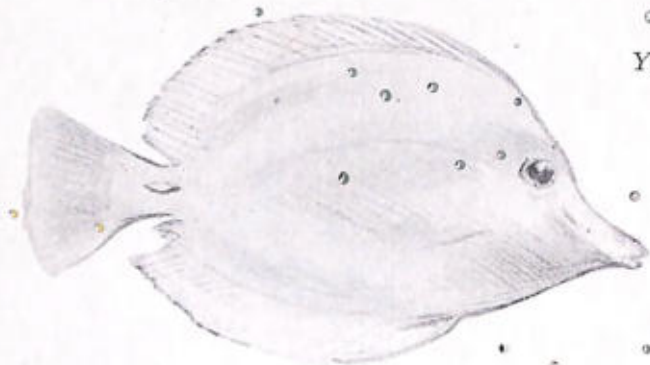
before you die,' and now here was the opportunity. For three days we were free to go swimming over the most famous coral reef in the world. How, I wondered, would fish-watching compare with bird-watching?

When I first put my mask below the surface of the crystal clear water at Michaelmas Bay I can remember shouting aloud with delight – so far as the snorkel in my mouth would allow – for the scene was a supreme and unimagined combination of beauty

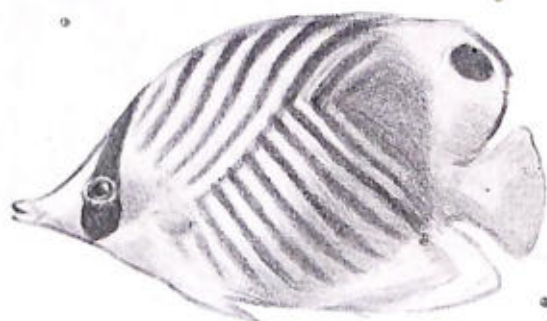
and interest. As an artist I was uplifted by the colours and shapes of the fishes and the corals among which they swam. As a naturalist I was amazed at the diversity of the living creatures I saw. In the clear sunlit water I could see at one glance perhaps two hundred fishes. Some were in little shoals all of one kind, others in pairs, others swimming singly – not only a profusion of fishes but a profusion of different kinds, and a profusion, too, of invertebrate animals as well – bright blue starfish, orange sea urchins, sea cucumbers, green mantic prawns, sea anemones, soft corals, giant clams. None of these creatures paid much attention to me as I cruised past lazily waggling my flippers in the balmy warm water. Little shoals of tiny sky-blue fishes which surrounded some of the coral heads withdrew into the branches if I came too close. Other bright blue and orange fishes about two inches long actually came out aggressively to try to drive me out of their territory. Fishes like vertical dinner plates with complex black and yellow patterns and comical turned-up noses swam in pairs and showed no fear at all. These I learned later were called Butterfly fish. From one spot on the reef I counted up to fifty different kinds of fish within sight. Where above water could such diversity of species be seen together? But at once I wanted to know more about them. It was not enough to distinguish different kinds, I wanted to identify them, put names to them, discover their relationships, study their feeding habits, their courtships, their aggressions, and above all to try to see

Yellow-tailed grunts in the coral reefs of Australia



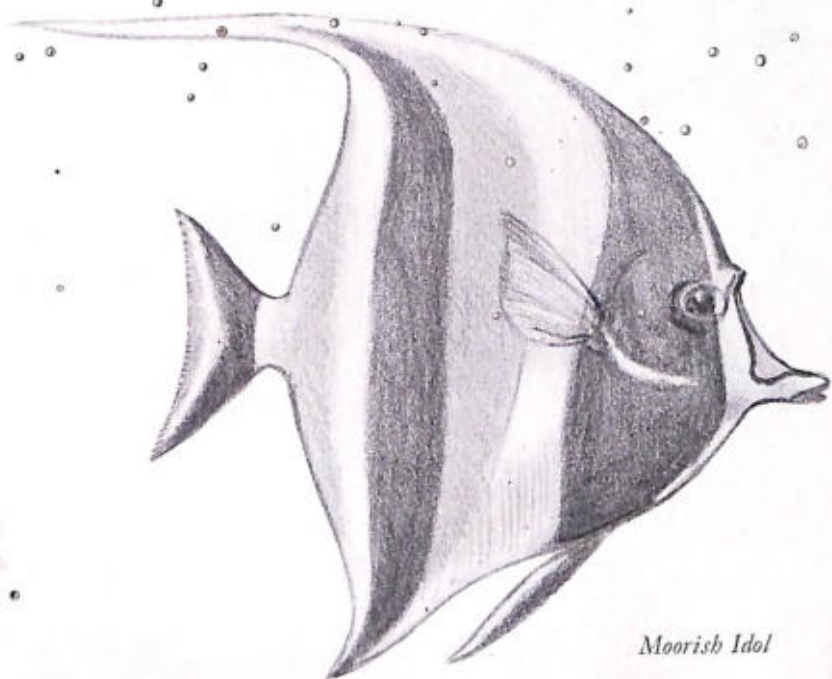


Yellow Tang



Chaetodont

how such diversity came to exist. About a month later we spent a whole week swimming on the reef at Korolevu in Fiji. Here we found more than a hundred species of fish, among them no less than fourteen species of Butterfly fish or Chaetodonts, swimming always in pairs and apparently living happily together at the same shallow depths on the same square kilometre of coral reef. How did all these Chaetodonts, which mostly seemed to differ only in the patterns of their stripes and spots, come into existence? At first I was baffled; but then I began to see a mechanism by which it could have happened. Suppose that long long ago the widespread ancestral Chaetodont species was hit by a great climatic change such as an ice age and could only survive in isolated shallow reefs where perhaps the sun warmed the water sufficiently. During this period the population on each reef might evolve different colour patterns under the selective pressure of slightly different conditions. Then when the climate improved again all these fishes might once more be free to travel between the reefs and indeed all over the oceans. But having been isolated long enough to become specifically distinct, and having a complicated courtship involving the striking colour patterns, they would not interbreed and become merged again, but would remain as different species all occupying the same habitat. Of course, this explanation may be quite wrong and many others are possible; for such things can never be known for certain. But for the fish-watcher speculations like this are inescapable.



Moorish Idol

It was not until January 1959 that we were able to go fish-watching again – this time in the Caribbean and later round the Galapagos Islands in the Pacific. There were new Chaetodonts we had not seen before, and there were old friends too, familiar from the reefs we had swum over in Hawaii and Fiji and Queensland. Once more the profusion and diversity of fishes was fabulous, and once more we realised how little was yet known about them. What made the brilliant Blue Tang in one coral bay swim in shoals while in the next they went about singly? Why should some males of the blue and yellow Damsel Fish, which rejoices in the scientific name of *Abudefduf*, be aggressive while others were not? Were those small greenish perch-like fish the young of the larger groupers that we saw, or adults of a related (or even unrelated) species? Were the two types of Bird Fish with their long down-curved snouts really two species as the text books said, or were they, as seemed so much more probable, male and female of the same species?

Soon we came to realise that fish-watching as a field study was at the stage reached by bird-watching about a century ago. The field is rich and now wide open to the naturalist. The aqualung is hardly necessary, the mask and snorkel – and perhaps a pad of plastic sheets, and some wax pencils with which to make drawings and notes – are all the equipment needed for great new discoveries in the study of animal behaviour and evolution. And as a delightful and stimulating occupation I can wholeheartedly echo Konrad Lorenz, 'If you are a naturalist and you have not yet swum over a coral reef it is something you *positively must* do before you die.'



Fixing up an aquarium in Fiji for filming with Charles Lagne



I longed to go in search of a Painted Lady

Letter to a Young Naturalist *Walter Murray*

Dear Joan, Tom, Keith, or whom it may concern,

A few weeks ago Desmond Hawkins asked me if I would write you a letter with some general advice both of particular things and also the spirit of being a naturalist.

'Advice? Advice?' I can hear you storming, Tom. 'What young naturalist ever wanted advice? We want to get out and do things and see things for ourselves. We don't want advice from some old fogey we've never seen let alone ever heard of. Why should we be told what we ought not to do? I'm going out.'

Right-o Tom, you go and enjoy yourself. But while you are getting your coat on might I just say that when I was your age I felt exactly like that. I didn't want anybody to lay down the law to me. I was dead keen, just as you are, to go birdsnesting. I longed to map and explore the wood, to make my way over the Downs in search of the first migrant Painted Lady butterflies or assembling Emperor moths, to get hold of an old camera and a box of cheap plates and try my hand at nature photography. I even hated the thought of having to waste my time playing games when I might have been on my own, hidden up by the pond watching the pugnacious coots. I had such an intense love of nature that I had a kind of horror of anyone inter-

fering. I remember one of the games masters taking me aside one day and telling me that I would be a fool if I didn't join in school games. He told me I would regret it all my life if I didn't take part. Almost under compulsion I had to learn the rules and try to play the game. I didn't want to take the master's advice, but fortunately I had to, and as you can well imagine I've never regretted it.

I know now that I could well have done with some advice in the field of natural history. Now don't shy again, Tom. Go it alone by all means. There are many things that a naturalist can only do alone, and that intense intimate joy that sometimes comes when in close association with nature is rarely experienced unless you are alone. Unless you derive pleasure from your study of nature, unless you frequently glimpse a revelation of beauty in the work and observations you undertake, I think that as a naturalist you will be very unnatural. Of course you want to go out alone, in fact you must go alone, you must feel as well as record, observe and study.

A tawny owl was hooting





Scent draws Emperor moths to the female from great distances. Here a female prepares to release the scent

Have you ever been out alone by a woodland pool as the sun sets? Your purpose perhaps is to study the roosting behaviour of certain birds, or maybe you are noting down the times of the last songsters. I remember on one occasion I wanted to observe the behaviour of moorhens and if possible to make a sound recording of their peculiar bell-like notes as they began to assemble on the pool before going up to roost. I sat motionless with my fingers on the switches of the recorder ready to set the instrument running at a moment's notice. I was very tense. Everything seemed to depend on my doing the right thing at the right moment. I tended to become impatient. How slowly it got darker!

But very gradually I began to realise that I was a very insignificant factor indeed in the exciting new world that everywhere began to wake around me. I became aware for the first time in my life of that remarkable 'change over' which takes place at dusk when creatures of the day begin to droop while creatures of the night rouse and stir. I heard a pheasant go noisily up to roost and some wood-pigeons already there stirred uneasily. Before the song thrush had finished his last notes a tawny owl was hooting. Then profound silence. Upon it, like a finger upon velvet, a rustling felt rather than heard. Two wood mice streaked across an open space. Then a dog fox barked on the other side of the wood and the vixen, so close to me that she made my hair rise, squealed in answer. Only then did I think to press the switches of the recorder, for the moorhens had already commenced their strange little concert.

I did get a little bit of tape, recording their voices, but what an insignificant thing this was compared with what I had experienced.

The first point that I would like to make is this: it seems to me imperative that you should have some particular quest, that when you go out, as you are so anxious to do, Tom, you should go with a definite purpose, and not with a hopeful expectation that something will be sure to turn up. You have each got your own particular skill or aptitude, just as you, Keith, have a flair for drawing birds, and as you, Joan, have



Moorhen feeding chick

for photographing flowers. Develop that skill for all you are worth. Never let a ramble, an expedition, a holiday go by without using it, without adding to your 'collection', to your knowledge, to your experience, and achieving a greater mastery of your technique.

Not long ago I heard in a radio programme James Fisher 'speaking personally'. The theme of his talk was stressing the importance of doing your work, your study, your hobby, 'professionally'. By this he did not mean what is often understood by the word professional – being paid for it – he meant doing it with meticulous care as if indeed your livelihood were dependent upon it. The professional touch is not necessarily the work of the paid craftsman, it is the hall-mark of thoroughness, accuracy, attention to detail, and finish. James Fisher is our greatest ornithologist today and what he says goes. Do your study, your observations, records, your drawings, your photography, as accurately and as thoroughly as you know how. Do not think to make money out of it – few naturalists ever do or even expect to, but if your work is absolutely reliable it will always have its worth.

The second point that I want to make is that you should not specialise too early in one particular branch of nature study, or on one particular subject. This might appear at first reading to be directly contradictory to what I have just said. But this is not so. Of course you must follow your flair and master your technique, but if you think that you know all there is to be known about, say, water beetles, to the exclusion of all else, then you will be a young bore not a young naturalist. Set out to be a good



A red-necked phalarope swims briskly through the bog-bean of a Shetland loch

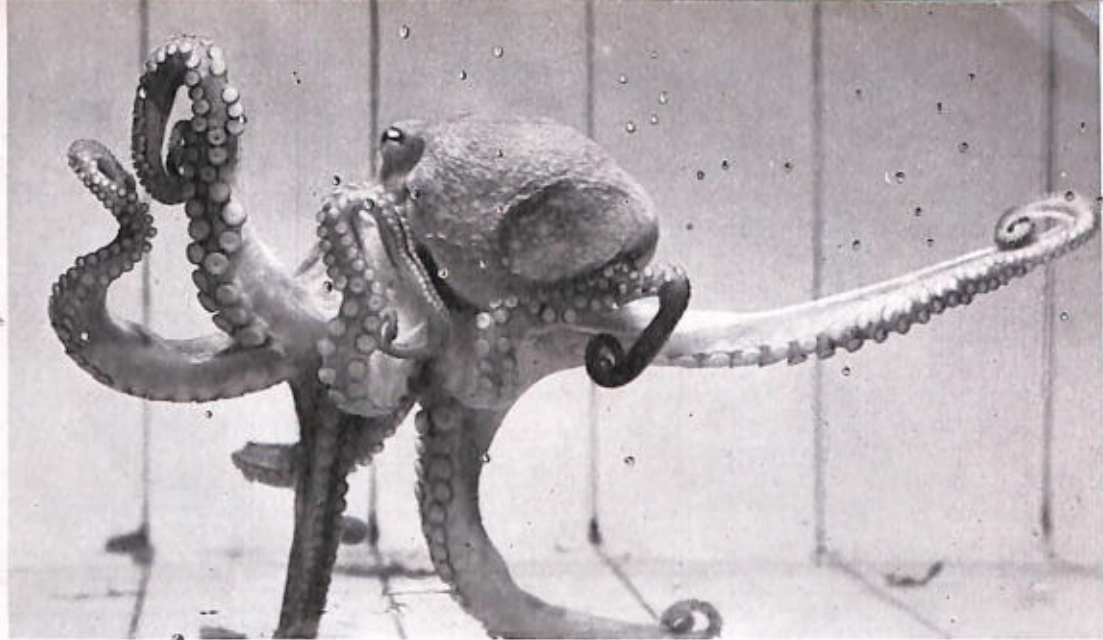
field naturalist first. Know your wild flowers and insects as well as your mammals and birds. Be alert to everything and then you will never bore yourself. And when you do specialise later, as you are bound to do, please don't become a bore. That is a person who is unable to listen or talk about anything else but his own particular subject. There are too many of this type about; they cast a dusty shadow across nature's fair greensward. You are young naturalists now, always keep a young naturalist's heart, alert, keen, enthusiastic.

If forty years on you can still lie flat on your tummy on the mountain top in adoration of a wild flower you have never seen before; if your heart can still pound so violently that you cannot hold your binoculars steady as the little red-necked phalarope comes swimming briskly towards you through the bog-bean of a Shetland loch; if you are almost suffocated through holding your breath as you see the wood mouse you have so long waited for come at last into sharp focus of your camera; then I shall be happy indeed that I dropped you this note, for to experience these things is more than all burnt offerings and sacrifices.

I have only used one 'don't' in this letter, Tom, did you notice that? For young naturalists the key word is not 'don't', it is DO. Thanks for reading. I look forward immensely to meeting all of you in the field some day.

Yours very sincerely,

WALTER J. C. MURRAY.

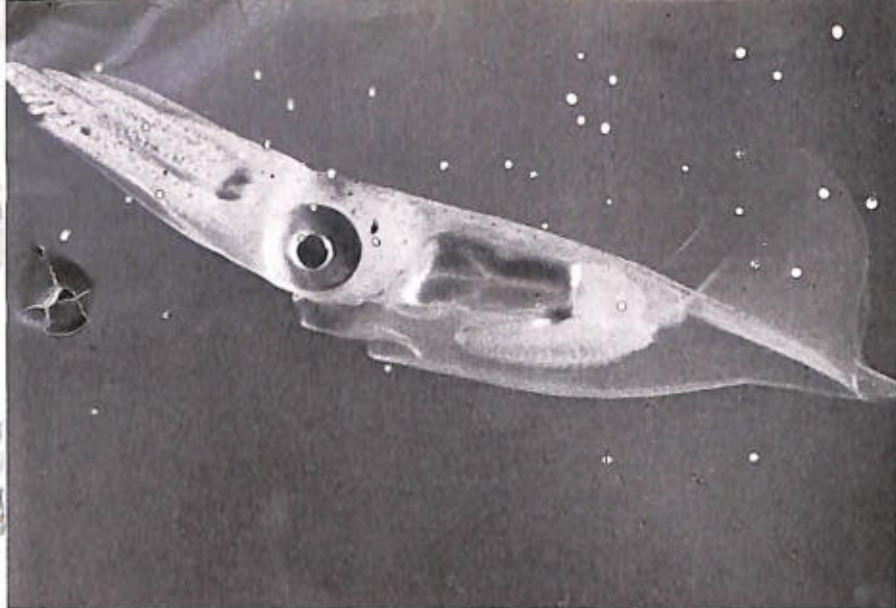


Octopus pushing its mantle and visceral mass against the side of the tank

Devilfish *Brian Boycott*

DEVILFISH IS A popular name for a number of powerful and supposedly ferocious animals; for example, the sting and eagle rays, the piranha and some of the whales. But perhaps none of these has gained such diabolical status as the cephalopods. In Victor Hugo's famous novel *Toilers of the Sea*, the octopus that attacks the hero is made to exemplify the quintessence of evil. The supposedly enormous strength of cephalopods is dramatised in the squid that attacked Captain Nemo's submarine the *Nautilus*. The devilfish I am writing about are the squids, cuttlefishes and octopuses.

Quite how cephalopods came to be regarded as 'devil' fish would make an interesting study in itself. In sheer size they may be formidable. Large squids, some 25 ft. in total length, are probably not uncommon. They are mostly known from the sucker marks they leave on the heads of the whales that feed on them. Squids as big as 50 to 60 feet in length, including their extended tentacles, have been caught occasionally and there is an octopus in the Pacific with a span between the arms, when it is fully grown, of something like 24 feet. Yet there are few well authenticated accounts of these large creatures being dangerous to unwary seafarers. Perhaps it is their unfamiliarity which has led to the fear they seem to inspire, and certainly a very large animal with eight long arms and vertebrate-like eyes must be a startling thing to meet. But in countries where they are fished as food there are more stories told of their cunning, than of their diabolical nature. Pliny relates how an octopus that could not pull open the shell of a large bivalve retired a little way, picking up pebbles as it went. When the bivalve opened its shell, in order to breathe, the octopus reached forward and placed some of the pebbles in the opening of the shell. The shell could



In this picture the dark liver of the squid can be clearly seen, and under it the darker dot of the ink sac. The funnel, under the eye, is open



Squid washed ashore

not then be shut and the octopus reached in and scooped out the flesh. There are many other stories of this kind. This one is of particular interest because it was claimed as an independent observation in 1857 and published in a scientific journal. It is still currently supposed to be true by some Mediterranean fishermen. If it were confirmed, it would be a unique example of an invertebrate using a tool, but I have never been able to confirm it.

Such subjects apart, cephalopods are remarkably interesting animals. They are not, of course, fish. They belong to a large phylum of the animal kingdom – the molluscs. This phylum includes snails and slugs, mussels and oysters (bivalves), sea-hares and sea slugs, among others. Unlike these beasts, cephalopods have in the course of their evolution, specialised as predacious animals chasing their prey actively, rather than sitting wafting their food to them or browsing on plants and sedentary animals.

Cephalopods are so called because the head bears the arms and tentacles. The body consists of three main parts. The first is the arms and tentacles, which bear suckers and serve to hold on to the prey or propel the animal along the bottom. In the octopuses there are eight arms, in the squids and cuttlefishes there are eight arms and two tentacles. The second main part is the head, which has two large eyes superficially resembling those of a vertebrate: a brain lies between the eyes. The rest of the body is a muscular sac containing the guts, the heart and the gills. In cuttlefishes and squids there are fins on this sac.

The cephalopod group is a very old one, as we know from fossil ammonites and belemnites which are all now extinct. Some idea of what a living ammonite may have looked like can be obtained from the Pearly Nautilus, now found only in the Pacific area. The large nautilus shell is made up of many chambers coiled round the original chamber. As the animal grows it adds a bigger chamber, as the last becomes too small for it. The shell protects the soft parts of the body, while the arms are free to move



A cuttlefish lying on the shell of a large bivalve. The cuttlefish is camouflaging itself with a sandy brown colour.

outside and grasp the prey. The animal probably never leaves its shell until it dies.

Other than the Pearly Nautilus, all other living cephalopods have, during the course of evolution, enclosed the shell within the skin, where it has undergone considerable modification. In cuttlefishes the shell is very familiar as the cuttlebone that we give to budgerigars as a beak sharpener and source of calcium. At one time it was used as an abrasive in toothpaste, as pounce and in minute quantities in homoeopathic prescriptions. In squids, the shell has been reduced to a long rod, the so-called pen; and in octopuses it has disappeared almost completely.

To understand the significance of these alterations in the ancestral shell we must look at the different ways of life of these animals. Octopuses have no skeleton except that which surrounds the brain. They live on the sea bottom squeezing in and out between narrow cracks and crannies and making their homes in suitable crevices; their soft body and long arms are admirably adapted to this mode of living. Although they can swim well they are not such good swimmers as squids and cuttlefishes. Squids live together in shoals in the open sea and rarely go to the bottom except to breed. They are long and thin and can swim very fast. The long thin body is maintained by the rigidity of the pen of shell that remains to them. The shape of a

Cuttlefish (Sepia officinalis) showing the zebra colouration



squid is comparable to that of a destroyer, which can move fast, but needs relatively more room to turn in than a tugboat. This it has in the open sea. A cuttlefish on the other hand is short and squat, rather like a tug. At rest it lies partly buried in the sand of the bottom. When hunting it swims in and out of the rocks and weeds of the environment where it lives. In such circumstances ease of manoeuvre is a greater advantage than sheer speed.

How do these animals breathe and catch their prey? The lower half of the muscular bag behind the head is filled with seawater into which hang the gills. The size of the cavity can be altered by muscular contraction; when the cavity is made larger, water flows in through valves at the side of the cavity. When the cavity is made smaller, these valves shut and water is pushed out through a median funnel. In this way

The lesser octopus, Eledone cirrhosa, more often found in British waters than the common octopus



water goes in and out of the cavity, thus bringing oxygen to the gills and taking waste away. All the time the animal is alive there is a continuous rhythm of contraction and relaxation of this bag. The system is also used to provide the propulsive force for swimming. If the muscular bag contracts more vigorously than during breathing, stronger jets of water are shot out of the funnel, and as a result the animal is pushed in a direction opposite to the jet of water. By pointing the funnel in different directions the animals can steer themselves. Squids and cuttlefishes, moreover, have fins which supplement these movements.

The tentacles of squids and cuttlefishes are specialised for catching prey. As a cuttlefish approaches its prey the tips of the tentacles appear between the arms. When it has got within range the tentacles are shot out very fast and almost invariably

hit the mark. The tips of the tentacles are club-shaped and armed with suckers which hold on tight. As soon as the prey is seized, the tentacles are coiled back into pockets under the eyes and the prey is held by the arms and suckers. Jaws, very similar in appearance to a parrot's beak, bite into the captive and a poison from the salivary glands is injected to kill it. Octopuses have no such tentacles and catch their prey by pouncing on it and holding it with their arms.

In ancient times Mediterranean peoples paid tribute to the beauty of cephalopods by using them as motifs on vases, walls and floors. A particularly pleasing example has been unearthed recently by Dr. Blegen, of the University of Cincinnati. He and his colleagues have dug up a palace which was probably that of King Nestor, and dates from about the 13th century B.C. This Nestor was probably the king, referred to in the Iliad and the Odyssey, who was visited by Telemachus when he went in search of his father, Odysseus. The motifs of the floor of the Queen's apartment include octopuses, dolphins and fish, with what are probably stylised representations of fish scales, starfishes and cephalopod suckers. Doubtless some of the usage of cephalopods as motifs was due to their flexible bodies which could be artistically disposed, but I think another reason must have been their considerable beauty of coloration and ability to change colour.

To my mind this ability to change colour is one of the most remarkable things about them. In the skin of cephalopods there are bags filled with coloured matter, which are expanded by muscle fibres inserted on their walls. The bags contract automatically to pin point size when the muscles relax so that the body becomes pale. There are several different kinds of pigment in separate bags, and by expanding or contracting these different chromatophores the animals are able to produce different patterns of coloration. In this way a cuttlefish or an octopus can come to resemble a sandy bottom or assume the alternate light and dark bands of the shadows produced by the weeds amongst which it is swimming. The range of colour patterns is not limited to camouflage, and patterns are produced which are important in the recognition of the sexes and attraction of a male for a female. Other patterns are probably important in deterring a predator from attacking. The rate at which the animals can change from one colour pattern to another is uniquely fast. A single chromatophore can change from full contraction to full expansion in as little as two-thirds of a second.

An octopus swimming backwards, moving towards the right

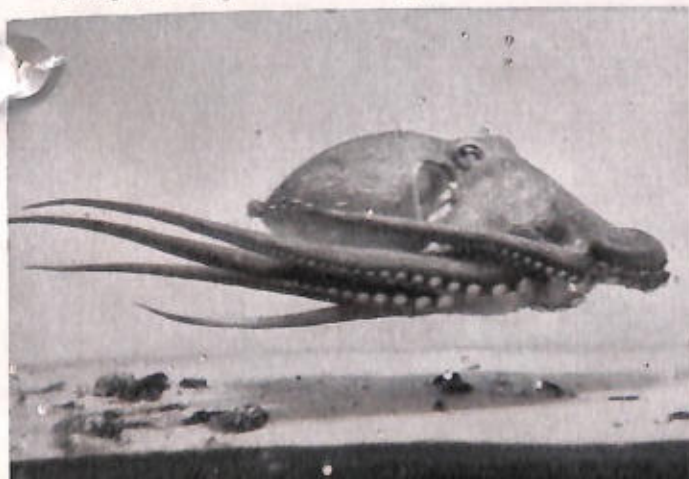


The cephalopods of open water are generally transparent. They have chromatophores which give them some coloration, but they are mainly only expanded when the squids are disturbed or breeding.

When cephalopods reproduce they lay their eggs in clusters; in the case of squids and cuttlefishes of several hundreds and in octopuses of thousands. The eggs of cuttlefishes resemble bunches of black grapes. Inside the black case there is a large mass of yolk and on this the embryo feeds while it develops. Squids and cuttlefishes, once they have laid their eggs, either die or swim away. The female octopus, however, lays them in a crevice in the rocks and spends the four weeks or so while they are developing guarding them from algal growths and keeping browsing animals away. The Paper Nautilus, *Argonauta*, has carried maternal care to the extreme of developing a special shell in which she carries the eggs while they develop. *Argonauta* is a pelagic octopus, but it is popularly confused with the Pearly Nautilus because of its shell, although the shell is an entirely different structure from that of the Pearly Nautilus. The shell is unique to the female Argonaut. The male is a tiny little creature, not much bigger than a haricot bean. His habits are obscure, but once he has fertilised the female, his job is done. The Argonaut was once famous because the web which is found between the arms of octopuses was supposed to be raised by her above the water and so act as a sail. Actually she swims by jet propulsion like any other octopus. The web is, in fact, concerned in the formation of the shell. Recently it has been shown that it is also a special device for catching food. If potential food bumps into the web as the *Argonauta* swims the sense organs in the web detect it and the arms grab round to the touched spot, seize the food and carry it to the mouth.

There is no space to describe all the fascinating aspects of cephalopods, to describe the luminescent ones, those that have eyes on stalks much longer than their bodies, those with short arms and a shape like a bun, those with special thick gelatinous coverings; or how in Southern seas squids are so common that they replace fishes as a major part of the food supply of large carnivorous creatures such as seals and whales. Indeed we know very little about these animals. But I hope that by describing something of the organisation and behaviour of the common species I have shown that they are of interest for their own sakes as well as for legendary, culinary and artistic purposes.

Octopus swimming forwards. The arms are held out on either side of the body to act as stabilising fins



A jar, discovered by Dr. C. W. Blegen in King Nestor's Palace.





Lapwing in flight

The Speed of Birds *Frank Lane*

IN DECEMBER, 1927, observers in Newfoundland and Labrador saw lapwings flying in from the sea. Starting from Britain, they had flown 2,200 miles across the Atlantic in about 24 hours. The average speed, therefore, was about 91 m.p.h.

But this does not mean that the lapwings *flew* at this speed: a 55 m.p.h. tail-wind was blowing across the Atlantic, accounting for over half the birds' speed. A paper bag, blown along by such a wind, would travel at nearly a mile a minute.

True speed, that is speed through the air, is measured in level flight in still air, where the bird's speed is due entirely to its own efforts, without help from gravity or wind. It is, of course, difficult to obtain speeds in these ideal conditions, or where exact allowance can be made for wind speed. That is one of the main reasons why contradictory figures are sometimes given for the speed of the same species of bird.

A bird timed one day diving in a strong tail-wind may reach 100 m.p.h.; the next, climbing against the wind, it may clock only 10 m.p.h.

Nearly all birds have two, and some three speeds: for cruising, emergencies, and migration. A bird that normally flies at 10-20 m.p.h. may average 30 m.p.h. on migration and in panic flight before a predator may reach 40 m.p.h. for a few seconds.

All birds of the same species are not capable of equal speed. Age, state of plumage and other factors modify a bird's powers of flight. One bird in a covey of partridges was seen to fly about 15 per cent faster than the others when the whole covey was in full panic flight before a falcon.

Various methods have been used to time birds although unfortunately many of them have not allowed for the complications of wind and gravity. Ordinary and electrical stop-watches timing over a known distance; car, motor-cycle and aeroplane speedometers; marking birds and noting the time taken to travel a measured distance; and applying the methods used during the First World War to time aeroplanes (which involved the use of balloons, theodolites and stop-watches) - all these have been used to find the speed of birds.

In France, birds have been harnessed by silk thread to an indicator which recorded the amount of line taken out as the bird flew and the time occupied. A simple calculation then gave the speed in miles per hour. Another method was used to find the speed of a game bird shortly after it rises. In a covered range, which obviated wind factors, birds were made to fly 40 yards, and then pass through two screens of fine invisible cotton. The time was recorded by electrical chronograph and the speed worked out from the known distance between the two screens. By this method it was found that partridges and pheasants, shortly after being flushed, attain a speed of about 30 m.p.h., the pheasants being slightly the faster.

About 45 m.p.h. would be the cruising speed of these swans



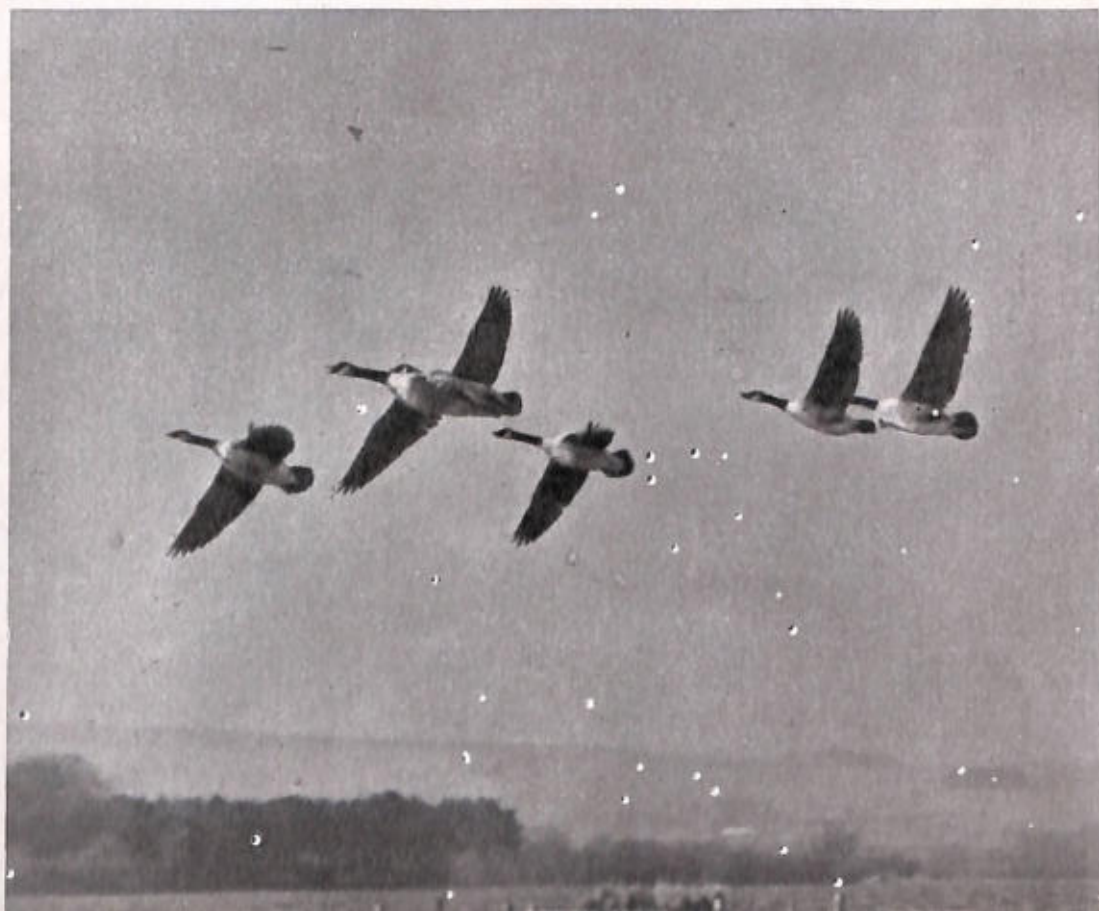
Incidentally, the clay 'birds' released from the traps of a shooting-tower come whirring over the heads of the guns at 50 m.p.h. The 'birds' are then smashed to smithereens by pellets travelling at 700 m.p.h.

It should be emphasised that visual observations of flying birds, unless checked with instruments, are apt to give very misleading impressions. The smaller the bird the faster it appears to be flying, yet actually some of the largest, such as geese, are among the swiftest of all British birds, sometimes attaining an air-speed of a mile a minute. This is about twice the speed of such small birds as sparrows and chaffinches, which appear to dart about so quickly.

The aeroplane is one of the best ways of timing birds' speeds as it can fly in the same air-stream and direction as the bird. Unfortunately for ornithology, aeroplanes are much too fast now, but before the jet-age some interesting records were obtained by pilots. The *U.S. National Bulletin* reported in 1938 that a pilot who was nose-diving at over 170 m.p.h. was passed by a peregrine falcon stooping on some ducks 'as though the plane was standing still'. But in level flight the falcon is much slower.

A Royal Air Force pilot in a training plane learnt another aspect of avian aerobatics when he was about to overtake a mallard. The duck was flying all-out at nearly 60 m.p.h. and as the plane overhauled it the bird's quick backward glances showed its mounting fear. When no more than a yard separated bird and machine the duck flicked onto its back and dived vertically towards the ground and safety. If the pilot

Some of the largest birds, such as geese, are among the swiftest



SPEED, HEIGHT AND WING-BEAT

SPECIES	SPEED IN M.P.H.	HOW TIMED	WING-BEATS PER SECOND	HEIGHT IN FEET
Blue tit	21	M-C		
Green woodpecker	23	Car		
Sparrow-hawk	25	Car		
Snow-bunting	26			
Goldfinch	26	M-C		
Cuckoo	27	Car	4.8	
Common tern	29	Car		
Blackbird	33	Car	5.6	
Chaffinch	35	Car		
Crow	35	Car	4.2	
House-sparrow	35	S-W	13.0	14,000
Raven	35		3.6	
Skylark	35			
Magpie	35	Car	3.0	
Heron	35	Car	2.9	3,000
Mistle-thrush	35	Car		
Herring-gull	36	Car		
Manx shearwater	40		5.4	
Swallow	40			
Woodcock	40			
Little owl	40	M-C		
Shrike	40			
Kestrel	40			7,000
Whooper-swan	44	S-W		
Cormorant	45		4.4	2,500
Rook	45		3.0	11,000
Tawny owl	45			
House-martin	45			
Gannet	48	Pl	4.3	
Jackdaw	50		4.2	800
Snow-goose	50	Pl		
Lapwing	50	Pl	4.8	8,500
Curlew	50	Car	4.2	4,600
Starling	50	S-W	7.5	3,500
Common snipe	50		5.8	
Partridge	50			
Pheasant	50		9 (rising)	
Red grouse	50			
Sand grouse	50		6.0	
Wood pigeon	51	Car	5.2	
Racing pigeon	58.7		8.0	
Stock dove	59	M-C		400
Canada goose	60	Pl		
Mallard	60		5.1	6,300
Pintail	60			
Teal	60		10.0	
Golden plover	60			6,600
Swift	60			6,700
Eider duck	70		4.9	
Albatross	100			
American sandpiper	110	Pl		12,000
Golden eagle	120	S-W		9,750
Peregrine falcon	200+	Pl	4.4	
Needle-tailed swift	219	S-W		

Abbreviations used:—M-C for motor cycle, S-W for stop-watch, Pl for Aeroplane.

NOTE.—All figures should be regarded as approximate. Generally the highest authentic figures have been given throughout this table.



The house-sparrow beats its wings about thirteen times a second

had tried the same manoeuvre the plane's wings would probably have collapsed. But the 'flick-half-roll', so well designed as an evasive measure, was perfectly performed by the duck – with probably a little creaking of its joints.

Incidentally, when a Spitfire once collided with a duck at a combined speed of some 450 m.p.h. the bird just disappeared. When the plane landed, a hole the size of the duck's head was found in the leading edge of one of the wings, and through this the entire duck had been forced at an estimated pressure of some two tons to the square inch. When recovered from the wing panelling the mallard was a compressed raw rissole of bones, flesh and feathers!

What is the fastest flying speed for a bird? Col. R. Meinertzhagen, who has been interested in the speed of birds for more than 40 years and has amassed a great deal of information on the subject, questions the accuracy of any record giving a speed much in excess of 60 m.p.h. for any bird in level flight in still air. I think he is probably right, although there are some apparently well-founded records giving higher speeds.

One of the most famous of these is Stuart Baker's observations on the spine-tailed swift in the Cachar Hills, Assam. Baker's house was exactly two miles from a distant ridge, and he says:

In the evenings the spine-tails used to come over my house and fly straight to the opposite ridge and, on reaching it, at once dip down into the farther valley. With a stop-watch, I could time them as they swished over my house until they dipped into the valley over the ridge . . . the actual times taken to traverse the two miles varied between 32.8 and 41.8 seconds.

Thus the fastest speed was 219.5 m.p.h. Baker adds that the difference in speed between the British and spine-tailed swift is extraordinary: it is doubtful if the British swift can fly faster than 60 m.p.h. (For full details see my *Nature Parade*, 1955).

Another high-speed flight was recorded by Fraser Darling who timed a golden eagle at 120 m.p.h. when it was being chased by two peregrine falcons. Darling took a careful note of the time and the distance the eagle flew, and says that it rose 1,000 feet during the chase.



Only very high-speed photography can capture the wing-beats - 75 in a second - of a humming bird. This photograph was taken at a speed of 1/100,000th of a second

Why are such records difficult to accept? Chiefly because the speeds are so much in excess of the known speeds of such fast flyers as the racing pigeon. A careful test was made with Royal Air Force pigeons during the Second World War. The speed was the average of a two-way flight. The highest speed recorded was 58.7 m.p.h. It is difficult to believe that an eagle, while gaining 1,000 feet in height, can travel at over twice the speed of a racing pigeon, and that a swift can travel nearly four times faster. Hence the scepticism. Possibly special air conditions help to explain these remarkable records.

Leaving such exceptional speeds there are some British birds which can equal or surpass a mile a minute - say the avian equivalent of the human runner's four-minute mile. Among these are mallard, eider-duck, teal, pintail, several species of geese, peregrine falcon, great northern diver, racing pigeon and stock dove.

Another aspect of bird speed is the frequency of wing-beat. Compared with speed of flight little work has been done on this but some interesting figures are available. There is a great difference in wing-beat frequency as anyone realises who has compared the slow oarage of a heron with the invisibly quick wing-beat of a sparrow or finch. But only instruments, especially the high-speed cinematograph camera, can show how great is the difference by giving exact figures.

No British bird approaches the frequency of the tiny humming-birds, some of which have been proved to beat their wings - complete up and down movement - 75 times a second. The house-sparrow beats its wings about 13 times a second when in fast flight - the heron two or three. Incidentally, a midge (*Forcipomyia*) which is less than one-tenth of an inch long, beats its wings 1,046 times a second!

The same bird does not maintain a constant beat. When taking-off, accelerating, or in panic flight, many birds beat their wings faster than in ordinary flight. Observations on a jay showed that when taking-off its wings beat four times a second, in steady flight 2.6 and when descending 2.2. Taking-off consumes much energy. If a bird is made to rise and fly several times in quick succession it will eventually stay panting on the ground.



Arnold Benington

believe that it is worth while putting
of making the most of your hobby.
is that even with a few years' intensive
at No-Man's land that lies between
edge. But to do this, of course, you
enjoy each week-end's bird watching

he is fortunately tending to use the
the strong instinct to collect some-
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We saw all kinds of other things

Sometimes week-end naturalists are discouraged by the limited amount of time that they are able to spend out of doors. But there is no need to be downhearted. I am a great believer in making the most of one's opportunities, and taking advantage of whatever offers. Really valuable work may be done in your own garden and its immediate surroundings.

Within two miles of my home there is a small wood. Indeed, it is hardly more than a mixed collection of trees and bushes, growing round the rim of a couple of disused quarries, in which water lies; just a sort of overgrown place on a neglected farm. Yet it provides cover for a surprising number of birds and mammals, although it cannot be much more than ten acres in extent.

At Easter this year I jumped on my bicycle and went out there with a couple of friends to see what we could find. Bicycles are excellent for this work, because not only do they get you there, but en route the rider frequently sees and hears things from the saddle that he might miss if using other means of transport. We were working along the fringe of the wood when somebody said – 'long-tailed tits' – and we all crouched in cover. Just overhead there were two birds with nesting material, and it was only a matter of minutes waiting before we found the nest, thirty feet from the ground, in the fork of an old elm, so well camouflaged with grey lichens that it just looked like a swelling on the tree trunk. Actually the birds were lining the nest, so we moved a little distance away so as not to disturb them, and spread out a bit in the hopes of finding the source of their nest lining. I have known a dead wood-pigeon, and on another occasion, a dead mistle thrush to be made use of by long-tailed tits in this way, so I was very pleased when one of my friends traced them to a dead woodcock.



Long-tailed tit at nest

We stood fascinated within a few yards and watched them convert the useless body covering of the poor woodcock into an up-to-date cosy interior decoration for their own nursery!

Soon we found that there were at least three pairs of long-tails in that wood, and that every half hour or so they all met together at one place to feed for a few minutes, then dispersed again to their various nesting territories. But although we spent the rest of that day watching and waiting in the wood, we did not succeed in finding a second nest. The other two pairs of long-tailed tits were giving nothing away, but we saw all kinds of other things. There were two or three pairs of goldcrests, several blue, great and cole tits, chiffchaffs, chaffinches, and so on, as well as woodpigeon, magpie, hooded crow, kestrel, sparrow hawk, and moorhen and mallard in the quarry hole.

Of course, like most other people, now and again when time permits, I like to get away for a longer excursion. If you have a head for heights, then tree and cliff work provide a welcome change from the garden birds. In my case, the grand Antrim coast cliffs, with their peregrine, buzzard, chough, fulmars, auks, and golden eagles provide me with all the excitement I can take. Indeed a couple of years ago I had almost more excitement than I could take. It was at a buzzard's nest, built on a huge boulder that had fallen from the cliff higher up and got wedged across a narrow chimney in the rock face.

One day I was going down to see the young and photograph them, and, perhaps, even ring them. I had arrived at the sloping ledge and was intending to traverse it down to the actual nest when, in an unguarded moment, I slipped. Both feet shot from under me, and as I had no handhold at the moment I shot outwards and down.



Choughs – one of the special features of the Ulster Coast

As usually happens in accidents, a great deal passed through my mind in the second or so that my life hung in the balance. As I spun and shot out over the sea, it looked very far below. Also I noticed several nasty looking rocks jutting out of the breakers directly beneath me. I suddenly remembered that the rope round my waist was a borrowed one, since my own nylon rope had been mislaid at the outset of the day. Then just as I was hoping that the rope was sound, and that the chaps at the top were holding tight, there was a sharp blow in my short ribs, the breath was knocked out of me, and I was hanging in a most awkward position, like a sack on a cord, against the cliff face.

A few minutes later I had been hauled up on to the ledge again, and was rubbing the sore parts of my anatomy, and congratulating myself on my escape. It had been a tricky moment, and I deserved the worst for being caught like that without a handhold. But it all ended happily, and eventually two young buzzards flew successfully from the nest.

With experiences such as I have described, our knowledge grows, and as this happens so do our opportunities for helping others.

Quite possibly, I think, this may prove to be the most valuable asset of a hobby. When I began I used to be a lone wolf. As a small boy in a lonely country district this was almost inevitable; and perhaps, at first, not a bad thing. Certainly I learned a great deal that way at first hand. Then one day I was exceedingly fortunate. An experienced naturalist, Mr. Horace G. Alexander, paid a short visit to my father and at the same time smoothed out a lot of my teething troubles. A few days later I got a handsome present of some magnificent bird books – and this insignificant little country boy felt almost as if someone had given him the key to heaven.

So Horace Alexander set the first stepping stone for me. I have never been able to repay my deep debt of gratitude to him, but since then it has been my ambition to help other young people, as he first helped me.

The Pine Marten *H. G. Hurrell*

THE PINE MARTEN is an animal full of surprises. When multitudinous TV screens showed ranch-bred martens at liberty in natural woodland it was as unexpected to the public as it would have been to me a few years earlier. It all started through an accident. The door of one of my three original marten, which had been imported from Germany, was not securely fastened one evening and next day he was missing. The prospect of ever again seeing a marten which was not even bred in this country seemed very slender. I searched the district, but there was no sign. Moreover, a sea of bracken covered much of the countryside and once enveloped beneath this canopy it seemed hopeless to expect an animal to find its way back. I spent a good deal of time near the empty pen, leaving the door open with the usual food inside. I listened intently in the adjoining wood, but no alarm note was heard from any bird suggesting the presence of a marten. For once even the jays did not see the richly furred brown animal with bushy tail weaving its way through the wood at dusk towards the pens. He had reached the guard fence which surrounded the pens when I spotted him. I held my breath as he looked at the fence and I wondered whether he would regard it as too much of a barrier. It had been erected to prevent the escape of silver foxes in the event of them getting out of their individual pens. To my immense relief the marten whipped over the fence and headed straight for its pen. All I had to do was shut the door as soon as it started quietly feeding. I remember that evidence from the droppings next day showed that he had been feeding on mountain-ash berries and blackberries. It was the feeling that there was now a reasonable prospect of this marten returning that caused me to contemplate the possibility of deliberately letting him out just before feeding time in the hope that he would respond to my call and the food I provided.

It seemed to me that something was needed corresponding to the lures used in training hawks for falconry. My experience in training hawks was considerable, but a hawk's lure did not seem to appeal to a marten and, in any case, it would be difficult to garnish it rapidly and frequently with meat. The answer came when I devised what I call a 'martinet', a pan attached to a long pole as a handle. Small pieces of meat could be quickly dropped into the pan and the marten trained to look to the pan for the reward inside. A hawk-bell attached to the handle where it joined the pan enabled the marten to locate and follow the pan more easily. My qualms were soon allayed when I found how well the marten responded and I was soon able to let him out at feeding time confident that he would behave as expected and return when required. Several other martens were trained in the same way and their reactions to the martinet were almost unbelievably parallel to those of a trained hawk responding to the lure. Now it became a question of finding the most interesting routes and jumps from tree to tree in the wood. All martens are quick in deciding whether or not they intend to take a particular jump but they vary individually in their climbing ability, some being less willing to take risks. I have noticed that,



unlike a horse, a marten which refuses a jump is never encouraged to try it because another marten gives it a lead. The difference here is evidently between a herd animal and one which is essentially an individualist. Many times I have had a hesitant marten on a branch and have tried to encourage it by getting another marten to take the jump right in front of its nose, but it makes no difference whatever.

There is one type of locomotion which I think it would be safe to say is never used by a marten. They do not trot. An otter or a badger will often trot, but a marten only progresses either by walking or bounding. It may walk a few steps, perhaps when examining a very small area for food, but as soon as it wants to travel it uses steady rhythmic bounds which enable it to stride along with graceful ease. For years I was under the impression that it was designed for endurance rather than speed. It was a great surprise when I was able to compare the speed of a marten with that of a rabbit. It is well-known that over a short distance on its own ground a rabbit is very fast indeed. I had a revelation when I saw that a marten could be even faster than a rabbit in the first 20 yards after breaking cover. After this the rabbit increased its lead. The inference from this is that the marten has phenomenal powers of acceleration. These facts emerged as the result of training one particular marten called Blondin to go hunting. His total of rabbits killed was 28 and they were all caught in fairly thick cover. Usually, I encouraged him to go into a likely patch of bushes where his nose could detect the presence of a rabbit. His aim was to spring upon the rabbit before it had time to run off and in this he was many a time successful. Occasionally I have seen him trying to catch field mice by stiff-legged jumps, like a fox or a dog. One night he was following me through our brake when he killed a mole in a patch of bracken. There is no doubt about the fondness of the Pine Marten for insects. Acute hearing enables them to pin-point any beetle which drops into the

Female marten in her summer coat





Female marten in winter

grass. I have also seen them climbing about among the high leafy branches of an oak tree catching and consuming beetles which I believe were Lesser Cockchafer. One of my martens had a fondness for bumble bees which she would catch by knocking them down with a quick sweep of the paw as they visited bluebell flowers in our wood. She would then eat them with very hurried jaw movements as though the sooner it was done the safer and better.

I found it most enlightening to have martens which at times approximated to those living wild. But this freedom was not without its anxieties. There were times when they had no intention of responding to the martinet and they would go off and stay away, perhaps for hours. It was only too easy for me to imagine all sorts of fates befalling these erring martens while they were absent. Often they would be out of sight and some distance away. Once I watched one which was proceeding peacefully underneath a group of beech trees when suddenly a tawny owl swept down from behind and struck it head over heels. The owl did it three or four times before the surprised marten took the hint and got clear of the owl's nesting area. Sometimes, owing to prolonged absence, it was not possible to await a marten's return. Then the door had to be set as a trap so that when the marten came in and pulled at a piece of meat inside, the door would close.

In referring to the gestation period of the Pine Marten the older books were very wide of the mark. They were believed to mate in January or February, to produce young in April. Fur farmers who tried to breed from martens had no success whatever while they were only run together at this time of year. This led to the discovery that mating takes place in July or August to produce young the following April. So the gestation period is no less than 8 or 9 months. Delayed implantation takes place and the embryo does not really begin to develop until a few weeks before birth. Although I have had matings on a variety of dates in July and August every litter has arrived during the first week of April or, in one case, the last day of March. The average number of young is three. I have also had two and four, but three is the usual number. The cubs do not venture out of the den until they are about two months



Reaching for the 'martinet'

old; twice the age at which fox cubs first appear. At first the tail is not bushy, but it is soon about half the thickness of the adult's bushy tail and remains like this until the first winter coat is acquired in October. Only by degrees do they become expert climbers. At first they are exceedingly timid when on a tree and cling tightly to the bark. Both a marten and a cat find coming down a tree much more risky than going up. I remember seeing a young marten, whose climbing skill was well-developed, have the misfortune to miss his foothold when negotiating a large knob about twenty feet up an oak tree. He came hurtling down, but landed, as usual in such circumstances, the right way up. Without a moment's hesitation he climbed up the same tree to the same place. I have often noticed that they do not seem to be put off by falling and exercise precisely the same degree of caution before or after a fall. The temperament and ability of Pine Martens varies considerably from one individual to another.

For fifteen years I had daily fed my martens and had, from time to time, seen them at liberty in our woods. Yet I longed to see a real wild marten. But what a difficult proposition! The first thing was obviously to go to marten country. I decided that although wild marten exist in Wales, Ireland and the Lake District, they are so rare in these places that it seemed hopeless to try to sight one. The most promising area seemed to be the North-West of Scotland. So my wife and I set out from Devon to visit the Beinn Eighe nature reserve in Wester Ross, Scotland. This was the Nature Conservancy's first reserve, and it meant a long journey of about a thousand miles from my Dartmoor home. It was June and we found vegetation so high that the only hope of seeing a marten seemed to be to watch a likely stretch of road. The first night nothing happened, but the next night we tried again and at 11.2 p.m. my wife and I saw a marten bounding along the road until it was about 30 yards away. Then it stopped and looked at us, so that, although the light was rather dim, we could see the throat-patch quite clearly. After a second or two it moved off, disappearing in long vegetation. Only a brief glimpse but we were immensely satisfied at having succeeded in viewing this rare British mammal in the wild.



The winter search for food

Birds in Winter *R. P. Bagnall-Oakley*

PERHAPS one of the few events in the yearly pattern of bird movement, observed by almost everybody, whether interested in ornithology or not, is the congregation of swallows and martins as they prepare to leave in the autumn. It is the annual reminder that winter is on the way and that vast numbers of insectivorous birds are leaving this country for summer regions, where their food supplies will continue in abundance. And while our resident species remain, they are joined by numerous others from places with more severe winters than our own for precisely the same reason - food.

As we watch summer migrants depart and passage migrants move through on their southward journeys, we also wait in anticipation for the arrival of the winter visitors. Here, in my native Norfolk, we look, with the passing of September, for the bramblings and snow-buntings, the redwings and fieldfares and for the steady increase in the numbers of duck and geese. But the migrants are not all species which are absent in summer. Indeed, the majority in actual numbers are probably species with which we are entirely familiar throughout the year. Huge numbers of starlings



Winter has its beauty and its hardships

and blackbirds, chaffinches and even tiny goldcrests pour across the North Sea to augment our own winter populations. Some of these movements are 'weather migrations'; such as those which occurred within Britain on a huge scale in early 1947, when thousands of birds migrated away from the sudden onset of severe conditions. Other arrivals may include species which have been driven off-course by persistent cross-winds. In October, 1951, hundreds of thousands of robins landed on the East coast from the Firth of Forth to Kent. At Cley Observatory, a hundred and twenty were caught in three hours on about a hundred yards of the shingle ridge and a conservative estimate of the numbers seen by various observers along the four miles of Blakeney Point was three thousand.

These birds moved inland a short distance and the local robins – they are very territorially conscious birds – became quite exhausted in their attempts to maintain their domains against this overwhelming foreign invasion. Subsequent recoveries of ringed birds suggested that they reorientated themselves and set off south-eastwards to get back onto their proper courses from Northern Europe southwards. Moreover, a recovery of a Cley-ringed bird the following summer in Northern Germany shows that some, at least, succeeded in doing so.



Acrobatic berry-eaters – waxwings



Caught in fog and overhead wires – a 'wreck' of starlings

Accidental drift also produces ornithological excitements by bringing in rare vagrants such as dowitchers and surf scoters from America, White's and other rare thrushes from Eastern Europe and Asia, while unusually severe winter conditions may drive such northern species as Harlequin ducks, ivory gulls and snowy owls to this country – far beyond the normal limits of their winter range.

Our winter migrants sometimes include species whose appearance is far from regular, though in some years they appear in large numbers. Such 'invasion migrants' are waxwings, whose sporadic irruptions depend more on the irregularity of food supply in their normal winter quarters than on the lack of it. Siskins and crossbills are subject to similar 'invasion' migrations. Of all our winter migrants, my favourite is the waxwing. Beautiful, comfortably compact and almost wholly indifferent to human approach, these acrobatic, starling-sized berry-eaters are delightful to watch. They are just as likely to be encountered, gobbling the berries of some ornamental shrub in a city garden as in a country hedge, feeding on hips and haws.

They are great drinkers and frequently punctuate their meals of berries by flying with remarkably starling-like movements to drink at some roadside puddle. Their black and yellow wings with the pink 'swan-vesta' tips to the secondaries, their insuppressible crests and yellow-tipped tails, combine with the soft browns and greys of the back and rump and the rich chestnut undertail to make a most distinctive bird – a delight to the expert in bird behaviour or the beginner in identification.

Hardly less fascinating to watch are snow-buntings on the shingle ridges and adjacent coastlands. Their musical flight-calls, uttered as they twist and flash in lively

undulating manoeuvres, give the impression that this kind of flying is stimulated by sheer *joie de vivre*. The newly arrived flocks of bramblings, as yet unmixed with other congregations of finches – give the same impression as they rise from the beech mast or seedy fields to flit around before alighting on some nearby tree or returning to feed. Flocks of mixed tits with tiny goldcrests work steadily through the woods, and down by the shore Lapland buntings and shorelarks scurry over the pebbles and sand or creep amongst the low vegetation in their tireless searches for food.

As the winter wears on, the black bibs of the male Lapland buntings and the yellow and black heads and tiny 'horns' of the shorelarks may appear as they start to assume their breeding plumage.

Out on the muds of the tidal estuaries the wigeon can be seen cropping the zostera (or grass wrack) and Brent geese – late comers, often not here until January – may be feeding with them. From the Humber to the Wash pink-footed geese flight daily inland to the stubbles, potato fields and grasslands and Bewick's swans swim in scattered herds on the flooded washes of Fenland. Every year recently a flock of bean geese has come to the Yare Valley Marshes and sometimes these large orange-legged, brownish geese bring vagrant lesser white-fronts with them.

Every winter a huge westward or south-westward movement brings starlings from Scandinavia, the Baltic areas and Eastern Europe. All through October and November they pour across the North Sea in suitable conditions, to augment the numbers in the vast roosts which serve as nightly collecting centres for these very gregarious birds. Big roosts – which have to be seen, heard and smelt to be believed – may serve as much as a thousand square miles.

Recoveries from starlings caught and ringed in East Anglian roosts show that a high proportion come from East Germany, Poland and Russia. One night last winter a huge influx of continental birds was caught by foggy conditions and thousands were killed in the mazes of telephone wires and electric cables which criss-cross the brilliantly lighted coastal military camps.

As already indicated, winter is the period when the struggle for survival is clearly the main factor in bird life. Feeding habits change with the weather. Snow drives the fieldfares, redwings and native thrushes to feed on berries or to scratch about in hedge bottoms; frost sends the birds of the fresh waters to the saltings and estuaries or to the fast flowing streams which remain open.

Woodcock and snipe, water rails and moorhens search the margins of the little streams where the mud is still soft.

But prolonged hard weather takes a heavy toll of bird life and several species are noticeably quicker to succumb to these conditions. Redwings, herons and redshanks, to take a varied selection, are always hard hit.

I have picked up twenty dead and dying redshanks in a single afternoon when the weather is severe enough to freeze the surface of the tide-abandoned muds from several tides.

Some species like starlings and black-headed gulls become fearless and cheeky scroungers of man's hospitality, usually taking food put out for other smaller birds

or for domestic animals. Such a wide variety of diet is a great asset in times of food shortage. Winter flocks of tree sparrows, yellow hammers and mixed finches invade the farmyards and search around the stacks, especially where straw has lately been moved or where the mantle of snow has broken through. Such eaters of this kind are quick to seize any chance of food in hard weather. I remember watching lorries leaving a Norfolk flax factory with dozens of finches of all kinds busily cleaning up the linseed which lay on the floor of the vehicles after each load was taken off. The trees round the unloading bays were full of birds, ready to fly down into the vehicles as soon as each load was discharged. Such adaptability in feeding is born of the need for survival.

The question of what to do for birds in severe weather is repeatedly asked by all kind of folk in town and country alike. For the familiar bird table species the answer is easy. Fat and meat, cooked or raw, bread and nuts (including coconut) are all good foods, while bird seed and crumbs for finches and finely chopped raw meat for wag-tails should be spread on the ground. Apples are welcomed by blackbirds, fieldfares and starlings. Water is also important, but must be constantly replaced, though it can be made to last for hours without freezing if placed in the lid of a shallow tin, resting on the tin itself packed with hot cinders or ashes.

An enclosed bird table, using wire netting which excludes starlings, but allows smaller birds to get through, is quickly appreciated by tits, robins and the like.

For me, winter bird watching is full of fascination. The sound of wigeon fighting to evening feeding grounds, the sight of waxwings feeding on berries or of siskins and redpolls searching among the alder cones, the flash of white as a flock of waders turns over the muds or the ceaseless twittering roar of starlings in a roost; all these can raise a thrill of excitement which repetition will never dull.





Swans in open water

Fieldfares and finches (opposite)



To join our familiar mute swans, the hard weather of winter brings the rare whooper swans (right of picture).

Below: Mistle thrush in snow



Ladybirds C. B. Williams

IT IS a curious fact that although so many people feel an instinctive dislike for 'beetles' in general, this antipathy does not seem to hold for the brightly coloured group that we call popularly the Ladybirds. For some reason these have always been considered attractive and lucky, sometimes even holy, and many rhymes and superstitions are associated with them in nearly every country in Europe.

There are hundreds of different species of ladybirds throughout the world, but here, in Britain, the group contains forty-two different kinds. Scientifically they are known as the Coccinellidae, from the Latin *Coccinatus* 'clad in scarlet'. All but one species in this country are predacious.

They vary in size from about one to four-tenths of an inch in length and are usually rounded in shape and polished in appearance, often with spots of a contrasting colour which show up distinctly when the wing-cases are closed. The number of spots varies from species to species and we have, for example, those known as the 'two-spotted', the 'seven-spotted', the 'eleven-spotted', the 'sixteen-spotted', and the 'twenty-two-spotted' ladybirds. Unfortunately, however, within a single species there may be great variation in the number of spots, due either to a reduction in their size, or to an increase in size resulting in the joining up of spots into larger markings. Thus the sixteen-spot is often found with only 12 spots, while the common two-spot ladybird can vary from a reddish-brown background with two black spots to a black background with two reddish spots, with a great variety of intermediates. Literally dozens of forms have been described and it is particularly interesting that the proportion of the different forms may vary from locality to locality. For instance it has been reported that in a large collection made near Birmingham 70% of all the two-spots were of the dark form with red spots, while in Staffordshire at the same time 78% were of the red form with two black spots. The variations in pattern are largely due to inherited factors, but why there should be such local variations is not understood. Here is a problem for investigation.

In the adult, beetle, stage ladybirds have two pairs of wings, the long under wings with which they fly being at rest folded under the hard coloured front wing cases (elytra). When flying the hind wings only are vibrated. Unlike many other beetles ladybirds fly readily in the sunshine and we have most of us when children allowed them to crawl on our hands while we recite: 'Ladybird, ladybird, fly away home.'

Ladybirds lay spindle-shaped eggs which hatch into small, active six-legged grubs. These (except for the one mentioned below) feed on green fly, scale insects, white flies, mites, insect eggs, and probably many other small insects. They crawl about on various plants seeking their prey and after a few weeks are full fed and turn into a sedentary, non-feeding chrysalis or pupa, which is attached to the stem or leaf of a plant by its tail. From this emerges some weeks later the full grown beetle, which is also a predator on other insects. One or two broods occur



Seven-spot ladybirds

during the summer, and the winter is passed over in the adult stage, often hidden away in crevices, or in turf or close vegetation.

The only exception to the predatory habit is a group of ladybirds known scientifically as the 'Epilachninae', of which we have in Britain a single species, the 'twenty-four-spot' ladybird. This is a vegetarian and both adult and young feed on leaves, particularly of clovers and lucerne. A closely related species, the Mexican Bean Beetle, is a serious pest of beans in North America.

During the hibernation of the adult beetles very large numbers often mass together in close quarters. An interesting case of this came under my own experience in Hertfordshire some years ago. At the beginning of November 1935 it was reported that large numbers of ladybirds were sitting on a gate-post on the farm at Rothamsted. Several thousands were on one of the posts, nearly all near the top on the south side, and scarcely any on the corresponding post at the other side of the gate. All were the twelve-spotted variety of the sixteen-spotted ladybird. At regular intervals we watched them, expecting that they would soon move to more sheltered quarters; but they remained on the post, exposed to all the rigours of the winter, until the following May. Then, during a warm spell early in the month, they all flew away.

Many other aggregations have been reported, both in Britain and abroad. A gentleman in Sevenoaks, Kent, was dismantling an old trellis on a wall in his garden in February 1950, and found enormous numbers of two-spot ladybirds hibernating between the wood and the wall: the total was in the neighbourhood of fifty thousand. Sometimes the aggregations are at the tops of hills; and the old French naturalist

Fabre wrote that on a small chapel on the summit of Mont Ventoux, near Avignon, at a height of about 6,000 feet, seven-spot ladybirds were so numerous that the building looked as if it were made of pieces of coral.

In America the 'Convergent Ladybird' was found, many years ago, to hibernate in such numbers on the hills in California that it was decided to collect them in the winter, and keep them in cold storage till the spring. Then they could be liberated in orchards and fields where outbreaks of green-fly were expected. It was hoped that they and their offspring would keep down the damage by eating up the green-fly before they became too numerous. Round about 1910 this was done on such a scale that literally hundreds of millions of insects were collected each winter. It was said that two men could collect fifty to one hundred pounds of beetles in a day - at about 1,500 to the ounce! Unfortunately the method was not the success that was expected, and some years later experiments were made by liberating marked ladybirds in the spring to see how many stayed in the district for long enough to lay eggs and establish a population. In one such test some hundreds of thousands, marked with silver and gold paint, were liberated, and in the next three weeks only nineteen were recovered. The rest had flown away - to where, no-one knows.

* These aggregations have been found, not only in winter, but in late spring, early autumn and even in mid-summer. Their meaning is not always clear, and we have

Seven-spot ladybird and grub

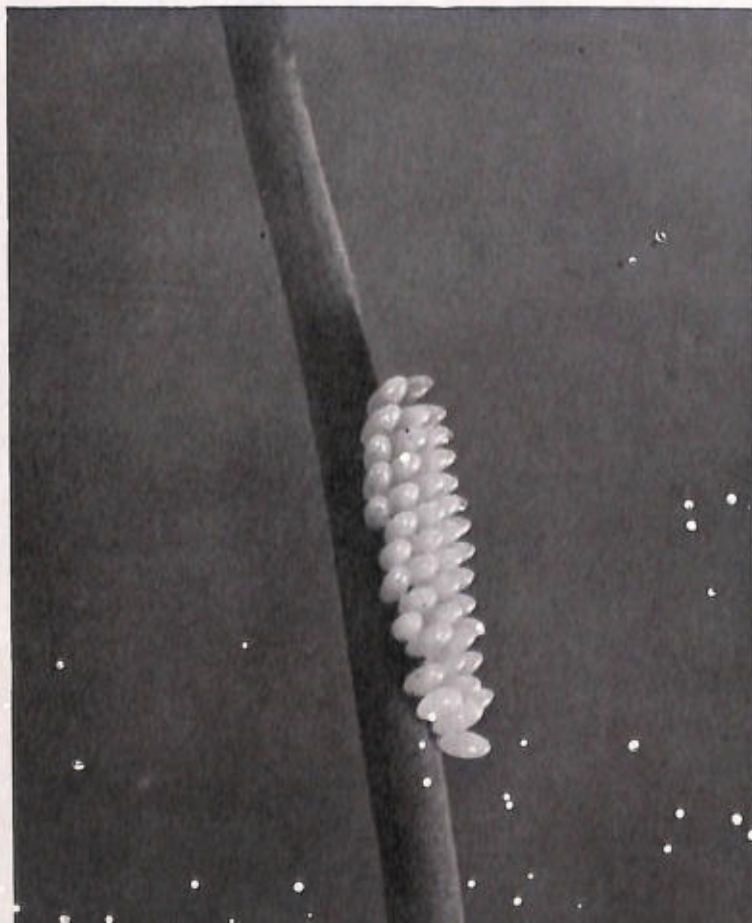


no regular series of observations to show whether the mid-summer swarms in temperate climates are early hibernators or late sleepers, or are only temporary gatherings. In some tropical countries there is evidence of massing for aestivation – that is to say, for passing the hot summer weather.

Still another remarkable aspect of the life of ladybirds is their habit of migrating in numbers in a definite direction, resulting in very sudden mass appearances, perhaps only for a short period. As long ago as 1847 huge swarms of ladybirds were seen early in August coming across the sea off the north-east Kent coast, and some hours later they came inland in great numbers. They were said to be mostly 'seven-spots', with smaller numbers with two and nine spots; this latter was probably a variety of the eleven-spotted species.

In June 1925 there were extensive flights of ladybirds – mostly 'two-spots' – in various parts of England, and Marriner, who collected information from over fifty correspondents, considers that there was a steady migration on a broad front from the Southern Midlands to the North and North-west, with evidence of flights crossing the Pennine Hills in at least two places.

In August 1944 there were sudden invasions of ladybirds into South-east England, coming from no-one knows where, and a local newspaper says that at Southend they came flying down the streets in clouds, so that people had to fend them off with newspapers, hats and handkerchiefs.



*Seven-spot ladybird eggs,
magnified five times*

A correspondent in Chelmsford sent me 231 insects and these included 191 seven-spots, 39 two-spots, five eleven-spots and one fourteen-spot. In 1952 there was an immense immigration along the Lincolnshire coast, and on August 16th the high-tide line on the forty miles from Cleethorpes to Gibraltar Point was marked by a pink band of millions of ladybirds. A sample of 142 individuals that I was able to examine contained 125 seven-spots, 7 eleven-spots and 10 two-spots ladybirds.

Perhaps the greatest of such swarms ever recorded was that seen by Professor Oliver on the Mediterranean coast of Egypt. On April 26th, 1939 he saw vast numbers of eleven-spot ladybirds flying in from the sea. Also unbelievable numbers were washed ashore to form a drift line extending for at least fourteen miles. He estimated that there were over fifty thousand beetles per foot of the drift line, so that on the ground alone there must have been about four thousand million ladybirds, in addition to the flying swarms in the air above.

Where these swarms originate, where they end and what is their meaning are still unsolved problems requiring study by enthusiastic field naturalists. Anyone can help by keeping a watch for any piece of information to fit into the jig-saw puzzle. If you are lucky enough to see anything unusual, keep accurate records – don't trust to your memory – and collect a number of specimens for accurate identification. It is not only the rare insects that are interesting.

Ladybirds basking in the sun on young nettle leaves





Do we begrudge the zebra the grass it eats?

Are Animals Necessary? *Armand Denis*

ARE ANIMALS NECESSARY? This seems a simple question, to which there should be a simple answer. Some animals, of course, serve a very important practical purpose; we breed them and raise them in order to kill them and eat them, and we make incidental economic use of various parts of their carcasses. But vegetarians would argue that the eating of their meat is not necessary; and scientists would agree that the day is probably not distant when efficient synthetic substitutes will replace animal proteins and fats in human feeding, as synthetic fibres are replacing wool and silk, and plastics are replacing leather, horn and ivory.

Some people consider that animals are necessary for the purpose of shooting off into interplanetary space, and generally to substitute for man in dangerous, painful or destructive experimentation; but again some other people urge that animals are not necessary for this, and that desirable or undesirable human beings would do as well or better.

Most people are inclined to see a profound difference between the domesticated species of animals and the so-called wild animals; and the tolerance with which

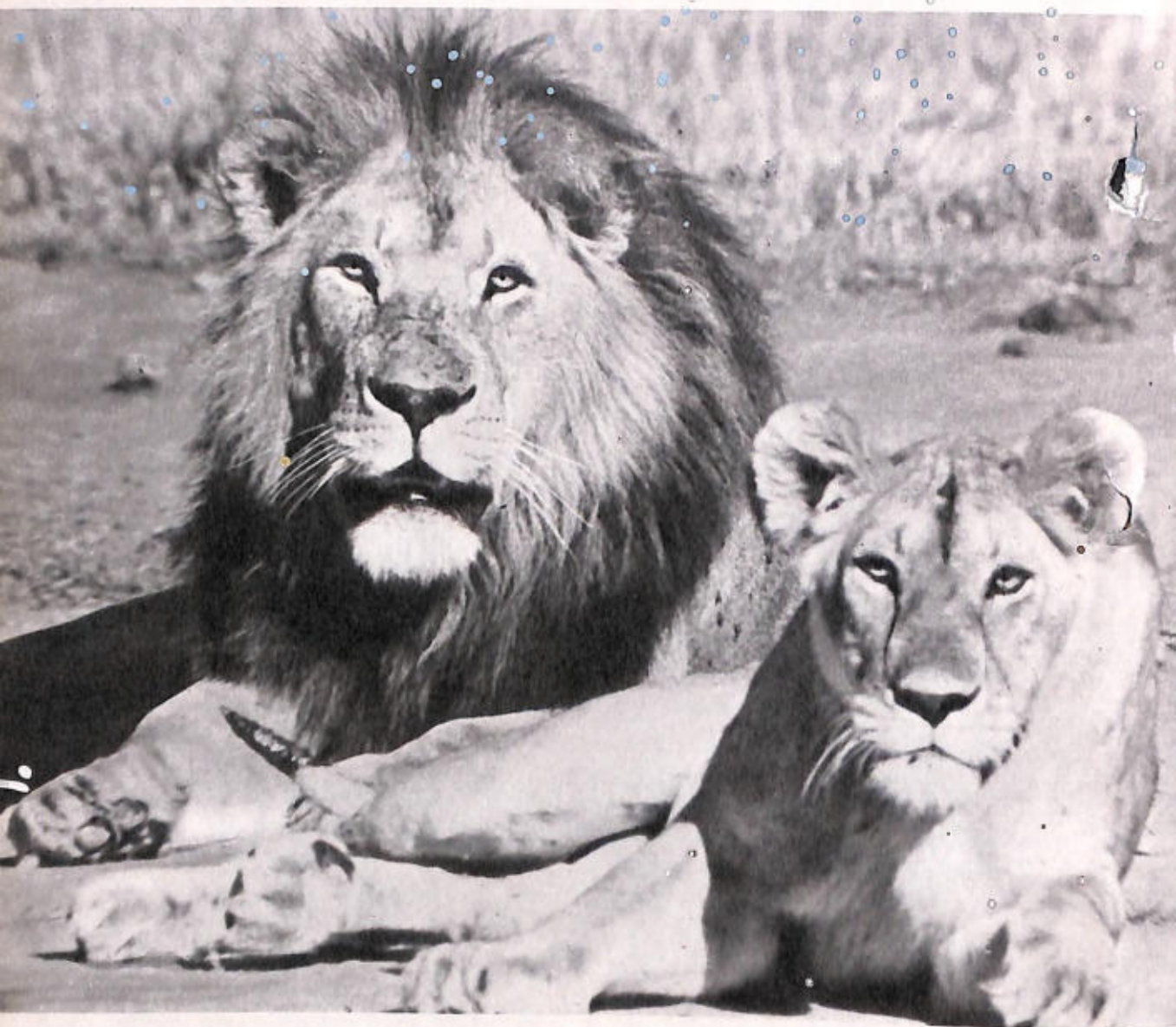


'There is no room in a civilised world for animals'

chickens, ducks, sheep and even infuriated bulls are generally viewed does not extend to the wild animals. Most farmers in Africa – and what I am about to say would be true also of other continents – consider the wild animals, not only as unnecessary, but also as a positive and serious nuisance; they begrudge the wild zebras the grass which should be eaten exclusively by their cattle, and the wild baboons the maize which they had planned to consume themselves. Other people look upon the remaining wild animals on this earth as gross survivals from a non-scientific age, unsanitary, and incompatible with the sterilized world of steel and plastic into which they see mankind advancing.

'No, no, Mr. Denis', a prominent and successful medical man told me recently in Nairobi, 'animals must go . . . we are *homo sapiens*, we are civilized people, and we are building a civilized world – there is no room in a civilized world for animals'. And a lady, apparently not unusually thoughtless or ignorant, overhearing me talk about the efforts made to protect the mountain gorilla in the Belgian Congo, exclaimed: 'Protect the gorillas? Why would anybody want to protect those horrible dirty animals? Isn't it possible to kill them all off?'

*There are, of course, large – although diminishing – numbers of people who value wild animals as targets to shoot at; they consider the wild animals so necessary for this purpose that they go to considerable effort and expense to breed them and protect



They must continue to roam, to remind us that such pride and freedom once existed

them from their more natural enemies in order to maintain a supply of targets.

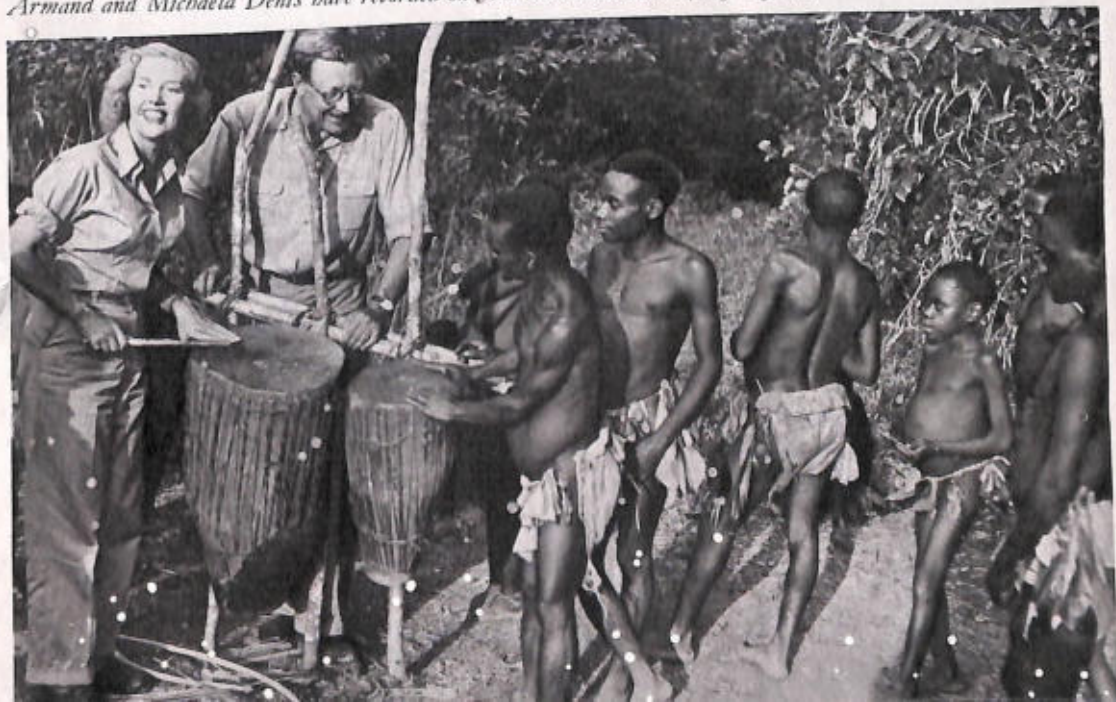
There are also a number of people, differently constituted, who call themselves animal lovers. They do not consider animals dirty, and they find no joy in chasing them, or in reducing them to corpses. Instead, they find a strange pleasure in watching them and consorting with them. The swift flight of a bird, or the graceful leap of an antelope, fill these people with inexplicable wonder and delight. But this is no more inexplicable than the music lover's delight in listening to music, the ballet-lover's pleasure in watching ballet, the mountain lover's exhilaration in climbing snowy

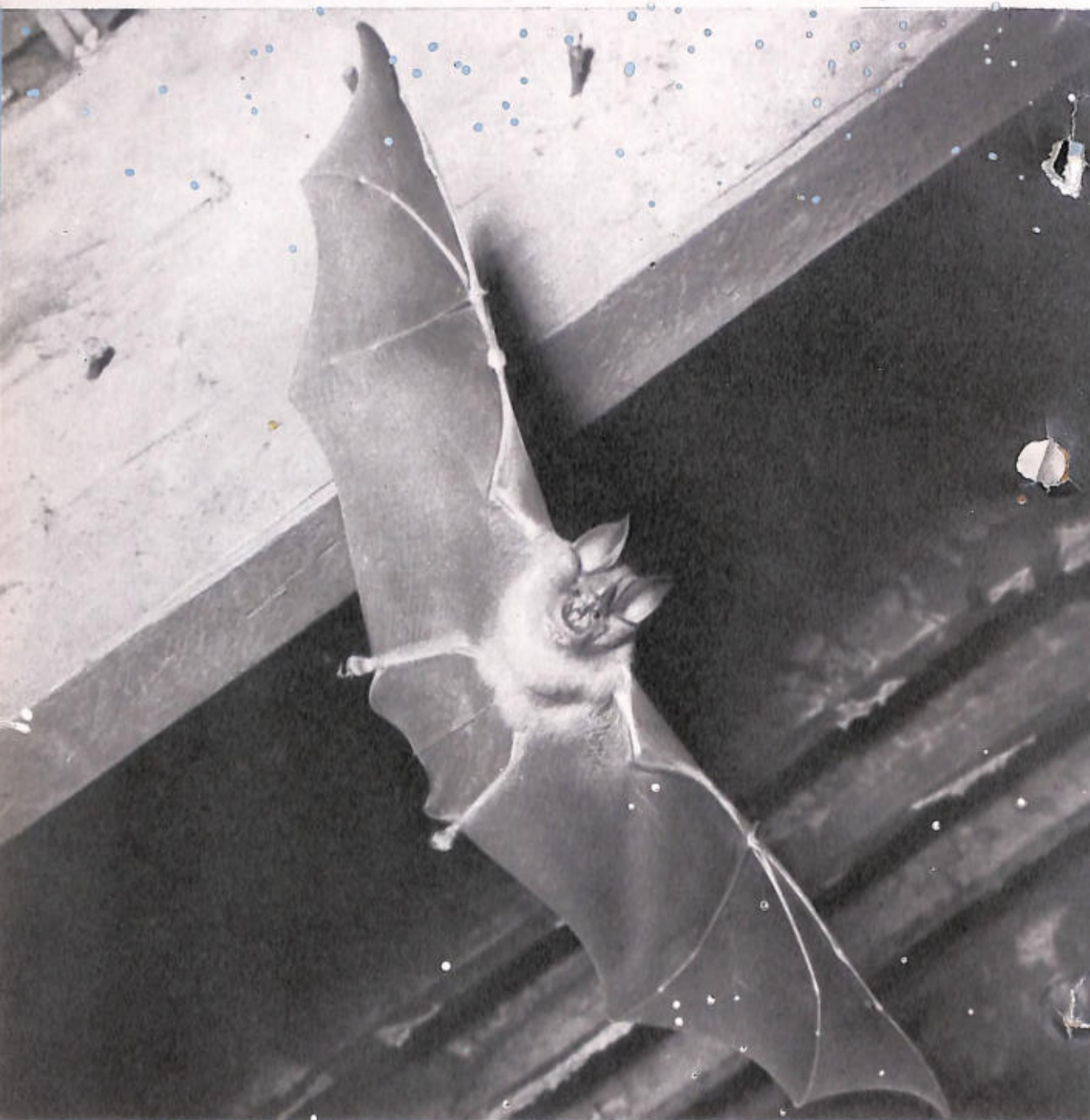
peaks. Strictly speaking, none of these things is necessary; it is possible for the music lover to live without music, for the ballet-lover to live in a remote and cultureless country, for the mountain lover to settle permanently in an alluvial plain. It is even possible for the freedom lover to survive in a totalitarian state and endure its disciplines – but it is not good for him.

No doubt mankind could survive in an animal-less world – but it would not be good for mankind. The loss would seem to me disastrous. The love of animals seems to me to have its roots deeper in human instincts than almost any other love; it is profoundly instinctive in children. What fills us with wonder in the animals, in the free and wild animals especially, is the mystery of life. The animals and we share the gift of life, which sets us apart from the rest of the huge inanimate universe; we have developed the gift of life into consciousness and thought, but we still have kinship with even the lowest of living beings.

We live in an age of destruction – we are destroying the almost infinite diversity of traditions, beliefs, ways of life, ways of dressing, of music making and dancing, which made this world so colourful and fascinating; we are tearing down our forests, spoiling our landscapes, filling our skies with smog, altering even our climates; our lives are becoming yearly more artificial, our environment more synthetic, more remote from that which moulded and determined our evolution; we are becoming correspondingly more insecure, unbalanced and neurotic. I believe, with Romain Gary, who has so persuasively pleaded the cause of the wild animals in *The Roots of Heaven*, that we need the wild animals to preserve our balance and our sanity. They must continue to roam in proud freedom at least some portions of our ravaged earth, to remind us that such pride and freedom once existed. Little will escape our furious destruction of almost all that was worth having on this earth; but we must at least respect, protect and save the animals, which no human science or genius could ever bring back to life.

Armand and Michaela Denis have recorded on film the traditional life of Africa





The bat is the only mammal capable of controlled and sustained flight. This Greater Horseshoe bat has a wing-span of 13 inches

Opposite: Greater Horseshoe bats hanging in a Devon cave. ¹ From here they range for up to forty miles

I like Bats *John Hooper*

FOR MANY YEARS, bats were nothing more to me than shadowy creatures, briefly glimpsed at dusk on a summer evening as they dived and swooped over country lanes in search of their insect prey. I had heard vague tales of bats becoming entangled in women's hair and had read lurid accounts of blood-sucking vampire bats in South America, and in consequence I tended to look on bats as unpleasant, if not evil, creatures. This feeling, I imagine, is still shared by many people and certainly the nocturnal and apparently secretive habits of bats have, throughout the ages, been associated with superstition and witchcraft. Even up to mediaeval times, bats or portions of their anatomy were considered to be essential components of wonder cures for every conceivable ailment from asthma to falling hair. A typical recipe for gout, for example, included three bats boiled in rain water, flax seed, three raw eggs, a cup of oil and ox-dung, which, after thorough mixing, was applied to the afflicted part. In recent times however, naturalists in many countries have started to make an intensive study of bats and as a result, the old wives' tales and the superstitions are disappearing and are instead being replaced by many new facts equally strange and fascinating.





Greater Horseshoe bat sleeping



Baby Greater Horseshoe. Curve of nose gives it its name

To begin with, the bat is the only mammal capable of controlled and sustained flight. The so-called 'flying' squirrels have a flap of skin which enables them to make long gliding jumps from tree to tree, but the bat can remain in the air for hours on end and can fly for many miles. Moreover, a bat can find its way through obstacles, as for example the complexities of a cave passage, in pitch darkness and it does this by means of an 'echo-location' system, analogous to Radar, but which it and its ancestors have probably been using for thousands of years. As a bat flies, it emits a series of sharp, ultrasonic 'squeaks', far too high in frequency for the human ear to detect (50,000 to 100,000 cycles per sec.). If there is an obstacle ahead, this reflects these high frequency pulses and the bat then picks up the echoes with its sensitive ears and so is enabled to take the necessary 'avoiding action'. We still have much to learn about this astonishing sound ranging ability, but we do know that it is sufficiently accurate to allow a bat to detect and avoid a network of fine wires, so it seems unlikely that the tales of bats and women's hair are true. More wonderful still, the bat can even use this system, so to speak, for 'air-to-air' interception of flying insects.

Throughout the world, the number of different kinds of bats runs into thousands. In Britain, there are only twelve species. These are all insect eaters, and do no harm to man. In fact, because of the insects they eat, they probably do a lot of good. The British bats range in size from the Noctule and Serotine, large individuals with wing spans of 14 to 15 inches, down to the tiny Pipistrelle, the 'flittermouse' of the country lanes and roads, whose span is only about eight inches. Many of the British bats have rather mouse-like features, in particular the Natterer's bat, Daubenton's bat and the

Whiskered bat, and at first sight these three look disconcertingly similar, although there are various distinguishing characteristics, in particular in the size, shape and length of their ears. These three are all of the Genus *Myotis*, and so also is the rarest British bat – the Bechstein's bat – although once seen, the large ears of this bat are unmistakable. And if the Bechstein's bat has large ears, then those of the Long-eared bat can only be described as enormous. This bat, with its large black, lustrous eyes, is one of the most attractive of all, and with ears almost as long as head and body combined, it is one of the easiest to identify. By contrast, there is the *Barbastelle*, an ugly, almost black creature with squat, square-shaped ears which merge into a grotesque and flattened face.

My own interest in bats arose from the hobby of cave-exploration, followed by my wife and myself. During our visits to the natural limestone caverns in Devon, we often saw bats, hanging from the cave roof like little clusters of dark, fat pears. Sometimes also, a bat would give one of us a fright, as it brushed past us without warning in the darkness, and on one epic occasion, while a friend of mine was crawling on hands and knees along a low tunnel, a bat actually flew up inside his trouser leg. The passage was too cramped for him to turn round to deal properly with this unexpected invader, but eventually it worked its way up inside his overalls and finally escaped from the neck – no doubt to the great relief of both parties! At first, apart from such encounters, we took little notice of the bats, just looking on them as natural features of the caves, but after a while, we thought of trying to study their habits. And so we came to know the Horseshoe bats. There are two kinds in this country – the Greater Horseshoe bat, with a wing span of up to 14 inches, and the Lesser Horseshoe, which looks exactly the same, but only has a wing of about 9 inches. Both kinds are unmistakable. They have a most extraordinary nose, a flat and leaf-like projection, in the centre of which there are two trumpet-shaped nostrils with a spike protruding above them. The base of this 'nose-leaf' is curved like a horse-shoe – hence the name. Once you have held one of these bats in the hand and studied the face, which looks like a caricature of a little old man, and felt the soft and incredibly fine fur, and seen the delicate, almost silken membranes, it is impossible to feel dislike for such creatures—although I must admit that one's liking for the Greater Horseshoe bat may receive a slight set-back if it succeeds in biting you. This bat has powerful jaws, with teeth as sharp as needles, and since these can crunch into large insects such as cockchafers and dor beetles, they can easily draw blood from a human finger – and have frequently done so from mine.

During the winter months, the Horseshoe bats retire to the cool and secluded darkness of underground haunts such as caves and old mine tunnels. Here they sleep, hooking their claws over irregularities in the rock, and hanging, head downwards, from legs that seem almost too slender to support their weight. They wrap their wings tightly round themselves like a cloak, and in this they differ from all the other British bats, which fold their wings to their sides. Not all bats are cave-dwellers. Some, like the Noctule, live in trees, but we have seen Long-eared, Daubenton's, Whiskered and Natterer's bats underground, and these usually tuck themselves into



Natterer's bat is one of Britain's twelve different species

fissures and crevices. The shot holes in mine or quarry tunnels are sometimes popular, and we once saw a Natterer's bat, about 9 inches deep in such a hole, and sprawling comfortably on its back with its legs crossed.

In 1948 we began in Devon to follow the example of naturalists on the Continent of Europe and in America and started marking the bats with numbered aluminium rings – adopting in fact the practice that ornithologists have long employed for studying the movements of birds. On a bird, the ring is clamped round the leg, but a bat's leg is too delicate for this, and so instead we put the ring round the forearm. The ring is shaped like the letter 'C' and is put on by gently squeezing the two ends together until they just meet – but don't puncture – the wing membrane. Each ring, of course, has a different number, and at first we merely identified them by means of initials. Now, in common with other bat workers throughout the country – in Somerset, Dorset, Gloucester, and East Anglia, for example – we use rings marked 'Lond. Zoo' and this gives an easily recognisable address to which reports may be sent if a ringed bat should be found by a member of the general public.

Once we began this task of giving a personal label to each bat that we found, we soon discovered that the Greater Horseshoe, at least, ranged quite far and wide. At first we merely expected them to move from, say, one cave to another tunnel perhaps a few hundred yards away, but it was not long before our ringed bats were found five, and then ten and then even fifteen miles from the haunts in which they had first been handled. In 1954 we received a decided shock when a Greater Horseshoe bat, ringed in some quarry tunnels near Beer in Devon, turned up a few months later in a cowshed at Blandford in Dorset. The straight line distance between these

two haunts is forty miles and our claim that this is a 'British Native Long Distance Bat Record' has so far remained unchallenged. In fact, just to show there was no mistake, this same Bat later on flew the forty miles back to Beer.

• We have also been particularly interested to find that the Greater Horseshoe bats in Devon quite often make flights of at least up to a dozen miles, even during the coldest months of winter. Although they certainly have quite long spells of sleep in the winter, they seem to move around every few days and never settle down to the long period of unbroken hibernation that was postulated by the earlier naturalists. We gained additional evidence on this point when, for several years running, we weighed as many bats as possible throughout the winter. We found that the Greater Horseshoe bats continue to hunt and feed almost until Christmas, reaching a peak weight about mid-December. After December they still find insects to eat, although evidently not so many, because their weight now drops steadily until roughly the end of April. During this period, a Greater Horseshoe bat might drop in weight from 24 grams to only about 16 grams, a decrease of over 30 per cent.

Many of the bats have turned up time and time again since we first ringed them

With ears almost as long as head and body combined, the Long-Eared bat is one of the easiest to identify





Known to country folk as the 'flittermouse', the little Pipistrelle is the smallest of our British bats

and we now have one 'old friend' that has been handled no less than nineteen times in the past five years. We hope in due course to learn just how long a bat lives, but it can be said already that we are still finding bats that we know to be almost eleven years old. This is a good age for such a small creature, but since the British bats only give birth to one young each year, they must obviously be fairly long lived and have a number of successful breeding seasons in order to perpetuate the species.

The young bats are born in the summer, usually round about July. During this month, the female Horseshoe bats collect together into large clusters in the roofs of buildings and form what are best described as 'nursing colonies', where their babies are born. A young bat is a tiny thing – blind and with a pallid, and sometimes hairless body, undeveloped wings and a face – if it can be described as a face – which is a grotesque caricature of its mother, to which it clings tenaciously with teeth, wings and feet. At first the mother carries her youngster around with her as she flies, but we have found with the Greater Horseshoe bats, that the adult often 'parks' her offspring so that she can fly unencumbered on her evening hunt, just leaving it to hang from the rafters where, in company with the other inhabitants of the nursery, all it can do is to squeak lustily and wait, somewhat helplessly, for its absent parent to return. Certainly one can hardly blame the long-suffering mothers for shedding their load from time to time, for these youngsters may be fully half as heavy as their parents. It must be quite a relief to the latter when their hefty offspring learn to fly for themselves.

In this rather brief account it has only been possible to outline a few of the fascinating aspects that one finds when studying bats. I hope however that enough has been said to persuade the reader that I am not really eccentric in writing, 'I like bats'.



This dowitcher made a surprising addition to the Norfolk scene

Bird Visitors from America *Kenneth Williamson*

SINCE 1947, when bird-watching really got into its stride again after the war, some thirty new birds have been added to the British List, increasing the total number of species reliably observed in this country to 450. Ten of these newcomers have reached us from European and Asiatic countries, while the remaining two-thirds have crossed the Atlantic from America. The best year was 1954 with no fewer than eight new birds, including five Americans, and in the past two years the additions have been exclusively from the New World – summer tanager, rose-breasted grosbeak, northern water-thrush, baltimore oriole and purple gallinule.

How do they do it? The Atlantic is more than 3,000 miles wide, and for a long time ornithologists steadfastly refused to believe that most of these birds, the smaller ones especially, could get across this wide stretch of sea unaided. They said that such of these Americans as were not escaped cage-birds must have had 'assisted passage', travelling most of the way on ships. The larger birds, such as the gulls and ducks and waders, constituted less of a problem, as it was thought that they, when tired, could rest for a while on the water before flying on.

Now, in the years just after the war a lot of high-powered bird-watching was going on in Britain: more and more people were attracted to this great outdoor hobby, and became intelligently interested in the problems of bird-life – and particularly the problems of how, when and why birds perform those quite staggering journeys which we call their migrations. Gradually, entirely through amateur effort,

a network of bird observatories grew up on lonely islands and headlands round the coast, especially to study bird migration. Soon these observatories, and in particular the one at Fair Isle between the Orkney and Shetland Islands off the very north of Britain, were preaching rather revolutionary ideas. The most important of these was that under certain weather conditions, when migrating birds could no longer find their way, they chose to fly down-wind, so that whenever the North Sea winds blew from the east or south-east in spring and autumn, we could expect big invasions of birds to reach us from the Continent.

These invasions were sometimes associated with the easterly airstream which blows across middle Europe when there is an anticyclone bringing fine, clear weather to the Continent (weather suitable for migration, because it enables the travellers to get a navigational 'fix' from the sun or stars); and sometimes they came when the easterly winds were of a low pressure type, associated with depressions whose rain-bearing fronts moved quickly northwards through the North Sea basin, bringing such poor visibility that the migrating birds were no longer able to navigate and quickly became lost.

Another interesting fact learned at Fair Isle was that these displaced migrants arrived at the island with their body-weight considerably below the normal for the time of year, showing that the prolonged flight across the sea (on which they could not alight to rest or feed) used up a lot of energy, for which the birds' metabolism had to draw on the stores of glycogen and fats which act as their 'fuel supply'. Sometimes, when this weight-loss was severe, the birds stayed 'off-passage' for a time, recuperating strength for the next stage of their journey - for birds which had been marked with numbered leg-bands on arrival were retrapped on later days at higher weights. Later, evidence from the recoveries of these ringed birds at foreign places at a later stage of their journey, strongly suggested that this loss of the power to orient their flight was only a temporary disablement, and that these wind-borne drift-migrants to Fair Isle and the east coast were able to get back on their preferred course or 'standard direction' again. This is known as 'redetermined passage'.

Soon many bird-watchers began to think that if Continental birds habitually crossed the North Sea in this way when they became disoriented, riding the wind so that they added the wind-speed to their own flight-speed and so got across this hostile environment in the shortest possible time (and with the minimum depletion of their vital energy-reserves) then it was surely possible and even probable that many of the New World waifs and strays crossed the 3,300 miles of the Atlantic Ocean in the same way. This might be true indeed not only of the crop of newcomers to the British List, which were for the most part small birds such as warblers and thrushes, but also of other American visitors like the lesser yellowlegs and pectoral sandpiper, which bird-watchers were finding on lake-shores, estuaries, reservoirs and sewage-farms almost every autumn. Probably well over a hundred pectoral sandpipers are now on record for Britain, and some other American wading-birds such as the killdeer plover, white-rumped and buff-breasted sandpipers, have been seen on a score or more occasions.



This semi-palmated sandpiper is probably unique : it was photographed, not in America, but in Britain

The Killdeer Plover has been seen in Britain on a score or more occasions

It was appreciated, of course, that if such a marathon trek were to be made non-stop from one side of the ocean to the other, the birds would have to move very fast to finish the course before their resources gave out, or they would either perish in the sea or arrive too exhausted to survive. What we had learned about the rate of weight-loss in migrants made it seem highly improbable that these Atlantic voyagers took advantage of 'assisted passage' on ships, because, even if they could find food at all on such vessels, their food intake could never be sufficient to compensate for the rapid depletion in fat reserves. Besides, if 'assisted passage' were a fact, why was it that practically all this avian traffic was one-way? Just as many liners, tankers and tramps sail from Europe to America as in the opposite direction, yet European birds are very, very scarce indeed in Canada and the United States. The suggestion that the warblers and thrushes were escaped cage-birds did not ring true either, unless one assumed that the cage-doors were carelessly left open only at the migration seasons. And as far as the waders are concerned, recent observations on board Weather Ships out in the Atlantic, have shown that such birds do not, as was supposed, rest on the water when tired - for if they do, they quickly become water-logged and either drown or fall prey to skuas and gulls.

There seems no escape from the view that the down-wind drift which operates in the North Sea region also operates over the Atlantic Ocean. It is well-known that the Atlantic is crossed from south-west to north-east by a storm-track, and that the gales which blow so frequently on our western seaboard originate there. These winds are very strong and sometimes span the greater part of the ocean, and if a bird, blown off-shore when disoriented by bad weather on the American side, were to fly down-wind along the storm-track, it might average some sixty to seventy knots and reach Britain in between forty and fifty hours. It is entirely possible that such momentous journeys could be undertaken even by quite small birds such as the



The spotted sandpiper is another American species that has made the momentous journey across the Atlantic.

American wood-warblers (of which no fewer than eight species have reached Europe) and thrushes, and the yellow-billed cuckoo which has appeared in Europe many times, and that the lucky ones might still have sufficient energy-reserves remaining to stay alive. Several American visitors have now been weighed at bird observatories soon after their arrival, showing losses of between thirty and forty per cent of normal body-weight, and one or two have even been recaptured subsequently, showing good 'off-passage' gains.

During the last half-century an interesting climatic change has been taking place in the north-east Atlantic, the winter temperature in places like Spitsbergen, Iceland and south-west Greenland rising markedly, which can only mean that the storm-track depressions are busier and more boisterous than they were, since the higher temperatures are the consequence of their transporting large bodies of warm 'tropical' air to northern regions. This greater activity of the storm-track doubtless explains, at least in part, why many more American birds are getting across the Atlantic now than ever before, and why two-thirds of the newcomers to our British avifauna since the war have come from this source. We must also be careful to bear in mind, however, that there are many more bird-watchers than there were, and that the standard of field-identification of rare birds is higher than it has ever been. British bird-watching is certainly at an exciting phase, for the indications are that this climatic amelioration will continue for many years, so that we may look forward confidently to an unfailing supply of American birds at our bird observatories, estuaries, reservoirs and sewage-farms – not very many, perhaps, in the course of a season, but enough to give migration-watching added spice.

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