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P R E F A C E.

THE subjects of Economic Zoology and Casual Distribution clearly pertain to our pages, and in this volume of 'THE ZOOLOGIST' two valuable papers appear on these subjects. We allude to one by Dr. Murie on the " 'Slipper Limpet' (*Crepidula fornicata*), its Introduction and Influence on Kent and Essex Oyster-beds," and another by Mr. E. E. Green on the " Wanderings of a Gigantic African Snail (*Achatina fulica*) in Ceylon."

"Bird-watching," one of the latest and most interesting pursuits in Ornithology, is also, as usual, well represented in this volume. Mr. E. Selous has given his observational diary on the domestic habits of the Sparrow-Hawk; Mr. S. E. Brock has detailed his observations on Lapwings in the pairing season; and Mr. F. Heatherley has done the same for the Raven "at home." Our "Notes and Queries" contain numerous shorter records on the same subject, and these have always been one of the most valuable features of our journal. A record is none the less valuable because it repeats a fact or an observation. If first recorded by A, it becomes of even greater importance when subsequently observed by others in different parts of the country. And here we venture to make an appeal to our contributors in giving the names of little-known localities. If these were denoted by *capitals* in the MS., mistakes would sometimes be avoided by both an anxious Editor and a painstaking "reader." It is a cause for congratulation that our

“Notes and Queries” are resuming their old vitality and greater volume, and it is a matter for regret that many valuable notes have had to be held over from the December issue owing to the necessary usurpation of the Index in that number.

In the past year the publication of many standard works on British Zoology is to be noted. We have now received Part viii. of the ‘History of British Mammals,’ by Major Barrett-Hamilton; Section vi. of Mr. Kirkman’s ‘British-Bird Book’ has appeared; Mr. Tate Regan’s volume on ‘The Freshwater Fishes of the British Isles’ has been published; the ‘Eggs of European Birds,’ by the Rev. F. C. B. Jourdain, is still in progress, and of course pertains largely to our British fauna; while Mr. Ogilvie-Grant’s “Annual Report on the Immigration of Summer Residents, and Notes on the Migratory Movements and Records received from Lighthouses and Light-vessels,” published in the ‘Bulletin’ of the British Ornithologists’ Club, appears with its welcome regularity.

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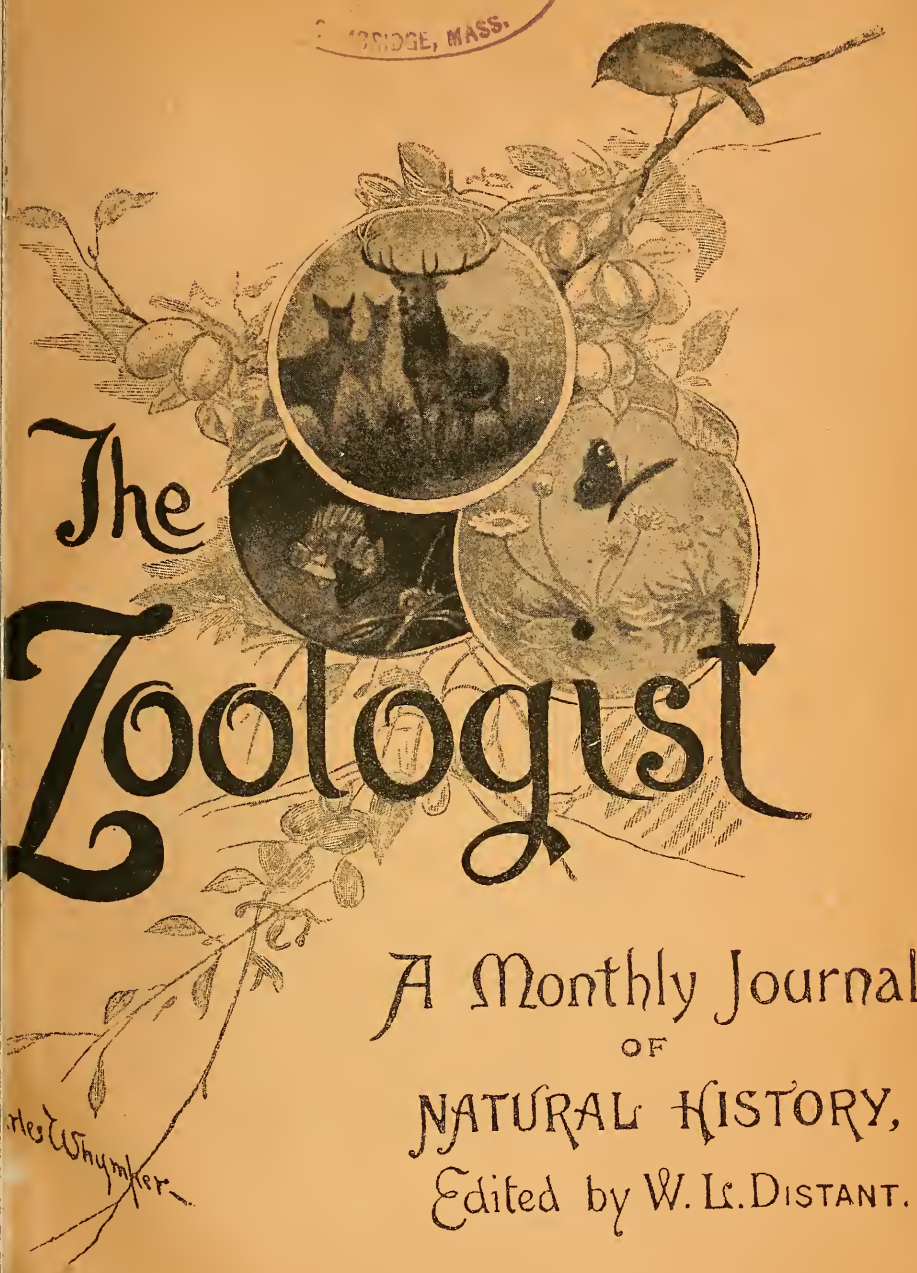
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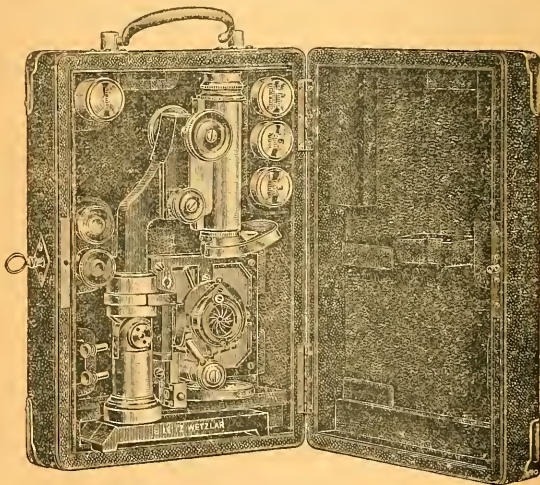
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THE ZOOLOGIST

No. 835.—January. 1911.

THE JERSEY VOLE (*EVOTOMYS CAESARIUS*,
MILLER).

BY GORDON DALGLIESH.

(PLATE I.)

THE investigations of modern zoologists with regard to our outlying islands' fauna have met within recent years with singularly happy results, the mice and voles receiving a very large share of attention. The painstaking and careful work of such naturalists as Barrett-Hamilton, De Winton, Millais, and Bunting must be of the greatest value and help to future field naturalists. To Major Barrett-Hamilton credit is due for having been the first to discover the Jersey Vole. It was, however, left for an American mammalogist, Mr. G. S. Miller, to first name and describe its peculiarities. In his paper, "Notes on the Mammals of the Channel Islands" (*Zool.* 1908, p. 462), Mr. R. H. Bunting first drew attention, in the pages of 'The Zoologist,' to this hitherto new and little-known rodent.

That the Jersey Vole should have escaped notice for so long is not surprising when one considers for how long the Orkney Vole and the Yellow-necked Mouse remained unrecognized. It should be remembered, too, that previous to the researches of the above-named naturalists our mammalian fauna had but lightly been critically examined. When Mr. Bunting returned from his collecting trip in the Channel Islands he kindly presented me with the skin and some skulls of the Jersey Vole.

Beyond just casually noticing that the specimen seemed larger than the British Bank-Vole, I took no further notice of the specimen until last November, when, having occasion to go through my collection of small mammals, I noticed a remarkable difference between it and *Evotomys glareolus*. I determined to try and obtain further specimens, and wrote to a friend in Jersey to get me some. The result of my letter was seven adult Voles, and I at once saw that I had something very different from the Common Bank-Vole. Beyond just quoting what Mr. Miller wrote, that *E. cæcarius* was "much darker in colour," Mr. Bunting gives us no description of the external characters, relying more on the shadowy characters of the cranium for his description. The Jersey Vole is remarkable in many ways. Its close affinity to the Common Bank-Vole of England is questionable, differing widely from that animal. That "things are not always what they seem" is a saying that is very often only too true. Writing of birds, Seebohm remarks:—"It is quite a mistake to suppose that the European Jay is more closely allied to the Japanese than to the Siberian or Chinese Jays. . . . It is nearest allied to the Siberian Jay" [*Garrulus brandtii*]. The above remarks would bear an analogy to the Jersey Vole, whose nearest ally (as anyone would naturally suppose) would be *E. glareolus*; but this in a sense is far from being the case. As far as Britain is concerned, certainly *E. glareolus* and *E. skomerensis* are its nearest allies. Mr. Miller says it is closely allied to *E. nageri*, *E. vasconicæ*, and *E. norvegicus*, all three being found in the colder portions of Europe. According to this statement, zoologists are here confronted with a puzzling but interesting problem which will be well worth attention to try and solve, especially the devotees of zoogeography. As Mr. Bunting truly remarks, that an animal like *E. cæcarius*, "which inhabits an island with so mild a climate as Jersey possesses, is interesting to notice."

It would appear, as the result of my examinations, that the Jersey Bank-Vole undergoes two phases of pelage—a summer and autumn and a winter (and spring?) one.

Description of an adult male (summer).—Muzzle and cheeks grey, intermixed with long black hairs; a long irregular area of deep reddish brown, each hair tipped black, extending from fore-

head to rump, resembling in tone the coloration of *E. glareolus*. Extremity of rump and sides of body a deep grey. Under parts resembling that of *glareolus*, grey, suffused with a yellow tinge. Tail more sparsely covered with hair than that of *glareolus*. The winter pelage differs so greatly from that of summer as to be at once noticeable even to the most casual observer.

Adult male (winter).—The whole of the upper parts very dark, looking as if the red of summer had been covered with a deep grey covering, but not so deep as not to allow the red to be just noticeable. In fact, the winter specimens approach very closely in colour that of the Field-Vole (*Microtus agrestis*), only, of course, being of a much darker shade. To try and convey an adequate conception of the coloration, I would say that had a Jersey Vole hitherto quite unknown been taken, say, in England, it would at once suggest—at least, to my mind—a Bank-Vole approaching melanism, or as a hybrid (granting, of course, that such a thing were possible) between *Microtus agrestis* and *Evotomys glareolus*. This is, at any rate, the best description I can give to convey the remarkable deep tone of the fur. The fur of a winter specimen is soft, thick, and woolly, about from 10 to 12 mm. on the back, against 6 mm. to that of summer. The British Bank-Vole is probably a trifle darker in winter than in summer. I suspect, too, that there is a race of Water-Voles inhabiting the fens of Cambridge which differ from the typical specimens in their much darker coloration, being midway between *Microtus amphibius typicus* and *M. amphibius ater* (the melanic variety); but about these I hope to say a few words in a future number of 'The Zoologist.'

It might be as well here to draw attention to the external features by which an *Evotomys* Vole and a *Microtus* Vole can be distinguished. Going over this well-worn path, so to speak, it is necessary to point out a further peculiarity of the Jersey Vole. The Field-Vole and Orkney Vole are Voles *par excellence*. They differ from the true mice in being of a heavier build, ears nearly concealed in thick fur, in possessing a short stumpy tail, and small eyes. They are, according to the conviction of many, a specialised Hamster (*Cricetus*), or a Hamster a specialised Vole. Between these voles and the true mice (*Mus*) comes *Evotomys*, a mouse-like vole having affinities with the voles in its shape,

and affinities with the mice in possessing a longer tail than the true voles, larger ears, and eyes. *E. caesarius* has a much more vole-like appearance than *E. glareolus*. In fact, it again should by rights be placed between *Microtus* and *Evotomys*. In its colour, smaller eyes, and less prominent ears it agrees with *Microtus*; in its longish tail and reddish summer pelage it agrees with *Evotomys*. No doubt to those who place more reliance on the characters of the cranium the Jersey Vole stands revealed as a true *Evotomys*. On the skull I shall not dwell. This has been dealt with fully by Messrs. Bunting and Miller. Regarding size, the Jersey Vole appears at first sight to be a much larger animal than *E. glareolus*, but actual measurements show but little difference in many individual specimens. Bunting writes:—"Specimens which have recently *been sent* [the italics are mine*] to me show measurements slightly exceeding those of the type specimens." My specimens (except the one presented to me by Mr. Bunting) show a decided decrease in measurements. It is only fair, however, to state that my measurements were taken from spirit specimens, or what would probably be regarded as such. All seven specimens were caught on Nov. 23rd, and at once disembowelled, stuffed with spirit-saturated wool, and forwarded. I received these on Nov. 25th, and at once took measurements. The spirit *may* have caused shrinkage, but I hardly think so, seeing that they were not wholly immersed in the fluid. Now, as will be seen, while my specimens decreased, Mr. Bunting's, which I examined and were also spirit specimens, exceeded the type. The probable explanation lies in the fact that Voles vary a good deal in size.† A careful series of measurements of English Bank- and Water-Voles have shown me this to be the case. Appended is a table of average measurements of the Jersey Vole, with those of Mr. Bunting's in parenthesis. It will be seen that the latter measurements, while exceeding mine in the maximum, are less

* For reasons see further on.

† A Field-Vole (*Microtus agrestis*), taken by myself at Thursley, Godalming, Surrey, on May 5th, 1910, measured: H. B., 120 mm.; tail, 37 mm.; H. F., 20 mm.; ear, 13 mm. Mr. Guy Dolman, of the Natural History Museum, to whom I presented the specimen, said they had none so large in the National Collection, and that mine must be a record.

in the minimum of H. B. and tail. For comparison I have added a table of measurements of the Common Bank-Vole. (All measurements in millimetres):—

Evotomys cæsarius.

	H. B.	TAIL.	H. F.	EAR.
Maximum...104 (120).....	51 (54).....	18 (21).....	11 (12·5)	
Minimum... 94 (91).....	45 (41).....	17 (17·5).....	10 (10·5)	

Evotomys glareolus.

	H. B.	TAIL.	H. F.	EAR.
Maximum.....	96.....	46.....	17.....	12
Minimum.....	82.....	40.....	16.....	10

To summarise the interesting points of the Jersey Vole, it should be specially noted that we have here an animal enjoying a much milder and more sunny climate than that of England, yet in spite of this having the appearance of and being allied to Voles of a colder climate than that of Britain on the whole. Students of evolution have here an interesting problem as to the origin of this Vole. It may be that the Jersey Vole is the descendant of a race of Voles that migrated south (in the same way that Lemmings of to-day migrate) when Jersey was connected with the mainland. Query: Are the Voles aberrant descendants of a Lemming-like ancestor?* No definite conclusion can be gained until a careful and thorough study is made of the Continental Voles. At present the Jersey Vole is only known from the island whose name it bears. It may therefore be found on the mainland. I am strongly inclined to think that the Skomer Vole (*E. skomerensis*) will one day be found occurring on the mainland of Wales (*cf.* Zool. 1907, p. 302).

If we do eventually discover the Jersey Vole or its prototype in Continental Europe, its range can then be worked out, and its limit may extend to the habitat of the northern Voles, to which, as Mr. Miller says, it is allied.

The next interesting feature is the dark colour of the Jersey Vole. Many insular forms of both mammals and birds exhibit this characteristic feature, as, for example, the dark Song-

* Barrett-Hamilton (P. Z. S., May 19th, 1896, p. 602) says:—"Mr. Bonhote informs me that the Norway Voles were very Lemming-like in appearance when alive, and he found them inhabiting the same burrows as Lemmings."

Thrushes (*Turdus musicus*) of the Hebrides, and the Wren (*Troglodytes p. hirtensis*, Seebohm) of St. Kilda. The Orkney Vole (*Microtus orcadensis*) is also of a darker shade than the Field-Vole (*M. agrestis*). It is interesting here to note that in the former species the adults very closely resemble immature examples of the Water-Vole. Millais mistook his species at first sight for a Water-Vole (Zool. 1904, p. 241).

There are many interesting problems connected with our British fauna which are well worth consideration. Why has the Lemming (*Myodes norvegicus*), once a British mammal, become totally extinct in Britain, though it swarms in countless numbers in other countries? Its near ally, the Field-Vole, on the other hand, remains with us, and often increases in such overwhelming numbers as to cause "Vole plagues." Yet its mortality must be enormous when we consider that it, together with Field-Mice, forms the staple diet of a host of carnivorous mammals and birds.

The most important literature and synonymy at present available with regard to the Jersey Vole and other Voles is as follows:—

JERSEY VOLE.

Evotomys cæsarius, Miller, 'Annals and Magazine of Natural History,' February, 1908; Bunting, 'Zoologist,' 1908, p. 462 (December).

BANK-VOLE.

Microtus (Evotomys) glareolus, auctorum.

Evotomys hercynicus britannicus, Miller, "Preliminary Revision of the European Red-backed Mice," 'Proceedings' of the Washington Academy of Science, vol. xi. pp. 83-109 (1900).

Other Species and their Allies.—Miller, "On the Genera and Subgenera of Voles and Lemmings," United States Department of Agriculture (Division of Ornithology and Mammalia), North American Fauna, No. 12, July 23rd, 1896.

THE PEREGRINE FALCON IN THE SOUTHERN MIDLANDS.

BY O. V. APLIN, F.L.S.

I HAVE just examined a very fine and unusually dark coloured Peregrine in the plumage of the first year, which was shot at or near Buckingham on Nov. 7th, 1910. I saw the body after it was skinned, and found it very well nourished, and the bird was probably following the Wood-Pigeons, which are abundant just now. The Peregrine is a regular visitor to the southern midlands. Those that occur in autumn—at least, those that get shot and I examine—are almost invariably young birds of the year, the “passage hawks” of falconers. On the other hand, when I hear of a falcon having been killed in mid-winter or in early spring (*e.g.* March), and I get a chance of seeing it, I almost always find (writing from memory at this minute, I should say I always have found) that it was an adult bird. The last I heard of was at Christmas, 1909—an old blue female shot at Chacombe, just over our boundary, in Northamptonshire. The young birds do not seem to stay long in autumn, and why they do not re-pass here in spring (if they do not) I do not know. Both young and old, when they are with us, usually either haunt woods where there are many Wood-Pigeons, or large sheets of water where there are wildfowl. Byfield Reservoir is visited, and I have heard of two passage hawks killed in one autumn at Boarstall Duck Decoy, where they are a great nuisance, and would soon ruin the decoy for the season if they were allowed to remain. Peregrines also sometimes frequent the river valleys if they are partly flooded, and there are any wildfowl and Peewits about. I am told also that they take up their quarters on the arable land on the lower slopes of the Chiltern Hills (retiring no doubt to roost in the woods that cap the hills in places), and there levy a toll on the Partridges. They frequent big open fields, and when on the watch, or when

gorged with food, sit on a clod of earth, where their lighter coloured breasts make them conspicuous. When gorged they will sometimes let a mounted man ride fairly near them before taking wing. Just round here (Bloxham) I think they live on Wood-Pigeons, but I have sometimes seen the remains of Mistle-Thrushes, which looked as if they had been killed by a falcon, and once I saw a falcon try to carry off a Red-legged Partridge which had been shot in a "drive" during a gale of wind, and fallen a long way behind the guns. The last Peregrine I saw about here (apparently from its size a female) was on March 29th last, over some grass-closes with a good deal of hedgerow timber, just outside the village; it was flying just over the tops of the trees, and no doubt was looking for a Wood-Pigeon. I was not near enough to see if it was an old blue bird or not.

HABITS OF THE CRESTED GREBE.

BY O. V. APLIN, F.L.S.

ON October 8th, 1910—a beautiful, calm, sunny day—I was fishing at Byfield Reservoir. When watching, through a telescope, one of a pair of Crested Grebes (still retaining breeding dress, although faded and not so bright as in the case of the bird I saw the autumn before last),* which were followed about (sometimes at a distance) all day by two half-grown young, keeping up their peeping cries incessantly, I saw it make a shallow dive and a considerable commotion in the water. It emerged in a few seconds with quite a large fish, comparatively speaking, in its beak, and had some apparent difficulty in dealing with it. Having got a comfortable hold of the fish, it set off swimming rapidly up the water; but finding, I suppose, that it did not go very fast, it took two long dives, and certainly, I think, it covered more space in the time by diving than by swimming. Each time it came up I could see the fish in its bill glittering, and I think it must have been quite between two and three inches long. Swinging my glass in the direction in which the old Grebe was going, I saw the two young birds, straining at their full pace with necks outstretched and craning forward, coming to meet her (or him), and directly after they met. What exactly happened to the fish I do not know; perhaps the old bird dropped it, or dived with it for fun. The young rushed at the old one (or at the fish), and all then went under water, to emerge again at once with a great splashing and disturbance. That was all I could see—a regular worry; and I do not know which of the young got the fish, though no doubt one of them did. The old bird then swam away. There were from twenty to twenty-five Grebes there that day. Except this pair, all the old ones I saw were far advanced in winter dress. The other young ones were full-grown, with the dark lines on their necks very conspicuous. One of these full-grown young flew a long

* 'Zoologist,' 1908, p. 407.

way down the water (gaining a height of twenty or thirty feet) without, as far as I know, being disturbed in any way. I have before this seen them take long flights at this season, and a little later in the year.

The Crested Grebe flies very freely in the autumn. One day early in November, 1898, when I was at this pool, there were some Snipe in the big reed-bed, and a lot of shots were fired at them by two men who had the shooting rights. This alarmed all the birds, including the Grebes (of which I counted fifteen young and old), and they remained very nervous all the rest of the day, long after the shooters had departed. I frequently saw one or other of them rise and fly for some distance over the water, rising to a height of about twenty feet in some cases. They are good fliers and fly fast. Wings narrow and curved downwards. The head and neck is outstretched and depressed, and the legs and that end of the body are also drooped; so the body at the saddle is the highest part of them. This gives them a curious appearance on the wing. The true Divers have something the same shape when in the air. The adult Grebes on that November day looked almost black-and-white birds (the immature birds were duller and more grey), showing a great deal of white on the wings—more white than dark except near the tip. When they are going to pitch down on the water they drop their hind parts and straddle out their legs. I have known Crested Grebes fly in summer, but very rarely.

SUPPLEMENTARY FISH-NOTES FROM YARMOUTH.

BY ARTHUR H. PATTERSON.

SPRATS.—Since my last Annual Notes were published in 'The Zoologist' (1910, p. 451) one or two other interesting occurrences have been noted. Sprats were late in their coming to the Suffolk coast, owing probably to the unsettled, stormy weather that prevailed in November; but towards December they made up for their delay by arriving in prodigious quantities. The Aldeburgh boats made enormous hauls on Wednesday, December 7th, when nine trucks, containing some thousand bushels (of from thirty to thirty-five tons), were sent off by the Great Eastern Railway to London and provincial centres, amongst them being three truck-loads for shipment to Germany. I noticed a goodly quantity from day to day on Yarmouth fish-wharf, in shallow boxes holding on an average three stone. Between Pakefield and Southwold the bay was reported to me on the 17th as "swarming with Sprats." During one breezy day one boat sank in the breakers with forty bushels of Sprats, its rudder being lost and sails torn to ribbons. The fish have been of excellent quality, and I noticed a marked absence of the parasitic eye-sucker (*Lerneonema monilaris*), which is frequent in some less turbulent seasons, nor have I seen the shoals infested with *Idotea* as in some years.

HERRINGS.—The Yarmouth Herring fishery wound up with a catch, in round numbers, of some 34,800 lasts, as against 43,965 lasts in 1909, and 44,362 lasts in 1908. Two interesting instances are worthy of record:—When the Herrings "fell off" in the home waters, an enterprising owner sent a boat down into French waters, where he made a rather surprising haul of fine fish. A Lowestoft trawler, fishing in the vicinity of the light-vessel 'Galloper,' early in December, off the Essex end of the Goodwins, captured a number of Herrings in his trawl. He informed the master of a drifter of his "take," who went there

and shot his nets, obtaining several crans. The Herrings from the Brittany coast, I thought, were somewhat tasteless when cooked.

CUCKOO WRASS. — To my indefatigable young friend, Mr. F. C. Cook, of Lowestoft, I am indebted for placing in my hands the first Cuckoo Wras (*Labrus mixtus*) I have seen “in the flesh.” It had recently been trawled up from the vicinity of the ‘Gallopers’ (light-vessel), during the second week in December, and, having been laid on the ice, came to port in excellent condition; the colours had, however, much deteriorated, if I may compare it with Couch’s brilliant figure, and the drawing of one sent me by the Duchess of Bedford two years ago from the vicinity of the western islands. The blue lines radiating from the eye and running down either side still contrasted strongly against the fawn ground colour; a row of blue spots ran along just below the lateral line, which I have not seen represented in any drawing of this species, which, I believe, varies considerably in the disposition of its brilliant colours. I notice both Couch’s and Day’s figures give the tail a rounded form; the present fish’s was distinctly concave or forked (!). Length, $8\frac{1}{2}$ in. Dr. H. Laver, of Colchester, to whom I mentioned the occurrence, stated that the fish has not hitherto been recorded off the Essex coast, and suggested I should place it on record.

MULLER’S TOPKNOT.—A fine example of this fish was taken at the same time with the preceding. Dr. Laver assures me he has several records of this interesting little fish as taken in the Essex estuary.

[HÆMULON. — I do not make any claim for this American *perciforme*’s admission to more than serious notice, but early in December Mr. F. C. Cook found stranded on Lowestoft beach the head and backbone of a strange fish. On examining it I saw a marked resemblance in the head to that of some Sea-Bream. I sent it to Dr. Boulenger for identification. He described it as one of the *Pristipomatidæ*, with the remark that “no Hæmulon has ever been recorded from the British seas.” Dr. Boulenger also truly remarked that no one knows how far fish may travel in ice. I make inquiries as to whether the Lowestoft smacks fished in French waters, and was assured

they do not, their favourite grounds being the vicinity of the Cromer Knowle, and further northward, but still south of the Dogger Bank. Nor do we have any large vessels, such as might necessarily carry refrigerators, come within reasonable distance of Norfolk and Suffolk waters. I merely mention the finding of this Hæmulon.]

DORY.—The John Dory (*Zeus faber*), or Doree, may be looked upon, on the Norfolk coast, as more or less of a straggler inshore. I have records of several taken in shrimp- and drift-nets, the largest weighing seven pounds, the smallest the size of a crown piece; but one taken on a hook baited with lugworm, the angler fishing from the beach, is the first specimen I have known hooked in this locality. It weighed one pound, and was captured late in December.

DUTCH SMELTS.—Considerable consignments of Smelts from Holland have been received in this country of late years. They come packed in shallow boxes containing two layers of fish; caught one day, some are on sale in Yarmouth next morning, having come to London by the night-boat, and dispatched thence. I have not dissected any, but have been informed on more than one occasion of numbers of intestinal thread-like worms infesting them.

HERMAPHRODITIC HERRING.—About Christmas-time a labouring man was preparing a smoked Herring for cooking for his tea when he discovered it contained a combined roe and milt. He sent it to me. The anterior portion is composed of well-developed ova, and takes up two-thirds of the length, the posterior ends are milt; the two portions of each lobe look as if they had been neatly welded together.

THE VOCAL AND INSTRUMENTAL MUSIC OF INSECTS.

By A. H. SWINTON.

(Continued from vol. xiv. p. 432.)

I HAVE a pamphlet, written in German, that explains that numbers of moths and butterflies having striations on the proboscis or palpi can play the trombone when occasion serves, but this instrumentation I have not chanced to hear; those with short tongues would be the most adapted to perform. *Acherontia atropos* is met with in Asia, Europe, Africa, and the islands of Mauritius and Bourbon, into which gardens in the sea it probably has been introduced by human agency. It was already in the Mauritius when the author of 'Paul and Virginia' visited it, for he tells us the inhabitants believed it cast dust when flying through an apartment that caused blindness. Similarly, the inhabitants of Sikkim are said to have a horror of a moth found near the Snowy Mountains. It is said of the other "death's-heads" found in Asia, that *Acherontia lachesis* squeaks like a mouse, and the smaller *styx*, the commoner species or local variety, found in Bengal, when vexed, emits yet shriller sounds. Mr. W. C. Gott says, in the 'Entomologist,' that the caterpillars of *Langia zenzeroides*, that feed on the apricots at Simla, are given to hiss, but that the moth when it emerges only faintly squeaks. Dr. George Gibb tells us, in the 'Canadian Naturalist,' that the *Hemaris thysbe*, which is accounted rare, squeaked loudly when captured, and continued to squeak in captivity.

Owing to their large composite eyes butterflies see all around them, and although the sense of hearing is not correspondingly developed, a perception of freedom seems to prompt those that are strong on the wing to click with exultation as they sail with proud dominion through the azure deep of air, and they, as would appear, produce this running music by jolting an inflated

knobby vein that runs along the inner margin of the fore wing along a curved, raised vein on the hinder. *Pyrameis cardui* that you may see the world over loves to sun on the pathway under the flickering shadow of the tree, and when disturbed returns with pertinacity to the delightful spot and expands its wings as before. An inquirer in 'Science Gossip' for 1878 asks: "Have you observed a kind of metallic sound when the 'painted lady' is on the wing?" and Mr. J. I. Fountain answers in the 'Country-side' for November, 1906, that when missed by a stroke of the net the rouged beauty is wont to return with a distinct and petulant "click-click!" It is wonderful this truculent butterfly should be so widespread; it is disclosed in numbers from land overrun with thistles, and its periodical migrations in Europe in 1741, 1828, 1836, and 1879 will in a measure account for it, but I have seen it enjoying the sunshine on the stony declivity that leads up to Napoleon's place of banishment in St. Helena, where it could only have been brought in a ship; this was in 1865. In 1875 Mr. Wollaston saw it there in company with that little wandering blue *Polyommatus bœticus* and a black and white *Danaïs*. In the Brazils and Isthmus of Panama is heard the parchment cackle of the "whip butterflies," *Ageronia* or *Peridromia*, *feronia*, *ferentina* (*fornax*), and *amphione*, when on the wing. These are said to feed and sun upon the fallen oranges, where the *Daleshampia* abounds, or alighting head downwards, with their wings expanded to catch the warmth, to crawl about the trunks of the *Cassia* and *Mimosa*, where they are protected by their purple tints that match the grey bark and sunlight shadows. Langsdorff, who met with *ferentina* in the island of St. Catherine, off the coast of Brazil, remarked that it made a noise like a rattle when it flew away, and the sound has since been commented on by Darwin, Wallace, Van Volxen, and Edwards, and compared to the "click-click!" of a toothed wheel or the startling din of a watchman's rattle. It is emitted by both sexes when they are chasing one another, and the crackling of *amphione* is said to be more grating. When approached, *feronia* and *ferentina* use their legs for running away, a performance not expected of a butterfly. The production of the sound seems obvious, for the vein that runs along the inner margin of the fore wing is at its origin inflated into two bead-like bladders

that crick like a scratchy pen over the circular vein at the base of the hinder. The specimen of *Ageronia feronia* I have been experimenting on comes from the forests of Bahia, where Darwin heard its parchment rustle during the wet season at the close of February, 1832; my father was there eight years later, and he has left behind him his sketches of the bay that transport me to the groves where it takes its delight. Fritz Müller, on Oct. 13th, 1876, saw two other butterflies chasing one another and making a similar clicking sound, after which they settled with their wings horizontally expanded on the dry stems of the *Tagnara* or bamboos that flourish at the mouth of the River Trombudo, a tributary of the Itajahy. He captured one, and it proved to be *Eunica margarita*. Mr. W. J. Kaye informs us that *Gynœcia dirce*, found in Jamaica and Brazil, makes a loud clicking sound when flying, and Mr. Edwards heard a similar sound when the butterflies of the genus *Prepona*, also inhabitants of Tropical America, took flight from the tree-trunks. The caterpillars of the *Paphia glycerium* feed on the *Croton capitulatum* that grows on the prairies that border the course of the Mississippi, and when the butterfly takes wing its flight is rapid, and a dry and whistling sound is heard; like the "painted lady," it returns when disturbed to its sunny resting-place, and Dr. L. K. Hayhurst, in February, 1870, found it hybernating in company with the "painted lady" and "Camberwell beauty" in a hollow of a tree filled with hickory-shells. What is remarkable, its caterpillar is a leaf-roller; that of the "painted lady" has something of this habit; those of the "skipper butterflies" are leaf-rollers. I do not know whether there is an existing link like our little *Nemeobius lucina*, that flies among the wild columbine in the New Forest, to connect the species that have four legs with those that have six.

From resentment certain butterflies rustle their silken robes; the sound is produced as before, only the vein that runs along the inner margin of their fore wing, and which moves over the curved one on the hinder, is notched like a file. Mr. Edwards tells us *Charaxes sempronius*, a native of Australia, as it alights on the branches of the sweet-scented blossoms of the *Bursaria spinosa*, closes its wings with a grating sound, which it repeats testily when disturbed. The year 1837

came after two seasons when the "clouded yellow butterflies" *hyale* and *edusa* had respectively abounded in the South of England. It was, astronomically, a year of most sun-spots, and no doubt of heat-waves, when an unusual cloud of locusts passed over Benares, in India. In the warm month of July, Mr. Henry Buist, then living at St. Andrews, on the east coast of Scotland, saw the "humming-bird moth" poise over the flowers in his garden, and when October came he started up from the flower-beds a "peacock" and "red admiral," beautiful butterflies that are rarely seen on the northern side of the Tweed, although we hear that in 1894 and 1899 the latter has been no rarity in the seaside resorts down the Clyde, where I never noticed it. Anywise, my mother, a Scotchwoman, was quite overcome with the loveliness of the *Vanessa* butterflies that she had not before seen when she came to live in Hampshire, and I well remember her taking me into an orchard planted with filberts and ribstones to see the "red admirals" feasting on the rotten apples that she had found a way of capturing by letting fall her pocket-handkerchief. Later on, when the frost-flowers embroidered the window-pane, I happened to dislodge some "peacocks" (*Vanessa io*) from their winter sleep among the cobwebs, and Bats that depended from the rafters of a hayloft, and I recall the delight I experienced on beholding the proud beauties expand their inky wings on the floor and disclose their iris eyes set in red velvet, while their fore wings chafed on the hinder with a rustle, resembling that made by the fallen leaves when stirred by the north wind they moved in twinkling dance over the pathway. So likewise a "peacock butterfly," disturbed when Mr. Hewitson's room at Weybridge was undergoing a spring cleaning, resented the proceeding by spreading its wings on the floor and rubbing them together with a sound of sandpaper. And it would be interesting to know whether those Himalayan butterflies of the genus *Kallima* he had preserved in his elegant cabinet, whose wings, when closed, so exactly resembled a rhododendron-leaf purpled by the frost, or a rhododendron-leaf brown and withered and mottled over with fungus, had learnt to play this forest melody. Among their natural surroundings the *Vanessa* butterflies are wont to pass the winter dormant in the hollow of old tree-

trunks, where, when they have closed their wings, they are protectively concealed by their resemblance to the horseshoe fungus that there abounds, and in England they seem to prefer the hospitality offered by the wide-spreading beech. Mr. Doubleday says, in 'The Zoologist':—"Last winter some large stacks of beech-faggots, which had been loosely stacked in Epping Forest in the spring with the dead leaves adhering to them, were taken down and carted away, and among them were many scores of *io*, *urticæ*, and *polychloros*." Once upon a time the Rev. Joseph Green, when out on one of his historical pupa-digging expeditions, was about to insert his trowel into a cavity at the root of a Buckinghamshire beech-tree when he heard a faint hissing, got up by three "peacocks" that were cosily wintering there, and who, on being ejected, one by one showed their resentment by raising and depressing their wings with continued uproar. These sounds, it would seem, are sometimes made during courtship, for Mr. Edwards says that when he began to collect butterflies in England he heard the "peacocks" make a rapping noise when many were flying together, and that the male did so when in hot pursuit of the female. The "Camberwell beauty" (*Vanessa antiopa*), that has a distinct resemblance to a flying horseshoe fungus, must be placed in the front rank of performers. Mr. A. H. Jones tells us, in the 'Entomological Magazine,' that in 1872 a sleepy female that came into his possession in a hybernating condition would, when disturbed, partially expand her wings, and at the same time produce a grating sound that seemed to come from their base; and Charles Wrackle says, in 'Insect Life' for January, 1889, that when in Lorraine he saw two "Camberwell beauties" walking round one another on a beech-stem, and, agitating their wings, they produced repeated stridulous sounds. On moving the fore wing of a "Camberwell beauty" over the hinder a music arises that recalls the trickle of the willow-fringed brook, but as a similar note may be evoked from a desiccated "large tortoiseshell" that is wont to sun with expanded wings on the gravel-walk under the elms, it seems to have a truer analogy with a serpentine hiss. On March 26th, 1880, I saw a "large tortoiseshell" fresh from hybernation flutter and drop down torpid on a grass-plot at Guildford. I went and picked it up,

and placed it in the sun at an open window upon a sprig of *Genista*, thinking to hear its waking expostulation ; but gratified as would seem with the aroma of spring, it began to vibrate its antennæ, and at length, when it bethought it to open its wings, it darted up high into the air and was gone. The bare reticulated and pitted under surface of the knob of the antennæ—the presumable nose, or position of the sense of smell—is better seen in the “large tortoiseshell” than any of our *Vanessas*. The next year (1881), on April 18th—an Easter Sunday—I chanced to take an afternoon stroll up what was known as the “one-tree hill,” on account of its being surmounted by a wind-swept elm that had spread out its branches, and until you came quite close looked like an oak. Several “peacocks” and “small tortoiseshells” (*Vanessa urticæ*), as I climbed the declivity, were flying along the hedgerow with their wing-markings bleached by the winter to a sepulchral white, and when I had descended into the dell beneath St. Matha’s Hill, I saw a male of the “small tortoiseshell” descend from the pale blue air and settle behind a female, who was basking with expanded wings on a nettle-clump, enjoying the rays of the setting sun. He then patted her with his fore feet, nodded his head, and, fluttering his wings, he made a faint stridulous sound, as I remarked at the time. But when provoked the “small tortoiseshell” becomes more decidedly musical, for it leaves with regret its fairy dreams. A fresh brood of this butterfly, on Aug. 22nd, 1876, hastened to find shelter from an inclement blast in an outhouse in Argyleshire, and, detaching one of these from the rafters, and placing it on the palm of my hand, I lightly touched the tails of its hinder wings, when it immediately opened both wings at once with a distinct soft and grating sound of sandpaper, and I caused it to perform thus three or four times before I set it free.

The notes of love and rivalry vociferated at the barn-door by the guinea-fowl and cockerel, and struck up on tree and briar by Cicada and Orthoptera, are then rarely sounded out by the Lepidoptera, whose males, like the *beaux* of days gone by, often revel in velvets, satins, and silken sheen, or whose scales kindle with a purple glow as those of the *Morphos* and *Apaturas*. Various ideas have been held in regard to the reason of this

phenomenon. The wing-scales are grooved zigzag, it has been said, and the opposite sides of the grooves are coloured blue and purple, so as to look different when looked at two ways; or their surface is striated or beaded, and when the scratches on a surface run close the mother-of-pearl colours always appear—that is to say, the strange iridescence is shot from the surface of the scales. I have in my hands, thanks to the kindness of a dealer, a perfectly lovely “purple emperor” from the forests of Peru; it is brown and orange, sashed with an emerald edged white ribbon; and I notice that when I hold it head upwards the wings are flaked with silky purple, and the white band has become orange; but when I hold it head downwards this lustre is gone. Hence I conceive it arises from the even rows of rounded scales being set on edge so as to cast behind them broad lines of purple shadow. So the wings of the other *Apaturas* kindle when slant to the light. The tawny *clytie*, common in forest clearings and distributed from Europe to Japan, is wont to assume a delicate strawberry hue, and our own *iris* dons its marine blue. I have often looked at the windows of a dress-shop, but I never saw anything so enchanting as this male costume. Admirers of butterflies are most overcome with the flashing splendour of *Apatura lavinia* and *Morpho cypris*, inhabitants of the forests of Tropical America.

Male butterflies, when not lovely, are sometimes perfumed; the white or yellow *Catopsilias* of the Old World, to which some unite the *Callidryas* of the New, expand scent-fans from under their fore wings, in connection with which there is a chalky spot of different scaling on the hinder. Certain only of the genus *Colias*—as our “clouded yellow,” *C. edusa*—have the spot and not the scent-tuft; there is a patch on the wings of *Hipparchia semele*, that lowers its fore wings and seeks concealment on the heather. No doubt a fragrance of jasmine diffused on the warm air causes the little winged pilgrims to leave the east of Ceylon on the setting in of the north-east monsoon, or rainy season, and crossing the island to travel along the sea-coast in company until they reach the northern extremity, where they are said to cross the strait to the continent of India. Major Neville Maunders, who has investigated the migration of *Catopsilia pyranthe*, says:—“A migratory flight was in full swing on the

day I landed at Colombo (October 25th, 1895), and I certainly thought I had stepped into the land of butterflies." In March, 1803, Mr. Lindley saw a flight of white and yellow butterflies passing south-west at Pernambuco, on the coast of Brazil, and in September, 1890, a migration of the citron-yellow *Callidryas ebule* passing south caused some excitement in Alabama. On Sept. 4th, 1832, when the 'Beagle' was off San Blas, myriads of butterflies of one of the numerous local forms of the "clouded yellow" surrounded the ship. Those flocks of white butterflies seen from time to time on our own south-eastern coast must be susceptible to the charm of colour. A troop of the moth-butterflies, *Urania lelius*, was seen progressing from north to south at Pernambuco at the commencement of June, 1817. These butterfly migrations, like that of the Stork and Swallow, are seasonal. At the leaf-fall, the "American milk-weed butterflies," known as *Danais archippus* or *Anosia plexippus*, are wont to fly south in flocks, and on Sept. 23rd, 1886, they were seen in Maryland, hastening in that direction in the face of a stiff breeze. The male in this genus has what is supposed to be a scent-pouch on the hind wings.

Other insect migrations are periodical, like those of the "Waxwings," and recur in certain years, which are proverbially the weather ones. According to the 'Transactions' of the British Association the climax of the rainfall in our islands that are watered by the cyclones from the west came in 1726, 1728, 1734, 1737, 1744, 1747, 1751, 1756, 1763, 1768, 1770, 1774, 1778, 1782, 1789, 1792, 1794, 1797, 1799, 1804, 1810, 1816, 1821, 1823, 1828, 1830, 1833, 1836, 1841, 1843, 1848, 1852, 1860, 1866—I think I may add 1871, 1879, 1883, 1888, and 1894; and this series of certainly wet years will be found to indicate those which have been determined to be years of most and fewest sun-spots. The inhabitants of Sierra Leone, where an idea has long been prevalent that the locusts or strong-flying grasshoppers can hear, have been wont to drive them away with a clatter, so beyond a doubt it is the rush of their wings which has been compared to the roar of a waterfall that incites them to herd together. These Sierra Leone locusts are wonderful wafters on the gale. When on a voyage to the Mauritius in October, 1863, far out at sea, I picked up one on the deck of the

'Mareschal Pelissier,' sugar ship, and I now imagine it was the pink variety of the *Schistocerca tartarica*, of which Dr. Longstaff has kindly presented me with a specimen. Stray locusts or little flocks have come to the coast of Britain in 592, 874, 895, 1031, 1693, 1748, 1797, 1809, 1843, between 1846 and 1849, between 1857 and 1864, in 1868 and 1869, 1874 and 1876, and again in 1880. Commonly they have been the "migratory locust," but in 1869 *tartarica* arrived. These, however, were merely the scouts of great troops which have periodically deployed northward over Europe about the years 183, 475, 558, 593, 840, 852, 866, 874, 886, 1031, 1086, 1091, 1336, 1354, 1363, 1368, 1374, 1475, 1527, 1536, 1542, 1547, 1648, 1684, 1689, 1693, 1712, 1728, 1741, 1748, 1803, 1811, 1828, 1837, 1842, 1846, 1860, and 1869. Unless it be their large eyes and tinsel glitter, I do not know the incentive that caused the "four-spotted dragon-flies" (*Libellula quadrimaculata*) to assemble in bands and defile from the polders of Holland, or to set forth on a pilgrimage from the reedy source of the Elbe, Saal, Weser, or Abi in or about 1091, 1143, 1494, 1586, 1623, 1659, 1673, 1681, 1740, 1744, 1746, 1761, 1775, 1779, 1816, 1832, 1839, 1855, and 1867. On July 9th, 1908, following the recurring heat-waves that came with May, and, as seemed to me, when the spotted side of the sun rolled towards the earth, a swarm arrived in the island of Alderney from the French coast. On Sept. 4th, 1890, a flight of *Æschna eremita* was noticed in Wisconsin, in North America. A general spread of moths and butterflies northward over Europe took place in or about 1727, 1734, 1748, 1789, and 1790; in 1803 and 1804, 1811, 1816 to 1819, 1825 and 1826, 1831 to 1833, 1835 to 1837, in 1839, 1842, 1846 to 1852, in 1855, 1857 to 1860, in 1865, 1867 and 1868, 1870 to 1872, 1875 to 1877, 1880 to 1883, 1888 and 1889, in 1894, 1899 and 1900. When "Bath whites," "Camberwell beauties," "clouded yellows," "queens of Spain," and "tailed blue" butterflies were seen on the cliffs of Sussex and Kent; when "convolvulus," "madder," or "oleander" hawks came to the garden flowers, two other visitors, *celerio* and *lineata*, being blown across on the breathing of the sirocco from Africa to Montpellier in June, 1834; then the "humming-bird moth," that swarms where the tepid waves of the Mediterranean dash

on their tideless shore, like its namesake, the "rufus humming-bird," that appears in Canada with the gush of the spring tide, has been seen poisoning where the flowering creepers festoon the porch. *Deiopeia pulchella*, distributed from India to the Cape, has created surprise in the stubble-field, and *Sterrha sacraria*, its compatriot, has been seen fluttering at the evening lamp. Some little latitude must be here allowed, for the only example I have of the latter moth I captured at Shanklin on Oct. 9th, 1869, and about the year 1898 I found a "convolvulus hawk" floating in the water at the Needles; indeed, there has always been a presentiment that these stray butterflies and moths have not really flown over the Channel, but have arrived as passengers on board ship, while it cannot be overlooked that the "clouded yellow butterfly" was found exhausted on the beach at Deal at the commencement of August, 1908, when the south-west wind was blowing. In or about 1100, 1502, 1741, 1798, 1803, 1818, 1828, 1836, 1842, 1851, 1860, and 1879 the "painted lady butterfly," that must have been locally abundant, flew about in detachments, or migrated northwards over Europe in flocks; naturally the male and female would coquet in the air—there must have been some contention—and then, as I believe there is evidence to show, the whole assemblage wafted off like smoke on the sweep of the sirocco. The "small tortoiseshell" (*Vanessa urticæ*), as is known, employs a red secretion to free itself from the chrysalis-case, and this may prove an attraction. Our pious ancestors were often startled by blood prodigies, owing to the fungus stains that appear in paste, on bramble-leaves, and alpine snow; but in 1553, when a multitude of butterflies swarmed throughout Germany, and sprinkled plants, leaves, buildings, clothes, and men, there was little scope for credulity, and in 1608 a church and wall in the warm suburbs of Aix, in Provence, it was very evident, had been in like manner aspersed. The North American *Vanessa californica* is known to migrate, for in August, 1889, when ascending Mount Shasta, Mr. C. L. Hopkins, far above snow-line, saw a large flock going south-west. This butterfly has the appearance of being the ancestral form of our small and large "tortoiseshell," which the Rev. G. H. Rayner had known to pair. Mr. William White once found a web of caterpillars on Highgate Hill, from which he reared an individual on nettle that

resembled both, and which Dr. Butler remarked would answer well for *californica*. Indeed, it would seem, from Mr. W. G. Wright's plates of the 'Butterflies of the West Coast of North America,' the familiar butterflies of our woods and lanes had their origin there, for what we breed as a variety is there a recognized species, and each of the several kinds is there a link in a chain of butterflies differing slightly from one another in wing pattern. To some extent our butterflies vary in like manner as you go south in Europe, and a series so arranged is instructive, each form being adapted to its circumstances.

(To be continued.)

[RELIQUIÆ ANTIQUÆ. SCRAPS FROM ANCIENT
 MANUSCRIPTS. . . . EDITED BY THOMAS WRIGHT
 AND JAMES ORCHARD HALLIWELL. . . .
 VOL. I. LONDON . . . 1841.]

BY G. E. H. BARRETT-HAMILTON.

(p. 133) NAMES OF THE HARE.

THE following very curious composition is taken from a collection of English and Anglo-Norman poems written in the reign of Edward I., and preserved in MS. Digby 86, Bodleian Library, 4to, vellum, fol. 168 :—

Les noms de un levre en Engleis.

The mon that the hare i-met,
 Ne shal him nevere be the bet,
 Bote if he lei doun on londe
 That he bereth in his honde,
 Be hit staf, be it bouwe,
 And blesce him with his helbowe ;
 And mid wel goed devosioun
 He shal saien on oreisoun
 In the worshipe of the hare,
 Thenne mai he wel fare.

The hare, the scotart,
 The bigge, the bouchart,
 The scotewine, the skikart,
 The turpin, the tirart,
 The wei-betere, the ballart,
 The go-bi-dich, the soillart,
 The wimount, the babbart,
 The stele-awai, the momelart,
 The evele i-met, the babbart,
 The scot, the deubert,
 The gras-bitere, the goibert,
 The late-at-hom, the swikebert,
 The frendlese, the wodecat,
 The brodlokere, the bromkat,

The purblinde, the fursecat,
 The louting, the westlokere,
 The waldenlie, the sid-lokere,
 And eke the roulekere;
 The stobhert, the long-here,
 The strau der, the lekere,
 The wilde der, the lepere,
 The shorte der, the lerkere,
 The wint-swifft, the sculkere,
 The hare-serd, the heg-roukere,
 The deudinge, the deu-hoppere,
 The sattere, the gras-hoppere,
 The fitelfot, the foldsittere,
 *The liztt-fot, the fernsittere,
 The cawel-hert, the worttroppere,
 The go-bi-grounde, the sittest-ille,
 The pintail, the toure-hohulle ;
 The coue-arise,
 The make-agrise,
 The wite-wombe;
 The go-mit-lombe,
 The choumbe, the chauart,
 The chiche, the couart,
 The make-fare, the breke-forewart,
 The fnattart, the pollart,
 His hei nome is srewart ;
 The hert with the letherene hornes,
 The der tha woneth in the cornes,
 The der that alle men scornes,
 The der that nomon ne dar nemnen.
 When thou havest al this i-said,
 Thenne is the hare miztte alaid ;
 Thenne miztt thou wenden forth,
 Est and west and south and north,
 Wedrewardes so mon wile,
 The mon that con ani skile.
 Have nou godne dai, sire hare,
 God the lete so wel fare,
 That thou come to me ded,
 Other in cine, other in bred ! Amen !

(* p. 134)

NOTES AND QUERIES.

MAMMALIA.

Audacity of the Fox.—There is no part of the Oakley country where Foxes are more in evidence than in the numerous woods and plantations in the neighbourhood of Turvey and Stagsden, in Bedfordshire, where probably a dozen or more litters are reared every season. I have known this locality intimately all my life, and many are the instances of the boldness of Foxes, especially when with young, that have come under my notice, but never previously have I heard of a Fox actually attacking people. In May of 1909 a farmer friend of mine was passing at some little distance from a spinney where a vixen was known to have cubs some six or seven weeks old (into the earth of which a terrier had been sent a day or two previously), when she dashed out from the hedgerow and came straight for him, snarling and snapping, and approaching by a succession of short jumps until within a few feet of him. Having no weapon to defend himself with, he could only keep shouting at the Fox, and backing quickly away from the covert-side in the meantime. The vixen eventually slowly returned into the plantation. Previous to this instance a keeper, whilst gathering ants' eggs for his young Pheasants, had been somewhat similarly attacked in another plantation some distance away by what may have been a different vixen.—J. STEELE-ELLIOTT (Dowles Manor, Salop).

Albino Pigmy Shrew (*Sorex minutus*).—Owing to the kindness of one of my naturalist correspondents I have lately received a perfect albino of the Pigmy Shrew (*Sorex minutus*). This beautiful little creature is quite white throughout, including claws and tail. It is a male, and was taken at Brandon, Suffolk, in October of last year. The only other record that I can find of an albino of this species is by Barrett-Hamilton ('Irish Naturalist,' March, 1895, p. 76), who says:—"Sir Douglas Brooke has an albino example, obtained in Fermagh."—GORDON DALGLIESH (Midhurst, Sussex).

Beaked Whale in Norfolk Waters.—Considerable interest attached to the stranding of a whale at Holme-next-the-Sea, near Hunstanton, on Dec. 13th last. It had been sighted in difficulties in the shallow

waters of the Wash, blowing and lashing the waters as it passed Hunstanton. It appeared to have been badly wounded. It measured 27 ft. in length, with a girth of some 15 ft. Length of beak, 18 in., and both jaws equal. The head was described as rising abruptly from the base of the upper jaw to a distance of 2 ft. 2 in. Other measurements were given, and a photograph shown me, which made it out to be beyond doubt the Beaked or Bottle-nose Whale (*Hyperoodon rostratum*), and was a male. A local gentleman, at my suggestion, attempted to discover the teeth, but evidently he did not cut deeply enough, or in the wrong place, for he found none. After causing much stir in the surrounding country, from the publicity given to it by a newspaper correspondence respecting its identity, the Customs authorities ordered its burial in the sands. Mr. Genochio, of H. M. Customs, assured me that this is the fifth whale, none of which was under 22 ft., that has come ashore on the north-west coast of Norfolk within two years. It is more than a pity that no capable person appeared sufficiently interested in their appearance to at least identify them.—A. H. PATTERSON (Great Yarmouth).

AVES.

Willow-Wren in Yorkshire.— In 'The Zoologist' (1910, p. 401), Mr. Brock has given a very exhaustive account of "The Willow-Wrens of a Lothian Wood," a monograph with a wealth of observations which would have gladdened old Gilbert White. It is almost impossible to overestimate the value of such observations in working out the life-history of the birds as is described in the above article. In comparing Mr. Brock's with my own observations for this district, I find that the average date of first arrivals will be about four or five days earlier, but it is very irregular in its appearance. Frequently we have a spell of severe weather at or about their average date of arrival, when of course they are much delayed. I have known them arrive near Windermere in early April, and in normal numbers, a week before any have been seen in this neighbourhood. Mr. Brock gives the average clutch as about six, which, I think, will be slightly higher than here. I should give the average at not more than 5·5; and, contrary to what one would expect, Mr. Brock gives a higher proportion of second broods than obtains in this district. Is Mr. Brock quite sure that what he calls "second broods" have not in some instances had their first nests destroyed? At any rate, I should think that not ten per cent. here have second broods. In average seasons the difference in length of time between the arrival of males

and females here is not so marked as in the district to which Mr. Brock refers, but of course much depends upon the weather. As regards the direction of the opening of the face of nest, much depends upon the configuration of the ground in the nesting area. Where the ground slopes abruptly to the north, it is only natural to suppose that the general direction of the opening of the nest will have a northern aspect; other things, however, being equal, I think they seem to prefer a southern aspect.—E. P. BUTTERFIELD (Bank House, Wilsden, Bradford).

Migration of Linnets in Surrey.—About three years ago I noticed for the first time the complete disappearance of Linnets (*Acanthis cannabina*) from this part of the country in winter. My observations extend more or less to the whole county, except the extreme east and west. Roughly speaking, Linnets seem to disappear from October to March, and the careful notes I have kept during the last three winters convinces me that I am not overlooking the species. It is often easy to be mistaken in asserting that a bird is not found in a certain locality. I need hardly add that in the breeding season Linnets are very conspicuous and abundant on the gorse-commons of Surrey. I should like to know whether other observers confirm the existence of this migratory movement. There is no mention of the fact in Bucknill's 'Birds of Surrey,' nor in any of the regular text-books that I have looked at. Is this movement something new? Does it extend to other southern counties of England? What has been observed as to the migratory habits in Linnets?—HAROLD RUSSELL (Shere, Surrey).

An Albino Bunting.—In reference to Mr. Warde Fowler's interesting note on the above (vol. xiv. p. 471), I may say that in March, 1905, in North Anglesey, I saw a very pale coloured Bunting, though not an albino, which was undoubtedly a Yellowhammer. It was in a flock of about fifty Yellowhammers about a farmyard, and was very conspicuous amongst the other birds. The primaries and tail-feathers were practically white, and the rest of the plumage more or less fawn-coloured. On the wing it looked very much like an escaped Canary.—S. G. CUMMINGS (Upton, Chester).

Birds and Berries.—Mr. Aplin (vol. xiv. p. 394) remarks on the partiality of the Greenfinch for the berries of the sweet-briar, a fact which I have particularly observed for many years past. We have here a small shrubbery or thicket which was planted with a view to providing a quiet and secure retreat for the birds, and a supply of food for them in the shape of berries. The berry-bearing shrubs

and bushes growing there include the sweet-briar (in abundance), *Cotoneaster simonsi*, *C. microphylla*, *Mahonia aquifolia*, *Cratægus pyracanthus*, elder, whitethorn, wild rose, &c. For many years a number of Greenfinches have come regularly to feed on the fruit of the sweet-briar. I have sometimes watched them from a window at a distance of only a few feet, and it has always appeared to me that they eat the seeds only, rejecting the soft red pulp. I have seen these birds, too, devouring the berries of the winter-thorn, *C. pyracanthus*, and also the pretty apple-like fruit of *Cotoneaster simonsi*, which they apparently deal with in the same way as the sweet-briar hips. I believe, however, that these last are preferred to any other kind of berry. They are also much relished by both Cole-Tits and Marsh-Tits. Long-tailed Field-Mice consume large quantities of the fruit of both wild-rose and sweet-briar. To get at the ripe berries of the privet, the Bullfinch forgets his shyness and ventures into gardens containing hedges of this plant, even approaching close up to the windows of houses. The grape-like clusters of violet-coloured berries produced by the common evergreen barberry (*Mahonia aquifolia*), in spite of their intense sourness, are much sought after by birds of several kinds. I have watched Blackcaps and Garden-Warblers feasting on them, and staining their breasts with the rich crimson juice. Blackbirds are sure to find them out, and rapidly reduce their numbers. I think the berries of the cuckoo-pint, or "lords and ladies" (*Arum maculatum*), are, as a rule, rejected by birds of all kinds, being of a more or less poisonous nature. Yet I once saw a Robin with one in its beak. — G. T. ROPE (Blaxhall, Suffolk).

PISCES.

Ambicoloured Turbot.—Numerous accounts of so-called "double flat-fishes" have appeared from time to time in natural history journals, but I think many more occur than ever find that distinction. In a copy of Buckland's 'Familiar History of British Fishes,' which belonged to my father, the late Rev. Robert Elmhirst, of Farnham Lodge, near Knaresborough, he has sketched the head of a left-handed ambicoloured Turbot, caught at Redcar on Oct. 17th, 1877, and written: "Dark on both sides, except a small place on the head; top fin thus," and figures the anterior end of the dorsal fin free and projecting, as is often in such cases, over the eyes. The eyes are drawn in almost natural positions, so that the fish probably closely resembled that described by Mr. J. Ritchie in 1908 (an ambicoloured Turbot with eyes approximately normal in position) in the 'Annals of Scottish Natural History.'—RICHARD ELMHIRST (Millport, N.B.).

NOTICES OF NEW BOOKS.

The Coming of Evolution; the Story of a great Revolution in Science. By JOHN W. JUDD, C.B., LL.D., F.R.S.
Cambridge University Press.

THERE are evolutionists and evolutionists: those whose studies and knowledge compel them to hold fast to that conclusion as a necessity for thought and work; and others who are loyal to the great conception, without possessing the experience that proclaims its truth. There is of course a still larger number who deny evolution on non-scientific grounds. To all these the logic of this little book should prove very useful, though Prof. Judd in his few pages, can of course, only sketch the principal movements in the great battle that has been fought, and now—we may be allowed to say—won.

“*Ideas* of evolution, both in the organic and the inorganic world, existed but remained barren for thousands of years,” and Prof. Judd gives us an excellent illustration of what that sentence means. “Talking with Matthew Arnold in 1871, he laughingly remarked to me, ‘I cannot understand why you scientific people make such a fuss about Darwin. Why, it’s all in Lucretius!’ On my replying, ‘Yes! Lucretius guessed what Darwin proved,’ he mischievously rejoined, ‘Ah! that only shows how much greater Lucretius really was—for he divined a truth, which Darwin spent a life of labour in groping for.’”

In this small publication is an ample vindication of the part played by a few geologists in clearing the way for Darwin. In 1797, the year in which Hutton died, were born George Poulett Thomson (who afterwards took the name of Scrope) and Charles Lyell. Both were brought up under the strongest influences of the then prevalent anti-evolutionary teachings, but both ultimately became champions of evolution, and headed the successful revolt against catastrophism, and the substitution in its place of uniformitarianism, or, in other words, evolution. “The

cockpit in which the great battle between catastrophism and evolution was fought out" was the Geological Society of London. Some may be surprised, but few indeed will disagree with the following statement of Prof. Judd:—"Were I to assert that if the 'Principles of Geology' had not been written we should never have had the 'Origin of Species,' I think I should not be going too far; at all events, I can safely assert, from several conversations I had with Darwin, that he would have most unhesitatingly agreed in that opinion." The ever wise catholicity and candour of Darwin are enhanced by that statement, and his great theory loses none of its originality thereby. We have drawn particular attention to the claims made for geologists as having occupied positions in the firing line of the evolutionary battle, and perhaps this is the greatest feature of the book, for that statement is not so well known as to require no re-telling. It is, however, to be remarked that we find no reference to Herbert Spencer!

In conclusion, we may perhaps give a quotation from outside Prof. Judd's book, but it is not from an opponent. Huxley wrote* :—" *History warns us, however, that it is the customary fate of new truths to begin as heresies and to end as superstitions; and, as matters now stand, it is hardly rash to anticipate that, in another twenty years,† the new generation, educated under the influences of the present day, will be in danger of accepting the main doctrines of the 'Origin of Species' with as little reflection, and it may be with as little justification, as so many of our contemporaries, twenty years ago, rejected them.*"

Heredity in the Light of Recent Research. BY L. DONCASTER,
M.A. Cambridge University Press.

THIS small book is a digest of the latest views concerning "heredity," a somewhat neglected factor in the consideration of animal evolution, and a most important element to be considered by those who are interested in the progress and advancement of human societies. With the first view 'The Zoologist' is more particularly concerned.

* 'Collected Essays,' vol. ii. p. 229.

† This was published in 1880.

These excellent "Cambridge Manuals of Science and Literature," in which this publication is included, bear the *imprimatur* of the Cambridge University Press, and we are thus justified in concluding that Mr. Doncaster has not misrepresented the philosophical conclusions on evolutionary questions which are in the main held by the zoological school of that city. Nowhere is the name of Darwin more honoured, nowhere are his conclusions more deeply studied and valued, but in this manual there is no assertion of that "all-sufficiency of natural selection" which is to many evolutionists a stumbling-block. Neither is there any sign of that some time prevalent non-recognition of other theories that may be said to supplement, and in some points qualify, the great theory as left by its master. Thus, in the discussion on "Variation," we read:—"The recognition of discontinuity in variation, which we owe chiefly to the work of Bateson in England and De Vries in Holland, is one of the chief advances which the study of the subject has made since the time of Darwin." The question as to the inheritance of acquired characters is cautiously discussed, and the opinion expressed that most cases which at first sight seem to support the theory "are equally explicable in the view that both parent and offspring are susceptible to the action of the external factor; what is inherited is not the character acquired, but the innate power of acquiring it." Mendel receives a just appreciation in the chapter devoted to "Mendelian Heredity," and all thinkers will agree with Mr. Doncaster in the remark: "One cannot avoid speculating on the possible effects on biological thought had the experiments and conclusions of his now famous contemporary ever come to the knowledge of Darwin." No theory in the great Darwinian evangel has been more neglected and discredited than that of Pangenesis; it is now, however, apparently being recognized as stimulative, "and to a great extent it led to the formulation of other theories of heredity." It will probably be found to contain a still higher meaning, and we may profitably find some philosophical peace from the conflicting disputations of "Neo-Darwinians" and "Neo-Lamarckians" by going *back to Darwin*.

Ornithological Notes from a South London Suburb, 1874-1909.

By F. D. POWER, M.R.C.S. Henry J. Glaisher.

LOVERS of Nature, condemned to live amid the grim respectability of a London suburb, where even the builder can scarcely find more available sites on which to wreak his activity, may well feel surprised to read in the pages of this book that its author has been able to record the appearance of no fewer than one hundred and twenty-five species of birds at Brixton and its immediate neighbourhood. This is the result of thirty-five years' observation, mostly in the garden attached to his own house, but is in a line of migration, which, if not very marked when the birds are arriving in spring, is most pronounced and unmistakable at the time of the autumn passage.

The birds are thus enumerated:—

- I. Residents, comprising 29 species.
- II. Summer visitors, numbering 37 species, of which 17 have been found nesting, though only 13 do so now; 9 are seen only occasionally; and 6 are reckoned accidental.
- III. Winter migrants, 18.
- IV. Occasional 24;—9 summer; 15 autumn and winter.
- V. Accidental 26;—6 summer; 20 autumn and winter.
- VI. Various, 6 (“all, of course, escapes”).

This list is already attenuated, for a not inconsiderable number are now disappearing, or have disappeared.

The “Migration Notes” at the end of this small volume are suggestive and important, and the publication itself shows how Nature can be studied in an urban district.

The Home-Life of the Spoonbill, the Stork, and some Herons.

Photographed and described by BENTLEY BEETHAM, F.Z.S.
Witherby & Co.

THIS is another record of enthusiastic and patient bird-watching, and another example of the great service to ornithology rendered by photography. It is by the aid of these publications that we acquire a personal acquaintance with living birds, and forget for the time the preserved skins which we treasure so carefully and love so well. Mr. Beetham has visited the haunts

of the Spoonbill, Stork, and Common and Purple Heron, and has seen for himself and recorded for us many incidents of their home-lives, while thirty-two photographic plates illustrate his narrative. He has also referred to one peculiarity in animal life, the study of which will have a great future. He writes:—"There are personalities in birds just as in human beings, though through lack of intimacy they tend to pass unnoticed." This is a well-known observation so far as domestic animals are concerned, but is as yet inadequately observed and more inadequately recorded. When a bird-watcher is also what we call a "man of the world," and ceases to believe that many human traits and weaknesses are outside the lives of other animals, he will find that even among birds none is thoroughly bad, and none thoroughly good, and that a personal element pervades the whole. The bird-watcher will then provide material for enlarging the base of psychology. Aviculturists could already say much on this matter.

This small publication has followed Mr. Macpherson's 'Home-life of a Golden Eagle,' noticed in our volume for 1909, and we hope that a series may be thus inaugurated.

OBITUARY.

CHARLES KINGSLEY SIDDALL.

WE greatly regret to learn that our contributor, Mr. C. K. Siddall, passed away at 23, Eaton Road, Chester, on November 16th, 1910, in his thirty-second year, after a long illness. Two communications from his pen appeared in our last volume, the year of his decease. His parents have since published a posthumous paper in separate form, entitled 'Bird-Life in a Suburban Garden—The Garden that I Love,' for circulation among his many friends.

EDITORIAL GLEANINGS.

“It is with pleasure that I send you,* for your natural history column in New Zealand, some notes on *Notornis hochstetteri*,” writes Dr. A. B. Meyer, of Hohenzollern Street, Berlin. Dr. Meyer was formerly director of the Dresden Museum, which is the fortunate possessor of the third *Notornis*, and it was he who changed the bird’s specific name from *mantelli* to *hochstetteri*. “The specimen in the Dresden Museum,” he says, “was captured alive by a dog towards the close of the year 1879, and was on sale in Dunedin, but the New Zealand Government of that day was not up to its task, apparently because no naturalist put the matter in the right light. The skin and skeleton were then sent to London, where they were on sale for two years without finding a buyer. At last they were offered to me for the Dresden Museum. The institution was known in England, where I had many personal friends, as a museum with an ambition to rise. I did not dare to spend the money of the Government in purchasing the specimen of one bird, although nearly extinct, but I found a patron, who furnished me with the funds. As far as I remember, I bought the *Notornis* for £110, but I do not remember whether it was by auction or in the ordinary way of a transaction. Some time after it came into the possession of the museum as a gift of the patron who supplied the funds, I received a letter from the New Zealand Government, asking me to surrender the specimen for the price paid by the museum, and a collection of New Zealand birds as well. Of course, I refused the offer. In any case, the rules of the museum would not have allowed me to accept it. I named the species *Notornis hochstetteri*, and described the skeleton and the skin in scientific journals. The bird has also been dealt with by the late Professor T. J. Parker, Dr. W. B. Benham, Sir Walter Buller, and Messrs. Hutton and Drummond, and the Hon. Thomas Mackenzie wrote a letter entitled ‘The Rare New Zealand Bird’ to the London ‘Times’ in October, 1898. You will probably find something of interest in my paper on ‘The Eggs of the Moa’ in ‘The Ibis,’ 1903,

* James Drummond, F.L.S., &c., who provides the articles “In Touch with Nature.”

which has been revised and annotated by Professor Benham in the same journal of the same year. Mr. Travers, of Wellington, wrote to me in February, 1903, stating that a new Moa's egg had been found, and that the price was £180." — ('The Lyttelton Times,' June 11th, 1910.)

RHEE. — The following observations upon the Rheas of Uruguay by the Consul of the United States of America in Monte Video are interesting both from a commercial and a zoological point of view:—

"The native 'Ostrich' or Nandu (*Rhea americana*) of Uruguay and Argentina resembles the African bird in a general way, but is smaller, of a mixed grey colour, and has three toes, whereas the larger species has only two. A smaller species (*Rhea darwini*) is found in Patagonia, and seems to range further north; a third species (*Rhea macrorhynca*) being known. The males are polygamous, each having five or six females, generally keeping together in flocks of from fifteen to thirty, and are found roaming about the open country of Uruguay. The average height is 5 ft., the weight 80 to 100 lb. each. Their food consists of grass and insects. Several females lay their eggs in one nest, which is merely a hole found anywhere in the ground. The eggs weigh about 2 lb. each, are of a sordid greenish-yellow, and are sat upon and hatched in forty days, solely by the male. The Nandus are easily tamed, and may be occasionally seen domesticated. The wings and tail are considered great table delicacies, the other portions being very greasy and of a fishy flavour. The eggs also are relished.

"To secure the feathers—which have become an important article of export—the birds, at the time the plumage is full, are driven into previously arranged nets by peons, who pull out the feathers. They are sorted and graded and placed in their natural state in parcels of three-fourths of a kilo. (1.65 lb.) each. When disinfected and placed in boxes ready for export each box contains 100 to 200 kilos. (221 to 441 lb.) of feathers. Each bird yields about 600 grammes (1½ lb.) of marketable feathers, the best being valued here at 4 dol. 86 c. to 6 dol. 20 c. per kilo. (2.2 lb.), the inferior grades bringing from 3 dol. 10 c. to 4 dol. 65 c. During the year 1908 about 15,000 kilos. (33,069 lb.) were exported to France, the United States, Spain, and Germany, the shipments for 1909 being nearly 25,000 kilos. (55,115 lb.). The export duty is based on a valuation of 2 dol. 50 c. to 2 dol. 59 c. per kilo., on which the duty is 1 per

cent.; on each 100 pesos (103 dol. 40 c.) of duty there is an additional duty of 1 per cent.

“The majority of the feathers are very fine, sometimes equalling and even excelling the African in quality, but smaller, which is remedied by joining three feathers lengthwise. The large, specially selected feathers used on women’s hats bring 15 dol. to 25 dol. per kilo.

“Some years ago there were nearly 100,000 native Rheas in Uruguay, but the scarcity of food, due to drought and locusts, caused many of them to migrate to Argentina, whence they never returned. At the present time there are about 50,000, the number having been slowly decreasing, as so many were shot for their feathers. However, this year the Government of Uruguay has made an effort to protect them, and it is hoped that their numbers will again increase, as they are one of the nation’s important assets.”—(Diplomatic and Consular Reports, No. 4605, “Uruguay,” 1909.)

INTRODUCTION OF THE HUNGARIAN PARTRIDGE INTO THE UNITED STATES.—“Owing to the confusion of names, it is impossible to separate with certainty the Hungarian from the English Partridges in the records of importations into America, but the earliest attempt to introduce the Hungarian Partridge as such into American covers seems to have been made in 1899,* when 24 birds brought from Europe were placed on a private preserve at Lynnhaven, Princess Anne County, Va. This venture was subsequently transferred to Montague, Essex County, Va., and fresh importations were made until by 1906 about 180 birds had been brought over. Meantime, sportsmen and preserve owners in other States were making occa-

* As far back as the latter part of the eighteenth century the Grey Partridge had been introduced into the United States by Richard Bache, son-in-law of Benjamin Franklin, who stocked his place on the Delaware River, near the present town of Beverly, N. J., with English Pheasants and Partridges in large numbers; and attempts were subsequently made from time to time by wealthy landowners in New Jersey and Virginia to introduce these birds, but all were failures. The most elaborate was made by Pierre Lorillard, who established three game preserves of 100, 40, and 25 acres, respectively, on his place at Jobstown, Burlington County, N. J., known as the Rancocas Stud Farm, and put up costly houses for breeding Partridges and Pheasants, which he imported from England for the purpose. There is now no trace of any of these birds. (*‘Forest and Stream,’* xxv. p. 103, Sept. 3rd, 1885.)

sional importations. In 1900, 97 of the birds were imported and liberated in the Willamette Valley, Oregon, where the Ringneck Pheasant had been successfully introduced a few years previously; in 1904, 192 were liberated on Hilton Head Island, South Carolina, and 57 in Fraser Valley and other places in British Columbia; in 1905, 20 were placed on a preserve in Massachusetts, and 91 on one in North Carolina; in 1906, besides a fresh lot that went to the Virginia preserve mentioned, birds were placed on preserves in New York, New Jersey, Pennsylvania, North Carolina, and Mississippi. In addition to these, which consisted of comparatively small consignments, 1000 were imported in 1906 by the State Game Commissioner of Illinois and 200 by the State Game Warden of Kansas for restocking the covers of those States. The last two importations are apparently the earliest official efforts to introduce the Hungarian Partridge into any State. In 1907 about 2500 more were brought in for this purpose, and in 1908 the number of official importations rose to 12,000, while in 1909 it advanced to the important total of 27,000. The States thus experimenting with the acclimatization of this popular game bird include California, Connecticut, Delaware, Illinois, Indiana, Kansas, Nebraska, New Jersey, and Washington.

“The total importations of Partridges from July 1st, 1900, to December 31st, 1909, are shown in detail in the following table:—

Importations of European Partridges, July 1, 1900, to Dec. 31, 1909.

Period.	Unspecified.	Hungarian.	Total.
July 1 to Dec. 31 1900 ...	315	200	515
1901.....	40	20	60
1902.....	4	62	66
1903.....	72	—	72
1904.....	23	228	251
1905.....	364	181	545
1906.....	311	2,250	2,561
1907.....	422	2,556	2,978
1908.....	957	11,875	12,832
1909.....	1,665	27,425	29,090
Total	4,173	44,797	48,970

“While every effort has been made to insure accuracy in these figures, they are only approximate, because sometimes it is impossible

to ascertain the mortality on the ocean voyage, the figures being based in these cases on the number shipped. The mortality *en route*, under the best care, may be safely placed at 20 to 25 per cent., and is sometimes much greater. Thus, of 400 Hungarian Partridges shipped from England in 1906, consigned to the Essex Park Game Preserve in Virginia, only 50 reached their destination alive. While this loss of 350 out of 400 in crossing the ocean and making the land voyage from New York to Essex County, Va., is exceptionally great, other instances might be cited where the percentage of loss was very high, even after the experience derived from ten years of importation. On the other hand, an occasional consignment will come through very well. Thus in a recent shipment of 300 birds from Bohemia to Windsor Locks, Conn., only 5 died." — HENRY OLDYS 'Yearbook of Department of Agriculture for 1909,' Washington.

"A REMARKABLE scene was witnessed in Durban Bay recently, when thousands of 'Cape Salmon,'* chased up the harbour entrance by Porpoises, were engulfed in a narrow strip of water at the harbour extension works. When the tide receded, the fish fell an easy prey to a horde of coolies, who speedily gathered them, while the Natal Police secured large hauls, which were distributed to the crews of H.M.S. 'Forte' and other ships. Some of the fish weighed upwards of 25lb." — 'Shooting Times,' January 14th, 1911.

[I have also seen Porpoises in regimental order patrolling the shore at Durban, and afterwards entering the harbour there in a similar formation.—ED.]

* *Otolithus aequideus*.

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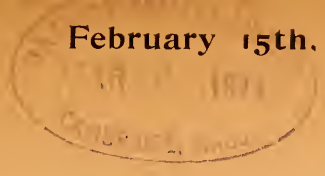
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THE ZOOLOGIST

No. 836.—February, 1911.

THE WANDERINGS OF A GIGANTIC AFRICAN SNAIL.

BY E. ERNEST GREEN.

(PLATE II.)

THE sudden appearance of an immense snail carrying a spire-shaped shell fully five inches in length will naturally attract considerable notice in a country where the largest snail-shell hitherto known measures two inches only. And this is a phenomenon that has recently occurred in the Island of Ceylon, where a well-known African Snail (*Achatina fulica*) has suddenly appeared in overwhelming numbers. It is the more remarkable in that the presence of this giant land mollusc excited no comment until it had overrun a thickly populated area of about four square miles, and had multiplied to an incredible extent. Then there was a sudden outcry from the alarmed villagers and an investigation by Government officials. The writer of this article was deputed to report upon the outbreak.

On visiting the infested locality, the huge snails were to be seen—literally in millions—crawling over the ground, climbing up walls, fences, and poles, and clustered upon the trunks of trees. Two hundred and twenty-seven snails were counted in one such cluster on the stem of a coconut-tree in a length of about six feet. Many other larger clusters were observed. The ground beneath the clusters of snails was covered an inch deep

with their excreta. The following paragraph may be quoted from the report to show the general effect of the plague:—

“The presence of such a horde of plant-eating animals in a comparatively small space would lead to the expectation of a scene of devastation, with the country eaten bare of all green matter. But the actual conditions are far otherwise. There is no appearance of desolation, and evidence of injury can be found only by careful search. A casual visitor might pass through the affected area without noticing anything unusual. The general aspect of the vegetation is as luxuriant and healthy as in any other part of the country. In fact, the wealth of varied foliage at this spot might even be considered remarkable, and becomes astounding when the presence of countless numbers of these giant snails is appreciated.”

Evidence of damage could be found in small vegetable patches, where certain plants had been defoliated and others denuded of their bark. Three hundred and seventy-five individuals were collected and counted from a space four yards square in one such garden.

But the comparatively small damage to vegetation that was noticeable could be accounted for by the fact that the snails were largely engaged in scavenging work. Ocular evidence was not wanting that they were feeding upon excrement (both human and cattle)—a habit that must be of great benefit in a densely populated native village. They were also feeding largely upon fallen and decayed fruit.

A snail of this size requires a considerable quantity of lime for the development of its shell, and it was observed that they were resorting to the whitewashed and plastered walls of buildings to obtain this supply. On abandoned buildings, where they were undisturbed, the snails had rasped large patches of lime-wash from the surface of the walls, and had eaten small holes in the plaster. But occupied buildings were easily kept free from attack.

Native reports specified individual monsters that scaled over a pound. This is probably an exaggeration. Average specimens were found to weigh between four and five ounces, but a single example of thirteen ounces has since been received, and the weight authenticated.

The extended animal has a large and broad fleshy foot, five inches in length and two inches broad. Individual shells of six inches in length have occurred. The eggs of this snail are oval, comparatively small, measuring about one-fifth of an inch in long diameter. They are of a pale yellow colour, and have a hard but thin shell. They are deposited in loose soil, just below the surface. But what they lack in size they make up in quantity. It appears that *Achatina fulica* attains its full growth in two years time, but the half-grown snail (of one year) is already sexually mature and capable of producing eggs. The maximum number of eggs that may be produced at one time has not been fully determined, but the animal has been known to deposit at least one hundred in the first year, and, from examination of several large clutches of eggs, it is probable that the produce of the second year may be as high as five hundred. Taking into consideration the fact that every individual is a functional female, that the snails breed once a year and live for at least two years, and allowing for only a brood of two hundred in the second year, the rate of increase is a matter of simple calculation. Excluding any casualties, we arrive at the astounding total of 10,930,442,400 (roughly, 10,930½ millions) as the possible existing progeny of a single snail in the fifth year! There must, undoubtedly, be some efficient natural check to counteract this amazing fertility. Otherwise the whole country would very soon be buried under a mass of living snails.

The adult snail, in Ceylon, appears to have very few enemies. The Common Pond-Tortoise (*Nicoria trijuga* var. *thermalis*) is the only animal that has been observed to attack it. But there is probably a very heavy mortality in the early larval stage. A species of ant (*Phidologiton affinis*) has been found swarming amongst a batch of eggs that were just hatching out. Insectivorous birds and carnivorous beetles may be expected to rank amongst their natural enemies.

Achatina fulica is a native of East Africa. It appears to have found its way into Mauritius many years ago, and is now said to be a common object of that island. With regard to its history on the Indian Continent, there is a note by Godwin-Austen (in the Proc. Mal. Soc. viii. p. 147, October, 1908) upon the introduction of *Achatina* into Calcutta. He writes :—"When

I was in Calcutta in 1876-77 an African species of *Achatina* spread all over the gardens of Chowringhi and the suburbs, to Howrah on the other side of the River Hooghly, and to Barrackpore, about fifteen miles north. It had been introduced originally into Calcutta by Mr. Benson some twenty years before, after his arrival from the Cape and the Mauritius." This account places the date of introduction at something over fifty years ago.

The origin of the present outbreak in Ceylon has been traced to the fact that the late Mr. Oliver Collett (an enthusiastic collector of land Mollusca) received some living examples of the species (either from India or Mauritius) some ten years ago. He liberated them in his garden, where they soon showed signs of becoming naturalized. Acting upon advice, he collected and destroyed them, and it was thought that he had been successful in exterminating the whole brood. But it has now been ascertained that the snails are still to be found in the locality of their original introduction. This is situated in the Central Province of Ceylon, at an altitude of between four thousand and five thousand feet, where the climatic conditions appear to be unfavourable to their excessive increase. The outbreak that has now attracted attention is at sea-level, on the south-western coast of the island, the two localities being distant over fifty miles in a direct line, and having no natural communication by water. But the existence of a family of natives having connections in the two places affords an explanation that will meet all the circumstances of the case. It is, in fact, known that one of these natives, on his return from a visit to his friends up-country, brought down a parcel of vegetables amongst which two of these snails were discovered.

It is to be remarked that neither in Mauritius nor in India, where the snail has been established for over half a century, is it considered to be a pest of economic importance. In the former country its value as a scavenger is recognized. The smaller individuals are occasionally troublesome in the vegetable and flower garden, but not more so than the garden snail of Europe, and it has not been recorded as destructive to any field crops. The full-grown snail appears to devote itself more exclusively to the removal of decaying and offensive matter.

Though they are not known to prey upon each other in the living state, these snails will greedily devour their dead relatives. This habit has been utilized in Mauritius to reduce their numbers in enclosed gardens. A few of the animals are crushed and left in an open spot. Numbers of living snails are attracted to feed upon the dead bodies. These, in their turn, are killed and left as bait to collect others, the process being repeated until there are no more snails within the range of attraction.

It is probable that the present excessive rate of increase is abnormal. A newly introduced pest usually multiplies itself out of all due proportion during the first few years of its existence in a new country, after which it gradually reverts to more normal conditions. There are already indications that this natural decline is taking place locally.

AN OBSERVATIONAL DIARY ON THE DOMESTIC
HABITS OF THE SPARROW-HAWK (*ACCIPITER*
NISUS).

BY EDMUND SELOUS.

May 30th, 1910.—In a very sequestered little clump of beeches lying a good way off the road—itsself quiet enough—and approached by a wild bridle-path, lovely with broom, I came this afternoon upon the nest of a pair of Sparrow-Hawks. One of them was upon it, and I saw it several times fly off and return, from which, as well as the lateness of the season, I at first supposed that there was a brood of young ones, but could never observe that the bird, in returning, carried anything either in beak or claws, which raises a doubt as to this. She would often, after flying in, stand, for a little, on the rim of the nest, before entering it, or even fly off again, without doing so. When she did settle herself down, her head was visible above the rim of the nest. Though the latter was much more visible than might have been expected, situated, as it was, in the top, though not the high top, of a beech with others close about it, all now in fair foliage, yet I could not make out that young birds were being fed, though the old one generally bent down its head into the nest. This, however, might be in connection with the eggs. So far as I can be sure, it was always the one bird that I saw—the female probably—and this, again, looks as though incubation were still proceeding.

May 31st.—Watched the covert from about 5.30 a.m. to 6 a.m., but did not see the bird issue from it. Going inside, she saw me and flew from the nest, and I then watched her back, and off, and on again. In returning the second time she had something in her bill. It was small, thin, and hung limply, and had more the shape and appearance of a slug than anything else. The bird generally perches in a tree near the nest before flying on to the latter, and it then utters a little squeaking cry, something like that of the Kestrel, but not nearly so shrill. As

was the case yesterday, I did not see the slightest sign of the partner bird.

June 1st.—A very long and weary watching of the bird on the nest, nearly from 3.30 p.m. to about 7.15 p.m. It flew off, once, on my arrival—seeing me—and was away about a quarter of an hour. On returning it brought nothing back with it, but at once settled itself, as though upon the eggs, and was there till I went. As before, there was no sign of the male (assuming the one I have been watching to be the female), except that once a bird that I could not identify settled in a tree near me, and then, seeing me, instantly flew on. This bird looked—it was no more than a glance—of the hawk tribe, but was too small, as I thought, even for the male of the one on the nest.

June 6th.—Rose at 2.30 a.m., and got to the little dark plantation about 3.30, so that I was able to steal through it to a tree from which the nest is visible without alarming the bird upon it, then, very possibly, asleep, since it was not till a little while afterwards that I could see the time by my watch clearly.

At 4.10 I saw the bird go silently off the nest, which (conjugally speaking) was left empty, no partner arriving just before or just after. At 5.5 she returned (supposing it to have been the same bird), and, from her actions, certainly seemed to be feeding the young; for she bent down her head, and did this more than once without settling upon it. In regard to the actual delivery of anything, however, I could make nothing out, till at last, in stooping her head again, she turned towards me, and I all at once saw something which she appeared to me to disgorge—what I cannot say, but I had the momentary impression of some dull-hued substance. A good while before this I had seen the pair of hawks in the coppice, between whom there was some action, one flying to the other, amongst the trees, and both uttering their squeaking cry, which seemed to me sometimes more and sometimes less shrill, as though there might be a difference in this respect between the sexes. It was the male, I think—the one, that is to say, that I have not yet seen on the nest—that, either before or after the other went to it—I think after—flew at a Squirrel which was evidently considered to be too near that sanctum, and drove it away. After the female had

acted as I have described—apparently fed the young, that is to say—she flew from the nest, again, and there was then the same scene as before between the two birds. When she returned, she settled herself down at once, and it was now that the Squirrel, having again come too near the nest, was a second time driven away from it by the partner bird—in a perfunctory sort of way, however, without the appearance of much indignation on the one side or of fear on the other.

At 6.20 the bird on the nest stood up in it for a little, and preened herself, then settled herself down in it again, and thus I left her at 7.

Thus, though the male does not share in the present duties of the female (whether they be those of incubation or of feeding the young, I am not yet perfectly clear), he yet visits the nesting-grove, and also, evidently, from the Squirrel incident, takes an interest in home affairs. I now, too, feel pretty sure that a bird I had once or twice seen, or got glimpses or hearings of in the coppice (see last entry), was the male hawk.

June 7th.—Was at the same place in the coppice as early or earlier than yesterday, but it was not nearly such a good *séance*. Either I must have missed the birds leaving the nest and return to it, or else she stayed on till past 6 a.m., when I startled her off it. In any case, she did not leave the nest in the same interesting manner, at the call of the male, to foregather with him. He, I have reason to think, was in the plantation from time to time, but nothing took place between the two, such as yesterday—within my knowledge, at least, and it could hardly have escaped me. The bird, I think, must still be incubating, and what has sometimes looked like feeding the young must have been the care of the eggs and the casting up of pellets. The incoming bird has never once, as far as I have been able to see, brought anything in her claws, and when I once thought she did, in her beak, it may well have been that as she alighted, or just before, she began the extrusion of the object described by me, which in appearance quite answered to a pellet, for it was the proper elongated shape, and had the moist darkish appearance that wet hair or feathers would probably have presented. General indications accord with the theory of incubation—for instance, the bird's frequent return to the nest, this morning,

later, when I as frequently disturbed her from it, as though the eggs were now nearly hatched. Her settling herself down on the nest, too, is just after the manner of an incubating bird, as also her change of position upon it, and bending the head down on rising, after a long sitting.

I think the bird must have sat close all the morning, as I heard no cry—at least, not during the time when she might have been off, and the reason for this difference may be that whilst yesterday it was a fine morning, to-day it was dull and misty, and, though not actually raining, had rained so heavily in the night and early morning that the whole country was saturated, and the coppice like a vapour- and shower-bath combined.

In the afternoon I was down again, getting to my place about 6. The bird saw me as I came, and went off, as also once or twice again after returning. There was nothing to note until 8.7, when, as she was standing up, preening herself, in the nest, as is her custom, at intervals, there came the little “tchu, tchu, tchu” of the male amongst the trees, and instantly, with a swift and graceful plunge, and one answering “tchu,” more prolonged, she was off, and joined him. For some minutes, then, I heard their cries, either in the trees or as they flew over them, but I could never see them, and at 8.12 the bird was back, and settled herself down in the nest again. At 8.15, looking again through the glasses, the nest seemed empty once more. If it was, the bird must have gone whilst I wrote the above. It was now darkening, however, and when I left about 8.30 it was impossible to make anything out.

June 8th.—In the coppice early again.

At 4.15 a.m. comes the little “tchu, tchu, tchu, tchu, tchu” of the partner bird, and instantly, upon it, the sitting one rouses herself, and flies off in its direction. Both, I believe, then leave the plantation—but, no! I now hear the note inside it, again. They probably fly up and down, just skirting it, and enter it from time to time, as I have seen other Sparrow-Hawks do.

4.19. Bird to nest again, and settles down upon the eggs. About 5 I left the coppice, and watched it for about an hour from outside. I twice, again, heard the cry of one or both birds

within it, but did not see either of them fly out. Thus on three days successively the male has called the female off the nest, but not on three successive mornings, but only on the two fine ones—for it was fine this morning again.

June 14th.—In plantation considerably before 3 a.m., by my watch, and sat down in another place, where I thought I might have a better chance of seeing something of the birds, should they come together again, though the nest itself was now out of sight.

At 3.20 heard the cry, but saw nothing, but at 3.55 a bird, which I mistook for a Cuckoo, made a little flitting circle or two, quite noiselessly, amidst the trunks of the beeches, then settled on a branch of one of them, in full view, and began rapidly to lower and again raise its head. It still looked like a Cuckoo, till, turning the glasses upon it, it became a hawk, rapidly devouring something which it had in its claws, and on which it, as it were, stood. What this something was I could not make out, but the hawk made several very fine little pecks at it with just the tip of its hooked bill, which did not seem to be followed by any process of swallowing, and certainly produced no gobbet, or anything I could see. These, I thought, might have been for the removal of a feather here and there, but I saw nothing that looked like a serious plucking. Whilst the hawk was thus devouring its prey a ray of the newly risen sun fell upon it, though but palely, both improving the view and adding to the charm of the picture. Having apparently devoured everything, the hawk turned itself about on the bough, ruffled and shook its feathers, preened itself a little, and flew off in the direction of the nest. Shortly afterwards I heard the cry. The repast hardly took five minutes. It appeared to be bolted in large pieces, and, at the last, I saw something go down that looked hard and horny—possibly a small bird's beak. For the most part, however, the light was not strong enough to show me the details of the feast.

After this I both heard the cry, and saw one, at least, of the birds, flying in the plantation several times. Once I saw it perch again (if the same), but could get no view of it after it had. About 4.45 I saw both birds flying together amongst the beech-tops, one as if it were attending the other, and uttering

the accustomed note, which seemed now to have a plaintive character. Then both settled on the same bough, becoming hidden for a few seconds, when one flew out from the plantation—this tree being just on the edge of it—the other remaining. All this is compatible with the view that the male Sparrow-Hawk brings booty to the hen, who alone incubates, and tallies with the instantaneous flight of the latter, from the nest, to seek him, upon hearing his cry, as observed on three occasions. If this is not the case, then the facts recounted are unexplained.

A little before, or after, the two hawks settled on the bough (as just before mentioned), one of them, as I then thought, flew straight to the trunk of a beech and disappeared amongst some of the foliage springing from its trunk, at only a few feet above the ground. I thought it a strange situation for a hawk to affect, for it did not perch on any of the small sprays that just projected, but, piercing these, seemed to go straight to the trunk. When I turned the glasses on to the leafy screen, something seemed to be going on behind it, but I could not tell what, and, it being then my cue to keep still, it was not till some time afterwards, and when not thinking much about it, that, walking in that part of the plantation, I all at once found myself opposite a nest of some size that was fixed between the trunk and some small twig-like boughs, diverging from it at an acute angle, some five and a half feet above the ground. It then immediately struck me that this was the very tree and place upon it to which the hawk had flown, and, searching the nest (which proved to be the abandoned one of a Jay), I found instead of any eggs a dead Redstart, I think upon the rim or partly so, but was not sufficiently careful in noting this point. The body was not yet quite cold, and the plumage was intact. I remarked no wound upon it, but my examination was a hasty one, as I went forthwith into cover in order to watch this nest, which I did till about 7 a.m., but with no fresh result. It would appear, therefore, that the hawks (or one of them) are accustomed to use this alien nest as a sort of storehouse, or depository, for birds killed by them, to be used afterwards as required—or, at least, that one of the pair had so used it on this occasion. I now left, purposing to come early next morning and again watch.

June 15th.—Rose before 2 a.m., and at 3.15 had taken up

my position on the briared bank running down one side of the plantation, at a spot commanding a close view of the tree and nest last spoken of.

From about 4 I once or twice heard the cry of the hawks, or one of them, and at 4.30 or thereabouts there was a violent rushing sound overhead, and a bird settled in one of the trees just in front of me at the corner of the plantation. I afterwards heard the cry more than once, but could never see the bird, till, some ten minutes afterwards, there was a gliding descent, past these trees into one of the bushes of a little oak shrubbery adjoining the plantation, and close to the tree in which the Jay's nest was situated. It was the female hawk. I saw her as she perched, and in another moment she flew into the lower foliage of the tree itself, gave a fierce, suspicious glance about her, then dropped upon the nest, and, gripping fiercely with both feet into its rim, flew off with something she had seized into the top of one of the beeches where she had sat yesterday. Here she was a good deal shrouded amidst the foliage, but I got the glasses on her nevertheless, and had a fairly good view of her as she sat voraciously tearing at and swallowing the booty which she had evidently carried away from where I had seen it yesterday, and where it must have lain overnight, since it was dark when I entered the plantation. Having finished her meal, the hawk flew in the direction of her own nest. I waited till nearly 7, and then going to the place from which I ordinarily watch, saw her on it, and so left her.

In the evening, about 7, I came down again, wishing to see if there would be anything fresh in the larder, but a peasant woman who was collecting leaves and sticks where it was prevented me from doing so, not wishing to be seen, on account of rustic curiosity—a somewhat embarrassing element in field natural history here.

It would be a point of interest to know whether it was the male or female hawk that deposited the dead Redstart in this Jay's nest, but this I could not be sure of at the time.

June 16th.—Was in the plantation about 3.15 a.m. I first went to the Jay's nest to see if anything fresh had been placed there, but it was empty, and this was the case on every subsequent occasion that I looked at it, though I did so almost

as often as I came. It was not, therefore, a regular store-place, though it had been used once for this purpose. Whether it had also been previously, I cannot of course tell, but I conjecture so, since the one time that I saw the hawk visit it, it flew there, directly, as to a known resort. In noting that the larder was empty, however, I startled a bird which I think was one of the hawks—therefore the male, for the female would certainly have been on the nest—out of the top of the same tree, in which, apparently, it had been roosting for the night. About 4.10 I heard the cry, which was shortly repeated, this time nearer the nest than before. It is just about this time that the sitting bird goes off the nest, and I make no doubt that she had done so now, and gone on to it again, for always, in returning to it, the cry is uttered. All was then quiet, as far as the hawks were concerned, till about 6.30 a.m., when I heard a very curious note, followed almost immediately by the bird's usual cry. This note I cannot transcribe, though writing soon after hearing it. It had a guttural intonation, and there was a sort of low rattle or *tremolo* in it. I believe it to have been uttered by one of the hawks, and that the other answered it, but I could not catch sight of either of the birds, and there was no farther conversation between them. In the afternoon I returned, but found a peasant woman, with a boy, in the plantation, and my next observation was the boy climbing the tree to get at the nest I have been watching. I brought him down, through the woman, by giving her a franc, to have it let alone, telling her that I was a naturalist who came to watch the bird's habits, &c., that I wrote books about birds, and so forth, all which she seemed to understand very readily, and the nest was faithfully let alone as long as I stayed in St. Servan. The boy told me that there were four eggs in the nest, and that they ought now to be hatched, as it was a month since he had climbed up to look at them, which was corroborated by the woman. Probably there was a mental reservation, *viz.* that the eggs had on that occasion been taken, for that this was the case and that the birds had laid again seems best to accord with the date at which—as far as I could ascertain—the young were hatched out. This incident so upset me that I awoke next morning with a headache, and did not visit the plantation all day.

June 18th.—At place at 3.30 a.m. A little before 4, which is a little earlier than the usual time, I heard the cry of the female (as I think), who alone sits, and between this and about 6 I caught sight of either one or both the birds in the plantation, but have nothing further to note.

June 20th.—At plantation about 3.30 a.m., and sat down at the foot of hawk's nesting tree. Some time before 4—perhaps 3.45, perhaps earlier—the bird went off. It flew into a tree near by, where it uttered its cry, and then, almost immediately, into another one, in that part of the plantation where it has always gone, before, on thus first going off in the morning, and which I think was the very one where I had last seen it make its breakfast. In my present position, the foliage hid it from view, but in just about the time that it took before, the meal, if there was one, was finished, and the bird flew straight back to the nest, and covered. It is clear that she flew to this tree with a definite purpose, and, having accomplished it, returned, at once, to her incubatory duties. That this purpose was the breaking of her fast, I have very little doubt, but I can hardly believe that she had first caught a bird, for she was only out of my sight for a moment or two in the first tree that she flew into, and though I could not see her in the next (where I suppose her to have been feeding), she must have been stationary, as I saw just where she had settled. If she did make a capture in either of these trees it must have been with wonderful ease and celerity, but what seems to me more likely (judging by what I have already seen) is that in either the one or the other was a dead bird from the night before—that these, instead of being stored regularly in some special place for the purpose, are deposited in various places.

At about 7, as I was making the above entry, I heard the hawk's cry, and, putting down tablet and stylus, marked it enter a tree, and then, stealing quietly nearer, saw it making a meal. I saw the object—which suggested, but not more, a small bird's body, and this was not finished when the bird flew off, nor could I then see it in her claws.* The hawk now flew from tree to

* From this I thought, at the time, that it was left on the bough, but it may have been a mere fragment, which, as on other occasions, escaped my notice, when carried. See *ante*.

tree, uttering her cry, as she had been doing, incessantly, even during her meal. It was difficult to see her each time, as she settled, amidst the foliage, but once I did fairly distinctly for a moment or two, and she appeared to me again to be tearing something to pieces—her head went down to her feet, and was raised, again, two or three times in rapid succession, which I think is pretty decisive. Soon afterwards she went to the nest. I then walked to the tree where she had first made a meal—and under it I found just a few feathers—a small beakful it might have been. I could not, however, with the glasses make out anything left on any of the branches where—that is to say, on one or other of which—she must have sat.

June 21st.—Overslept myself, and was late at the plantation, but found the bird still on the nest. She came off about 4, and flew to a tree, where I had a good view of her, but she did not feed, whilst there, and in some subsequent flittings from tree to tree I could make out nothing. I do not even know for how long it was she and not the male that I was watching, for when I looked she was on the nest again, but the male now kept flying about with a constant “tchee, tchee, tchee, tchee, tchee,” often, I thought, uttered very querulously. More than once he flew close by the nest, but without pausing, or settling, even in the tree. He seemed anxious, and as though—but this is conjecture—desirous of calling the female off the nest.

In the evening from about 6.30 to 7.30 I was down again, but saw nothing of interest. The male was again in the plantation, whilst the female kept on the nest—when I saw her she was standing on the rim of it.

June 22nd.—I could make out nothing, this morning, when the female first left the nest, but, later, when she again did so and flew about the plantation, I followed her, but was only once able to see her eating. She then uttered her cry—“tchee, tchee, tchee, tchee, tchee, tchee” at intervals, all the while, in, as I may say, a very customary manner. She also uttered it as she flew, and after alighting on any bough, but when she sat there, without eating, she was silent. As far as I could make out, she never left the plantation, except to skirt it, for a few moments, before re-entering, and I noted also that she flew amongst the branches with very great ease. When, later,

the male entered the plantation, it was just the same, so that, when the cry issued at successive intervals from the same spot amidst the foliage, I inferred that he was feeding, but when he settled elsewhere, and the cry ceased, that he was merely perched at his ease. In such inference, however, I may have been very much mistaken. When the male hawk left the plantation, I followed to the point of issue and stood at the edge, looking over a cleared space, grown with bracken, with covert on either side of it. Out of this latter, at a part where it was represented by grown trees, as well as undergrowth, the hawk presently went up with something in his claws, and I was at once struck with the peculiar appearance of this object. It had no resemblance to the body of a bird—such as should have been quite recognizable through the glasses—but looked more like something artificial, much smaller, and having a simple rounded contour and hard outline. It was a disc-like object, and presented in the bird's claws the sort of appearance that a snuff-box of that shape might have done. The hawk flew with this over some small bushy trees and descended into one of them, then in a few minutes rose again and flew, still carrying it, into the plantation. I was then a little way from it, and so cannot say what took place on his entry, or whether it was he or the female that shortly afterwards flew from tree to tree, uttering the cry exactly as I described before—failing, as I did, to obtain a good view.

I had a good view, before this, of the female, as she sat with one leg lifted, and the foot with the claws contracted together, as though closed upon some object (which, however, I could not see) projecting from amidst the feathers of the lower breast. Just here there was a deep crimson splotch, caused evidently by the feathers being soaked in blood, and matted together. This would not have come about through the process of eating, as the hawk then stands upon its prey and bends its head down upon it, but the feathers would be so stained, and just at that height, by the bloody morsel being thus held up and pressed against the breast. In this case the object, if held at all, was quite small, so that I could not detect it, but the attitude would have no particular meaning except as thus grasping something, or at least as originating from it.

When the hawk flew, thus bearing his prey, into the plantation, it was followed at a little distance by two birds that I at first thought were Thrushes, though there was something different about their appearance. Afterwards I recollected that they looked like Golden Orioles, though I could not, at that distance, get their colour—it was, I think, the much duller female and a young one. That they were Orioles I am now, however, certain, for a few minutes afterwards, and for the first time, I heard their cry in the plantation.

June 23rd.—In plantation before light. The female hawk went off the nest just at 4, and seemed to strike out from the plantation at once. I heard no cry either then or for some time afterwards. I now went to one edge of the plantation and looked out, then to another on another side, and so from one to the other. In a little while I saw both the hawks sailing over a covert of shrub oaks, and then across a narrow space, open except for bracken, to another such covert on the other side of it, and I lost them amongst some young trees and bushes skirting it. The pair were evidently seeking prey, and it is hardly possible they could have struck it here except amidst the covert over which they flew, for a bird flying out, and being pursued, could instantly regain the shelter it had left. If, therefore, the hawks had known themselves incompetent to strike the quarry under such conditions, they would hardly have flown here, whereas the male reconnoitred the same parts yesterday, and went up from such cover with prey in his claws. From this I infer that the Sparrow-Hawk is accustomed to seize its prey not so much in the open as amidst loose or scattered covert, as one may call it, and that it is only when the canopy is very close and thick that the small bird is really put in safety by it. Amidst, or rather into, gorse or bramble bushes the quarry could not, of course, be followed, but almost anywhere else they could, and the branches and foliage of trees are threaded by the hawk with as much ease as by themselves—or, at any rate, with both ease and swiftness. If the small bird could always pick its shelter, then, no doubt, foliage would be a great protection to it, but when the hawk appears it must get where it can get, and in the great majority of cases this will be where it can be followed and caught. I have myself seen here in Brittany a little flock

of Passeres pursued by a Sparrow-Hawk across a field into a hedge, where one of them was caught. The hawk never paused, but dashed into the hedge in a quite accustomed manner, and issued from it again some way farther on, and in only a few seconds, with a bird dangling from its claws. According to the common idea, these birds, having got into the hedge, should have been safe, but the result was very different, and gives no countenance to this view. The hawk would not have engaged in what experience had taught him to be a forlorn hope, but would, instead, have sailed off, recognizing his defeat—for energy is not unduly wasted in nature—but he dashed into it without pause or hesitation. Evidently it presented no idea of being foiled or baffled to his mind. “Now, I’ll have them” was rather, I think, the thought—justified, as we see, by the event.

Seeing nothing more of the hawks, I re-entered the plantation, and before long the male returned to it, and flew from tree to tree in it, uttering his cry whilst flying, and at intervals when perched. When I then managed to see him he was not feeding, and I could not make out whether he held anything or not. At 5 I found the female on the nest again, where she remained till about 6. The male was at this time perched in one of the beeches, luckily in full view, and upon his uttering the usual sharp cry the female left the nest, flew right up to where he sat, and for a moment hung in the air just in front of him. She then flew direct to a tree near, where I saw her distinctly go through the characteristic feeding actions. Evidently, though I could not quite see the delivery, she had received something from her husband. After only a few mouthfuls, however, she flew into another tree, near the nesting one, and from that on to the nest, where apparently she finished her meal. Standing upon the carcass (or portion of it) she pulled and tugged at it with great energy, once lifting it right up in her bill. It then looked like the headless carcass of a bird about as big as a Chaffinch, and that made me think that the more violent tugging had been given during the process of decapitation. She then sat quietly for about an hour, but before settling herself on the nest she made movements different to any I have seen her make there before, bending her body up, though still retaining her crouching

attitude, and also raising her wings once or twice. From this and her bringing prey to the nest, now for the first time, as far as I have been able to observe, I began to hope that the eggs are at last hatched, though I could not make out that she fed the newly hatched young.

The male now, having some time previously, re-entered the plantation, and reiterated, at short intervals, his querulous-sounding cry, flew close by the nest, then passed it again, and, at last, came down upon it. He stood there for a moment or two before flying off again, but whether he first delivered anything I was unable to see. The female seemed just to nod at him, as it were. A minute or two later, looking up from making this entry, I saw both birds standing together on the nest, but as I raised the glasses, the male flew off, and was followed, a moment afterwards, by the female. The latter now, at 7.30, is back, and has covered either the eggs or young—I do not yet know which.

Neither on this nor on the other occasions of the hawk's eating could I make out that the bird was previously plucked or "plumed" by her. On the morning of the 15th, when she visited the Jay's nest where I had seen the dead Redstart the day before, and then devoured something which she had obviously carried away from it—presumably this same bird—she certainly did not first plume it, for there were no feathers under the branch on which she sat after the meal was over, nor did I see any scattered in the air during the time of its continuance. It was the same on the 14th, and again on the 20th there were only some very few on the ground underneath—some half-dozen or so that looked as though they might all have come out together, though they were not, indeed, united by skin. Nor at any time in this small and open plantation have I noticed feathers under the trees—and this applies more especially to that part of it that the hawks more particularly affect—and where the meal, I believe, is always made, if in the plantation at all, and not on the nest. It is also curious that I have never been able to detect a bird carried in the hawk's claws when in the plantation, and that what the male hawk was carrying outside looked not like a whole carcass, but some fragment such as the breast or

back, whilst the hardness of the outline suggested its being denuded of feathers. All this makes me much regret my not having first examined the Jay's nest before taking up my position to watch it. I must then, I think, either have found the carcass already plumed, or else it must have been devoured with the feathers on it.

Left a little after 7.30 a.m.

Down again a little before 6 p.m. The bird was on the nest, and I at once noted that she was sitting higher. A little while after I was there the male hawk entered the plantation, and kept uttering his little plaintive "tchee, tchee, tchee, tchee, tchee," as though to call the female off the nest, and in a minute or two she did, in fact, leave it, and flew towards the cries. When she was gone I noticed something moving in the nest. At first it looked dark, but, several times afterwards, I saw distinctly the fluffy whiteness of an evidently newly hatched chick. Very soon the bird was back, and at once began to busy herself with the booty which she had evidently brought back, though I was not able to see it in her claws as she alighted, owing to the foliage and her quickness combined. She, I think, at first began eating herself, but afterwards I distinctly saw her feeding the chicks, picking out evidently very small pieces, and then bending down her head, and presenting them very carefully—once I saw the black bill of a little fluffy chick lifted up to meet hers. She fed them very carefully and thoroughly, and it took some time. Then she settled herself once more on the nest, and remained there brooding the chicks till 7.13, when I again heard the cries of the male in the plantation. Almost immediately his partner joined him, as was evident from the cries of both, at the same spot, now quite different in character, fuller, less shrill, and having an endearing, joyous tone in them—so, at least, it seemed to me—that was very pretty to hear. Then, at 7.15, the hen flew, with great speed, directly on to the nest—like a flash, in fact, as I have not before seen her do. She had, then, a fierce, wild look, and as she dashed down I caught sight of some dark-looking thing—it seemed in her beak—and a moment or two afterwards she began tearing fiercely at the body, evidently of another bird. On this she made a hearty meal, and she did not, this time, as far as I could observe, feed the chicks,

though the conditions of observation are not such that I can positively assert that she did not. But if so, it was, I am sure, quite subsidiary—she principally made her own meal, and, having done so, settled herself down as before, and thus I left her about 7.30 p.m.

It is now quite evident, taking these two observations, and the one of this morning, where I as good as saw the actual delivery, that the male Sparrow-Hawk brings in prey, at intervals, for the female, with which she both feeds the young, and also makes her own meal, either in the nest or a tree in its vicinity. It would seem as though the male did not particularly like going to the nest, and that when he did do so this morning it was after having in vain tried to call his partner off—she perhaps having then both fed the chicks sufficiently, and not being hungry herself. There was something like this on the 21st also (see entry), so it is possible that the young were even then out, though I did not see them fed or booty brought to the nest either on that day or the next.

June 24th.—On spot at 3.20 a.m.

4.37.—Male into plantation.

4.40.—Female off.

4.42.—Female back with prey and has a meal. I could not make out that she fed the chicks, but she may have done, a little, after satisfying her own appetite. However, I doubt it, and I did not see any of them reach up in the nest. From as soon, after coming, as I could distinguish it, I had kept my eyes on the nest, but had never seen the hawk leave it previous to the advent of the male as stated. After her meal she settled herself over the chicks, and it came on to pour with rain. At a little past 6 I heard the cry of the male once only, but it did not sound so near as usual, and, I think, was outside the plantation. The female sat on for more than another hour, and then went off without my noticing her, nor did I hear the cry of the male. A minute or two afterwards, however, I heard that of the female—which is not quite so sharp—at least, I think so—and at 7.15 she flew to the nest again with what looked like the mutilated body of a young bird—or, to speak more intelligibly, it was, as ever, much smaller than I should have expected. This she certainly ate herself, or at least a portion of it. There was

no sign of the chicks, and as the light was now better, and I saw her actually pulling and swallowing, with her head always in view, I could not have been mistaken. Having thus eaten for a little, she settled herself down in the nest again. If the male had come when she went off, I had not heard him, but it is true that I had once or twice previously seen a bird form flit over or amidst the tree-tops that I thought very like his. Unless we suppose that the female caught a bird almost instantly, she must either have received it from him or taken one that either he or she had previously killed and stored somewhere. If the male really entered the plantation before the female went off, then for the first time he was silent, and has so continued. I doubt my not hearing his sharp cry—so near as it always is.

At about 7.45 the female went off again, flew a little, from tree to tree, and uttered her cry, but sparingly. At 8 she returns to the nest, stands upright on its rim for some ten minutes, then covers the chicks. There was no feeding, and nothing, I think, brought in. Shortly afterwards there is the cry of the male again. He pipes, as one may call it, at frequent and short intervals, as usual, but the hen will not leave the nest. Then, at about 8.25, he sweeps like a flash through the foliage, down and then up on to it, stands there for one moment, and is off with the same lightning speed. Then the female, who has evidently received a donation, though it has been too quick for me to see, stands up on the rim of the nest, and begins to tear it to pieces. At first she again appears to be eating it all herself, but during the latter part her head is bent down into the nest so that I cannot see it, and she may then be feeding the chicks. She then stands a little on the opposite side of the nest's rim, and after a minute or two covers the chicks. At about 9, as I was leaving, she again left the nest.

June 25th.—As I enter the plantation, about 4.55 a.m., I hear the cry of the male hawk in the usual part of it, the end near the nest, that is to say, and in its immediate vicinity. The female is then covering the young, but, in a few moments, she rises, and, flying off, makes a little skirt round the bordering trees, and then flies up amongst them to her mate, when, at once, a little duet of delighted sounds is heard—those fair sounds of wild things rejoicing, not to be matched in palace or drawing-

room, or even by the cottage fireside. In another minute she returns to the nest—stopping and crying on the way, however—evidently with a bird in her claws (though this I can never see), for standing upon it, on the rim where she alights, she straightway commences to tear at it, and after a few mouthfuls, as I think, for herself, I plainly see her feeding the chicks, first tearing a piece off, and then bending her head down into the nest with it, and at the same time stretching forward in varying degrees according to the distance of each one from her, in a tender and motherly manner. There is a pause of a few minutes, the hawk still standing on the bird, then she recommences, and when she again stops, the feeding is over, the whole process, with pause, having taken a quarter of an hour (from 5 to 5.15). She stands where she is for some time, then steps over the chicks on to the opposite rim of the nest, and in eight minutes from having fed them settles herself down, and covers them. I heard the cry of the male once only after the female had returned to the nest.

The process of feeding the chicks here was so plain and unmistakable that I do not think I can have been mistaken in my observations of yesterday. It certainly seems strange that in three successive visits to the nest, each time with prey, the young should have been fed so little; yet certainly they got nothing on the second of these, and I doubt very much if they got anything, without my noticing it, on the first.

The stages of the female hawk's progress back to the nest, with her cries from the trees where she alighted, I attribute to her having partially satisfied her own hunger at each one of them—as I saw on the morning when I first found the young were in the nest. She may stop twice, or even thrice, in this way, but once is, I think, more usual.

6.30.—Cry of the male, as usual, and almost directly the female flies from the nest to him. She is back, with booty, at 6.35, and feeds chicks just as before, five minutes being thus occupied. Then, as before, she steps across the nest on to the opposite rim, and, at 6.43, is covering the chicks again.

I could, this time, see the pieces of flesh hanging from the hawk's hooked bill as she bent down her head over the young,

and I could also sometimes just see the white-fluffed young as they moved and stretched up in the nest.

At 8.33 there is the cry of the male again, and on its being repeated, after a minute, the female flies to join him. At 8.37 she returns, and at once begins tearing up what must have been brought her (though, as before, I cannot see it), and feeding the chicks with it. It is, however, a mutual meal, for she often swallows a gobbet herself. It takes about seven minutes, after which the hawk stands on the nest's rim for nearly a quarter of an hour, and at 9.5 covers the chicks, first stepping carefully over them to the opposite side, and standing there a moment or two.

I should mention that a little before this (at 8.15) I had accidentally disturbed the sitting bird. She was away for a quarter of an hour, but, although she might very well in that time have caught a bird, she came back without anything, preferring to wait for the male. Yet when he came she ate some of what he brought, herself, which shows that she was hungry. This illustrates how established is the differentiation in the parts played by the two sexes in the care of the young, and with what confidence the female relies on the male for her supplies.

At 9.50 and 55 and, again, at 10, there is the cry of the male in the plantation, and just after the last time his wife flies to him. I see her alight in the tree where, by his cry, he is, and then come the sounds of their rejoicing together. In a minute or two she flies back and feeds the chicks, with sometimes a bit for herself just as before—all plain and distinct, the little white heads bobbing up. At 10.10 it is over, and at 10.15 the hen covering the chicks again. She stood on the usual side of the nest and on the rim and stepped over to the opposite one before covering, as before, no plucking, as far as I could see.

At 11.15 I hear the cry of the male, as I think, in the plantation, but turning the glasses on to the nest, find it empty. The bird must have left it within the last minute or two. Again, at 11.20, 11.30, and 11.35, I hear the cry and after this, at intervals, in the plantation, till about 11.50, when the bird flies swiftly on to the nest, from the direction opposite to the usual one, and alights on the corresponding side, upon the rim,

as usual. She begins to tear up the prey, but all at once flies off in alarm, as an old woman, collecting into a sack the leaves in a trench that runs across the small plantation, approaches the home-tree. At 12 or 12.5 she returned and again fed the chicks, but as this lasted but a short time, it may have been with what was still left when she was frightened away and not with anything fresh that she had brought. I then left.

June 27th.—I was in the plantation before light, in order to see something of the domestic habits of a pair of Carrion-Crows that had built their nest at only a few paces from the home-tree of the hawks. I could not, however, see the two together, and the size of the plantation is so inconsiderable that, in order to watch the former, I had to sit in the centre, or approaching the other end of it. As one of my entries, however, as much concerns the hawks as the crows, I will quote it here. It runs thus:—“This was the last observation on the birds’ nursery habits that I was able to make, for whilst moving some of the boughs in front of me, so as to get a better view, I was discovered by one of them, who instantly raised a loud and most expostulatory ‘quaw.’ This was followed by others, and the noise was becoming tiresome, when it was put a stop to in an unexpected and interesting manner, for one of the hawks, whose smaller size and slighter build pronounced it to be the male, flew up swiftly through the trees, and descending right upon the vociferous crow’s back—no doubt delivering at the moment of contact an assault with beak and claw—both silenced her and put her instantly to flight. Having thus asserted himself the hawk flew into another tree, where he sat for some while in silence, nor did I afterwards hear his cry in the plantation up to 7.30, when I left. This, again, adds significance to the meaning of his cry here, when it is heard—to give notice of his arrival with booty, namely, and so call his wife from the nest. Without a motive he can be silent enough. The incident just recorded is interesting, for it shows that the hawk was irritated simply at the noise made by the crow. It is difficult to see any other reason for his conduct, since the crow was not near his nest but towards the other end of the plantation,* where, had she been silent she would probably have escaped his observation alto-

* She was not at her own nest at the time.

gether ; nor could it in any case have been her mere presence that annoyed him, since these hawks and these crows have been fellow-denizens of this small plantation probably since early spring, their home-trees separated by but a few paces, nor have I before seen any signs of hostility between them."

At place again at 12.13 p.m., and find hawk on nest—always the female. At 12.33 she rises quietly, steps on to rim, and flies off. I have neither seen nor heard anything signifying the arrival of the male.

12.38.—Hawk back with bird in claws, and I just get the effect of this as she comes down on to the nest ; she at once begins to tear it, and both feeds the chicks and eats herself—latterly almost undividedly. The mutual meal lasts till 12.55, and the hawk then sits, still and upright, on the rim of the nest where she has torn up the prey—perhaps yet upon it. There was certainly no pluming, for the bits became red at once, though from the glimpse I caught the bird seemed in its natural state when brought in, and I even thought it moved spontaneously, as though still alive—but I may very well have been mistaken in both points. From the appearance of the bits, which were pinkish rather than deep red, and often of a stringy appearance—in fact, unmistakably entrails—I have no doubt whatever that the visceral cavity was torn open, and the carcass disembowelled. I could often see the fragments go from the parent's bill to the chicks', as they reared themselves towards it. [My notes here go on to say that the cry of the male as the female flew in, with the shortness of her absence, again makes me certain that she has received booty from him and not caught it herself ; but as I have stated before that I neither saw nor heard the male, this point, as far as observation goes, must be considered doubtful. It is possible, and perhaps not unlikely, that I heard without noticing the cry at the time, and remembered it afterwards.]

1.28.—The hawk steps quietly over the chicks to the outer side of the nest, stands there on its rim for a little, and is brooding them again by 1.30.

Just before 2.33 I had seen the hawk standing on the rim of the nest—the opposite side to the usual dissecting-place—when, at 2.33, I heard the cry of the male in the plantation, and,

looking up again, she was gone. At 2.35 only, she flies back to the usual place, and though I could not observe that she carried anything, instantly begins to carve and distribute. She also takes a little herself, but it is a far less ravenous meal than the last and is over in ten minutes, when she stands on the place as before, and does not brood the young again before 3.5.

3.39.—Hawk suddenly off. I have heard no cry. At 3.50 she returns and settles in a tree. I thought she had a bird, but could not at all make it out—it was only an impression. She flies once or twice from tree to tree in the plantation—always quite silently—and at about 3.55 goes on to the nest. She brings no booty, but alighting on the opposite side to that where she has hitherto broken up the quarry stands quiescent, nor is there any sign from the chicks, who do not appear to be hungry. As said before, there has been no cry or any other sign of the male at or between this exit and return. It is, therefore, significant that the female who left the nest on her own initiative, as it would seem, should have brought nothing back to it, merely sitting there quietly after return, as she did on another and similar occasion, but as she has never done (as far as I remember) when she has gone off on the call of the male. It would be even more interesting if she had, during the interval between her departure and return, caught a bird for herself, but this I do not now think, or at least that she ate it in the plantation, since it is contrary to my previous experience that she should do this in silence, my impression of her having a bird, therefore, was, I think, probably erroneous.

At about 4 the hawk again covers the chicks, having previously sat—or rather stood—motionless. She remains thus for nearly fifty minutes, when hearing the cry of the male, I look up—my eyes having left her for a few moments—and find her gone. At 4.54 the male hawk flies over the plantation and almost immediately afterwards the female shoots swiftly on to the nest and feeds the young again. The feeding is over at 5.5, and the hawk then stands, sentinel-like, on the nest's rim where (as always) she has alighted, and is still standing so at 5.30, when I walk away from the tree. By 5.40, however, when I leave, she has covered the chicks—no doubt after first stepping over them, on to the other side of the nest, in the orthodox manner.

June 29th.—In plantation, to watch the crows at 3.15 a.m.

Cry of hawk (probably male) first heard at 4, and again at 4.2. I then heard them as follows, *viz.* at 5.35, 5.48, 6.7, 6.35. This may represent five comings in, with booty, on the part of the male. On the last occasion I saw first the female flying from the usual place of rendezvous to the nest, and then the male. I had walked out into the open in hopes of seeing the male strike prey, or at least beating about for it, so as to judge further of general habits in this respect, but without success. It seems a difficult matter to see the birds when once they are quit of the plantation. Leave, some time after 7 a.m.

(To be continued.)

NOTES AND QUERIES.

MAMMALIA.

Status of Dormouse.—For the furtherance of my book, ‘A History of British Mammals,’ I should be very glad to receive information on the status of the Dormouse in the following counties:—Dorset, Wilts Monmouth, Pembroke, Rutland, Huntingdon, Northumberland.—G. E. H. BARRETT-HAMILTON (Kilmanock, Campile, Waterford, Ireland).

AVES.

Distribution of the Linnet in Britain.—In answer to Mr. Russell’s query about the Linnet (*ante*, p. 29), I may be allowed to add a further remark or two beyond the answer required. The bird is a very well-known migrant, and is so described by many writers; without going any farther, I can mention Cordeaux, Gätke, Macgillivray, Montagu, Newton, and Seebohm. In Gilbert White’s time matters were rather different in the locality of Selborne to the state of affairs at present obtaining in other parts of Surrey, for he says that there were “in winter vast flocks of Common Linnets; more, I think, than can be bred in any one district.” It is, of course, possible that he made the mistake of confounding the Twite with the Linnet, for I cannot find the smaller bird mentioned in his letters; and, as we know, he was unaware of the existence of the Cirl Bunting, which is to-day common near Selborne.

I should like to again draw attention to the curious fact that the Common Linnet is absent as a breeding species, and rare in winter throughout great tracts of country on the western slopes of the Pennines. Mr. W. Greaves does not describe the species in his ‘Vertebrate Fauna of Hebden Bridge,’ and tells me that he has never succeeded in identifying a single bird in his locality, nor heard of one being taken by birdcatchers. I might say here that I have noticed the bird on one occasion at Walsden, a few miles away. Mitchell, in his ‘Birds of Lancashire,’ has a little to say on the curious rarity of the species in certain localities, and I can testify that his remarks hold good not only for South-east Lancashire, but for the adjacent parts of Yorkshire, Longdendale in Cheshire, and parts of Northern

Derbyshire. Here to-day it appears to be utterly absent in summer. Mr. T. A. Coward, in his 'Vertebrate Fauna of Cheshire' (1910), mentions it for the neighbourhood of Mottram, on the authority of one who knew the bird well; but the information is some years old, and personally I have failed to see any signs of it during an intimate acquaintance with the district. Rumours have reached me of its breeding on the rough sides of the Etherow Valley, in Derbyshire, but I have never seen it there, although of course it is common a few miles away. So here we have a tract of apparently suitable country, reaching from (at least) Hebden Bridge to, say, Glossop, where the "Common" Linnet is rare or absent in summer, and very scarce at other seasons. Gorse is often said to be very attractive to Linnets, and many of these rough Pennine slopes bear the plant. Few, however, are aware that the species which is nearly always the more abundant is not the common plant, but the little known and perfectly distinct Planchon's gorse (*Ulex gallii*). This flowers in the autumn, and at no other season. Just as the "common" gorse is here replaced by a totally distinct species, so is the "Common" Linnet replaced by another bird. On the hills and the lower moors the Twite is an abundant breeding bird, and is a common autumn and winter visitor to all the lowland fields, and I suspect that in many places its presence has served to mask the absence of the better known bird which it so much resembles.

All through the autumn and winter the Twite, like so many other moorland breeding birds, abounds on some of the East Coast sea marshes, especially those of Essex and Kent. Here, as in its breeding haunts, it is regularly called "Linnet" by the inexpert. It sometimes happens that the two species live side by side, but as a rule the Linnet prefers the drier sandhills, while the Twite sticks to the beds of *Aster*, *Statice*, and other plants that grow on the salt-laden mud. It is rather a thankless task turning bird-notes into written syllables, but I may be pardoned for remarking that many years ago I noted that the ordinary call of the Twite is a very musical and sweet "tweedley-dee," and that it frequently uses a harsher "zur-r-r." I have never heard a Linnet make such sounds, nor have I watched Twites for long without hearing one or both of these characteristic calls.

I think Mr. Russell's suggestion that we should note the absence of common birds is a very good one. The results in the cases of such birds as the Corn-Crake, Martin, Jay, Carrion-Crow, &c., could not fail to be interesting. The Linnet, however, is certainly worth a little special study on this point.—FREDK. J. STUBBS.

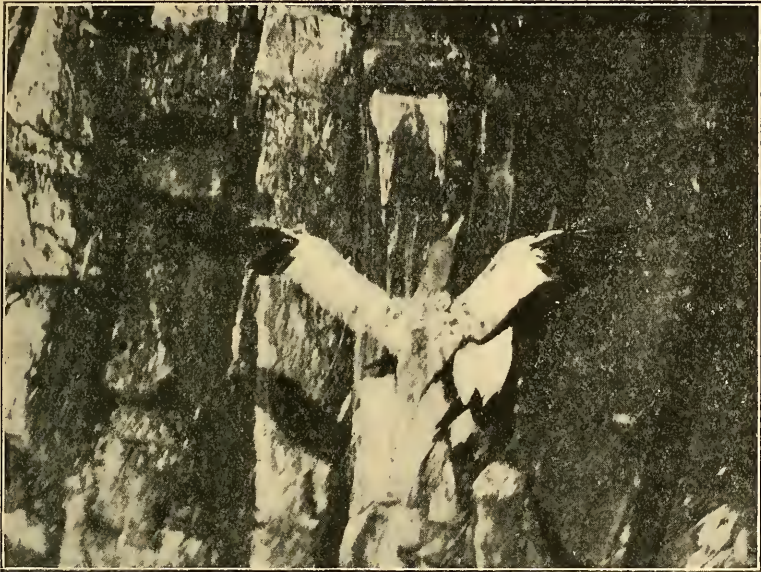
Migration of Linnets. — Admitting the truth of Mr. Harold Russell's remark that "it is often easy to be mistaken in asserting that a bird is not found in a certain locality," I think it may be said that, as far as I know, the Linnet entirely disappears from this district in Sussex during the winter months. This, however, is a rule, like most others, to which there are exceptions—because I do occasionally see one here in the winter. A few may sometimes be seen here until the first week or ten days in December, but as a rule the Linnet is absent from the end of November until well into March.—ROBERT MORRIS (Uckfield, Sussex).

REFERRING to Mr. Russell's communication (*ante*, p. 29), the total disappearance of *Linota cannabina* from the county of Surrey during the winter season is information which comes rather as a surprise to me, though Mr. Russell is not likely to be mistaken on this point. I did, however, think, up to seeing Mr. Russell's note, that at least the migration would have been but partial, especially in mild winters. The Linnet usually leaves this district about the end of September, almost to a bird, and does not return until March. It is one of the few species which has greatly diminished in this district within the last thirty years, notwithstanding the operation of the Wild Birds Protection Act and the total disappearance of the bird-catching fraternity which used to be in much evidence here. It is quite true that whin-covers have greatly diminished within comparatively recent years, but neither this factor nor the improved methods of agriculture which now prevail can but very inadequately explain its relative scarcity as compared with former years. What makes its scarcity still more a puzzle is the abundance of its favourite food in summer, *viz.* the seed of the dandelion, which afford it a perennial supply throughout the summer months. When the furze-covers died out it began to breed in whitethorns, but, next to the furze-bush, it prefers plantations of young spruce and pine trees. One variety I used to see when I was a boy with a yellowish breast; these were named by bird-catchers "femon birds," and were regarded by these gentry as old birds. It is a good many years since I saw this variety, but whether the colour is due to age, as alleged, I am unable to say. In taking my walks amongst what used to be the breeding haunts of this species, I feel the loss of its charming song more than I can express in words, and often sigh for a sound of its voice. No more interesting bird used to be found on our uncultivated hillsides.—E. P. BUTTERFIELD (Wilsden, Bradford).

Further Note on the Willow-Wren.—With reference to the points raised by Mr. E. P. Butterfield in his interesting note (*ante*, p. 28), it is perhaps not very easy to detail closely the various grounds for believing that the second broods recorded in my paper (Zool. 1910, p. 401) were genuine second broods, and not merely second attempts by birds whose first nests had been lost. In one case (No. 22), certainly, some doubt remained, owing to the fact that no first brood had been discovered, despite repeated efforts. The other nests, however, admitted of little doubt. Apart from their position, the fact that all the pairs of birds in the immediate vicinity had successfully reared their first broods settled the matter fairly satisfactorily. The question of the ownership of the second nests is at times more difficult to decide. To credit them merely to the builders of the nearest first nest is not always safe, and the only other criteria available are a comparison of dates and the rather more delicate one of the identification of the parent birds. In many instances individuals differ in character to a degree sufficiently striking to allow of distinction between neighbouring birds, apart merely from the area they inhabit. At the same time, I should like to point out that my estimate of the percentage of second broods is based only on two years' observation in one particular wood, and may not represent the actual percentage of the whole district. The same remark applies to the average clutch, which for the area treated of in the above paper may be stated at 6.0 in 1910. (With the inclusion of nests taken elsewhere in the district in the same season, this average holds.) Running through a list of Willow-Wren's nests taken within a few miles of the same spot during the last five years, I find that the average clutch of first broods works out at 5.9, that of the lowest year (1909) being 5.6; but the number of nests listed is not great. This subject of local averages is, I think, one of considerable interest when viewed in connection with facts of latitude, climate, &c. When nests found with young birds are included in the list, the average arrived at may tend to be lower than the actual, since the old birds sometimes eject addled eggs; but this consideration is perhaps not of great importance in the present species, owing to the small number of addled eggs, and to the fact that those which occur are usually allowed to remain in the nest. In this connection it may be of interest to record that a nest discovered in a neighbouring wood in 1910, with the small clutch of four eggs, two of which were addled and were later turned out by the old bird, was situated within a few yards of the spot where a nest was taken in 1908, in which case again the eggs were four in number, no fewer than three of which

were added—a coincidence highly suggestive considering the rarity of the occurrence of more than one infertile egg in a Willow-Wren's nest. (I have no note of the 1909 nest.) In the description of the wood it should have been stated that there was no definite slope in the ground likely to produce appreciable effect on the direction of the nest-opening, but of course there are other factors to be taken into account.—S. E. BROCK (Kirkliston, Linlithgowshire).

Variety of the Gannet.—By the kindness of Mr. Riley Fortune I am able to give a photograph of the singular Gannet which he and Mr. J. Atkinson detected on the Bass Rock on July 24th, 1910. The photograph is one of several taken at the time by Mr. Fortune, and shows the disposition of the markings on the back and wings very



VARIETY OF GANNET.

well. It also shows the tail of the bird to be white, which is usually accepted as a mark of the complete adult plumage, for in the ordinary course of its moult the tail is the last part of a Gannet's plumage to turn white. At the Bass Rock and elsewhere I have frequently seen Gannets which were not quite adult, but which retained a little black on the tail and nowhere else, the rest of the body having become white. This peculiar Solan Goose has excited a great deal of interest, and

very different opinions have been expressed about its origin. The question is whether it is to be regarded as a very unusual—one might almost say unique—variety of plumage, or whether it may not be one of twelve which were daubed with red paint (oxide of iron) by Mr. J. Campbell, the lighthouse-keeper, in May, for the purpose of ascertaining whether these birds always keep to the same nests, and to the same mate. If the latter be, as some think, the explanation of this supposed natural freak, the dappled appearance of the back is accounted for, because the new white feathers as they gradually pushed their way through would produce this effect. In a letter to Mr. Atkinson, which has since been printed ('Country Life,' Dec. 24th, 1910), Mr. Campbell states that it was not one of the Gannets marked by him with paint, but in a communication to the present writer he is less confident about it, preferring to reserve his opinion until next April, when he hopes it may appear again. Should it do so the matter is settled, and the bird will be proved to be a variety, for the whole of the plumage would have been moulted by then and the paint with it, if it was painted. Mr. Riley Fortune and Mr. Atkinson are both satisfied that this Gannet was not an artificially coloured one, and their opinion is entitled to the fullest consideration, as they are the only naturalists who have seen it, and they watched it for a long time at close quarters. They discussed the question of whether it could be one of Mr. Campbell's marked birds while they were looking at it, and came to the conclusion that the delicacy of the markings and the richness of the colour of the head and neck negatived such an idea.—J. H. GURNEY (Keswick Hall, Norwich).

Decrease of the Corn-Crake and Wryneck.—It would be of very great interest to obtain records of the present status of these two birds in this country in comparison to what they were in former years, and endeavour to throw some light on the cause of their extermination or altering distribution. In my native county of Bedfordshire thirty years ago one or more pairs of the Corn-Crake might be found nesting in any of the larger meadows of mowing grass, and more or less commonly throughout the county, whereas now they have practically ceased to nest everywhere. I have not heard of a nest being found for many years past. A few are still heard as they rest for a few days during their spring movements, and again they are not infrequently killed in autumn on their return movements southwards. The Wryneck, "Cuckoo's Mate" or "Touch-dial," was a well-known summer migrant, and its eggs were commonly found by us as schoolboys. From that time it seems to have

rapidly decreased as a breeding species, and the last nesting of which I have a record was in 1905. Nowadays it is an all but unknown bird, and very rarely heard, even as a passing migrant. — J. STEELE ELLIOTT (Dowles Manor, Salop).

Former Nesting of Shoveler Duck in Warwickshire.—It may be of interest to put on record the former nesting of this species in Warwickshire. Until at least as late as 1891 a pair had nested regularly for several years at the pool near Middleton Hall. Although I frequently saw these duck and their young, I could never find the actual site of nest. On May 6th, 1894, I have a note of flushing a pair from the cover alongside the large pool in Packington Park, which were probably nesting there also. Two years previously the gamekeeper on that estate informed me only Mallard and Teal bred in that locality. On the several large pools in Sutton Coldfield Park I have only known the Shoveler as a rare visitant in the winter months.—J. STEELE ELLIOTT (Dowles Manor, Salop).

OBITUARY.

JAMES WILLIAM TUTT.

JAMES WILLIAM TUTT died on January 10th, 1911, at the early age of fifty-two. After long service as a Headmaster under the London Education Authority, he had recently been appointed to the Morpeth Street Central School, the first of a new departure in Higher Grade Schools.

For the last quarter of a century Mr. Tutt has been in the forefront of entomology in England. As Editor of the 'Entomologists Record,' and author of many books, papers, lectures, and addresses, he is known to entomologists throughout the world; to him the junior Societies largely owe their present prosperity, and the Entomological Society of London owes him much in a largely increased membership, and in its business affairs being placed on a more secure footing. At the time of his death he was President-nominate, and had he lived a week longer would have been President. His most important work was, however, his 'British Lepidoptera,' of which the ninth volume was nearing completion. This work is a monument to his untiring industry and of his wide grasp both of

systematic and biological facts and principles. No such work had hitherto appeared.

Tutt was remarkable for the facility with which he seized and comprehended his facts, and the rapidity with which he arrived at sound conclusions upon them. He had a remarkable power of obtaining the co-operation of others in his work, and was always willing to assist other workers. Eager as he was to learn, he was as anxious to spread the knowledge of the facts and conclusions he had obtained, and was always ready to denounce errors due to faulty observation or to traditions without any sound basis.

His abounding energy and constant activity both in the field and in the closet were marvellous. He no doubt overworked, and this assisted by East End air and a long-standing heart weakness probably led up to his fatal illness.

T. A. CHAPMAN.

NOTICES OF NEW BOOKS.

An Introduction to Zoology. By ROBERT W. HEGNER, Ph.D.
New York. The Macmillan Company.

To adequately understand the scope and purview of this volume, it is well to give the opening paragraph to the preface: "*This book has been written for the use of students taking the introductory course in Zoology in Universities and Colleges. It has been prepared especially for the zoological part of the work in General Biology at the University of Michigan, and is expected to supplement the one lecture and four hours of laboratory work per week during the first half-year.*"

The treatise thus represents a more or less individualistic standpoint, and is intended to supplement a particular course of instruction. It is confined to the consideration of invertebrates alone; the writer states: "No originality is claimed for this text-book," and that "the majority of the figures have been borrowed from other textbooks and from original articles in scientific periodicals." It is, however, a publication that teachers should peruse and students carefully read with profit and instruction.

In the attempted definition of what is understood as a *species*, a very apt remark is quoted of a "prominent zoologist" who, when asked to give such a definition, said it was "somebody's opinion." The chapter on historical zoology is illustrated with portraits of Aristotle, Linnæus, Cuvier, Harvey, Von Baer, Johannes Müller, and Darwin, which add to its interest and value, while a subsequent chapter on general considerations of zoological facts and theories gives a compressed digest (in many instances a most difficult performance) of most of the generalizations and theories which have now become household words in biological and evolutionary conceptions. An appended bibliography gives references to two hundred and eighty books and publications, an excellent selection, and there is also a glossary of many of those terms now used in zoology and in biological theories and suggestions, which to completely remember and fully understand should in science be considered as a mark of "polite education."

EDITORIAL GLEANINGS.

TSETSE AND BIG GAME.—Major J. Stevenson Hamilton, Warden of the Transvaal Game Reserves, has a most important letter on the tsetse and big game preservation in the 'Buluwayo Chronicle,' from which we extract the following:—

“A good many hasty conclusions are apt to be drawn. Farmers lose stock, and naturally cry out that the game must go, without pausing to find out if the game is the real or the only culprit. Then there are many people who want to exploit the game, and on the principle of abusing your victim before you knock him down, try to make as good a case as they can against it, in order that they may justify themselves, and thereafter feel that their sport or profit-taking is surrounded by the halo of benefit to the country.

“It is an indisputable fact that tsetse-fly is well able to exist without the assistance either of the blood of buffaloes or of that of any of the larger mammals known as 'big' game, and conversely that buffalo and other big game are found in districts perfectly clear of fly. I notice it stated that fly and buffalo disappeared from the Crocodile River (Transvaal side) years ago. This is but partly correct. I have lived within the area in question for eight years, and have, in common with other members of the game reserve staff, trekked through every part of it with horses, donkeys, and oxen, so that I may lay claim to some knowledge of conditions there. Tsetse-fly disappeared during the rinderpest, as was the case elsewhere wherever the epidemic passed. It has been generally taken for granted that it disappeared after the rinderpest because the game, and more especially the buffalo, having been exterminated, there was nothing more for it to live upon. But this was not the case within the area of which I am now speaking. The fly had absolutely disappeared after the disease had passed, but the game was by no means exterminated. In the Eastern Transvaal, therefore, is found a case of buffalo existing in large and increasing numbers within what was once a fly belt, but which is now completely free from the pest. I feel tolerably certain that though we may kill out the big game we shall still find the fly with us, and the action will be

regretted when too late. A much more efficient remedy would be to clear the bush and thus destroy the natural environment of the insect."—*The African World*, January 21st, 1911.

AT a recent meeting of the Norfolk and Norwich Naturalists' Society, Mr. J. H. Gurney read a paper on the Great Auk's egg recently presented to the Norwich Castle Museum by Mr. James Reeve. Mr. Gurney said the history of the Great Auk's egg, which was presented last year to the Castle Museum of Norwich by Mr. James Reeve, is, as far as it is known, as follows:—Mr. Reeve bought it from Mr. J. H. Walter, whose father obtained it about the year 1850 from Dr. Pitman, at which time the Great Auk was commonly, though erroneously, supposed to be still an existing species. These particulars are given by Mr. S. Grieve in his book on the Great Auk. Mr. Grieve was informed by the late Professor Newton that this egg was one of those which came from Herr J. E. Brandt, the dealer at Hamburg, through whose hands so many of these rarities are known to have passed. In 1856 John Wolley was told by Brandt that he had transmitted no fewer than fifteen Great Auk's eggs to England, besides others which he sold on the Continent, and that all of them came to him from Iceland through an agent, whose name was Siemsen. Professor Newton further told me that our egg is very possibly the same one marked in Brandt's sale catalogue (No. 661), at 30s. It will be observed that the marbling of this egg is very rich, and having been kept from the light it is very little faded; the dark spots are very handsome, and some of the blotches of brown shade off with great delicacy. Like all the other Great Auk's eggs it has been blown by means of holes at the two extremities, that at the large end measuring .95 by 0.6, as Mr. F. Leney informs me, being filled up with a piece of egg-shell belonging to some other bird. I have compared the photograph of our egg with seventeen coloured plates of as many different Great Auk's eggs, and it is unquestionably one of the best. It most nearly resembles, I think, one in the Cambridge Museum. The stuffed Great Auk which has long been the pride of our Museum was formerly the property of Mr. Edward Lombe, of Melton, near Norwich, whose daughter, Mrs. E. P. Clarke, presented it in 1873. Mr. Lombe obtained it from Mr. Benjamin Leadbeater, but in what year is not known, but it must have been prior to 1822, because J. Hunt says in his *'British Birds*,' of which the third volume bears 1822 as its date, that his drawing was made from it. Leadbeater was a fellow of the Linnean

Society, and a dealer in natural history objects, who also had at least one Great Auk's egg pass through his hands. Iceland has furnished practically all the skins of the Great Auk now existing in collections, and it was in this country that they existed longest, the last ones known to have been killed being obtained in 1844. These were sent to Copenhagen, where by the kindness of Professor Winge I have been allowed to examine not only the skin of one of them, but also two Great Auk's hearts, as well as the lungs, windpipe, and tongue, all carefully preserved in spirits. The number of Great Auk's skins still in existence is believed to be eighty, but some of them are very moderate specimens, and must have been roughly prepared. Probably there is not a finer or better preserved example than that of which the Norwich Museum is the fortunate possessor; at all events, it is as good as any I have ever examined, and I believe I have at different times seen twenty-seven Great Auks, half of which were in Continental museums.—*Eastern Daily Press, February 2nd, 1911.*

TOADS EAT WASPS AND BEES.—I have on several occasions, in pursuit of my calling as a forester, come across a toad sitting near the entrance to a wasp nest, or "bink," as it is called in some parts, devouring the wasps as quickly as they came out and in. I wondered on those occasions how it could manage to swallow them without being stung. It is also fond of paying a visit to the apiary, where it may chance on a stray bee crawling along the ground through some accident in alighting, or being too heavily laden or tired to make the alighting board of the hive. I have on many occasions experimented with it in this way, and one is surprised to see how quickly it can lick them up with its tongue. The bee usually is very quick to make one feel when it is roughly handed, and how the toad makes away with it without showing any symptoms of being stung is a mystery I have never been able to solve.—WILLIAM HARPER, Garliestown, Wigtownshire, Dec. 13, 1910.—(*Extract from the ' Scotsman,' reprinted in the ' Fishing Gazette,' January 21, 1911.*)

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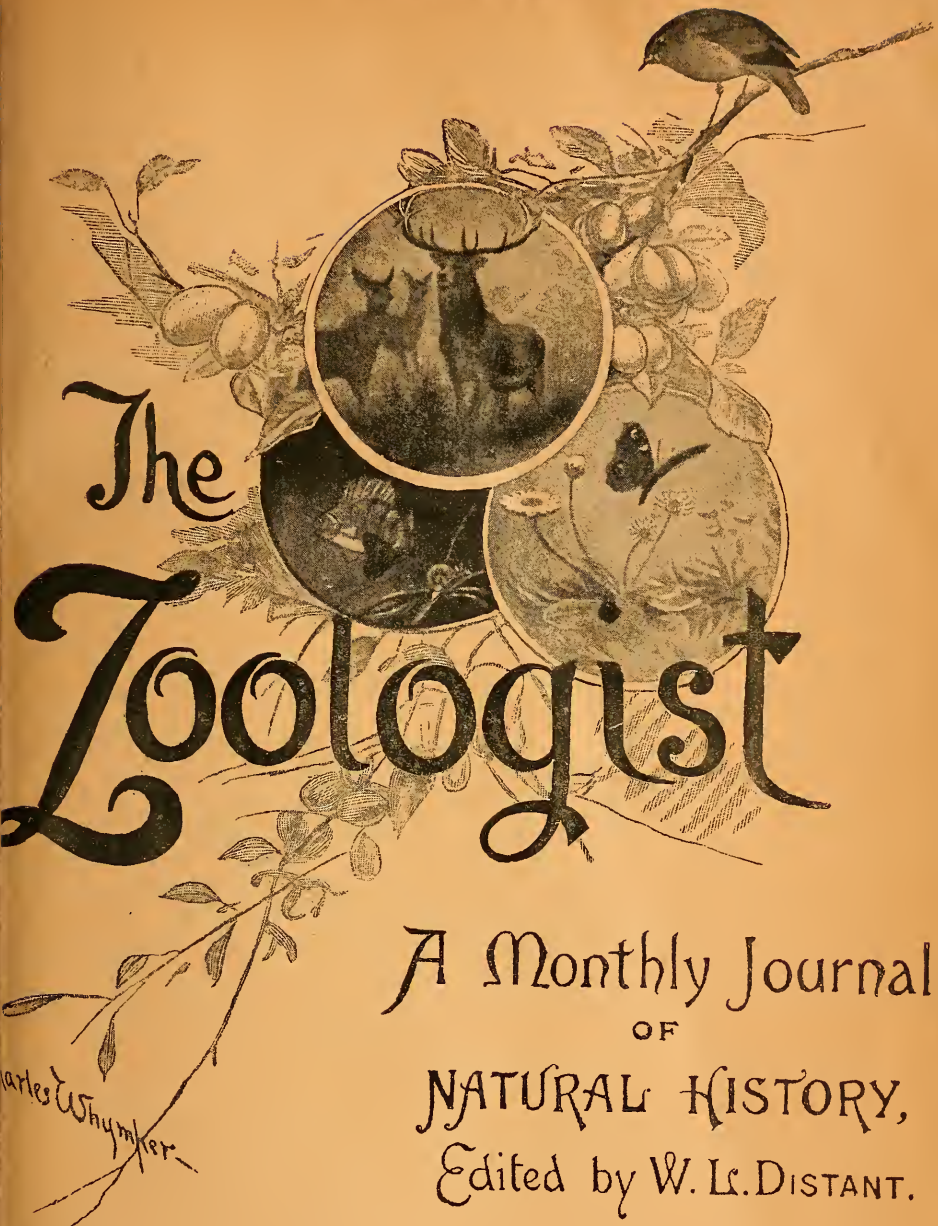
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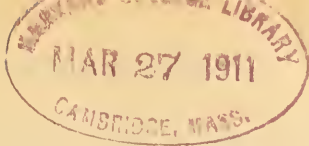
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THE ZOOLOGIST

No. 837.—March. 1911.

A BRIEF SKETCH OF THE TOOTHED WHALES (ODONTOCETI).

By Prof. McINTOSH, M.D., LL.D., F.R.S., Gatty Marine
Laboratory, St. Andrews.

AMONGST the larger denizens of the sea few are of greater interest either to the naturalist or to the ordinary observer than the Whales, or Cetaceans, as they are called; nor is this due alone to their size and strength, but to their peculiar habits, and in some cases to their intrinsic value. Moreover, in this group are the most gigantic types of living animals (for example, Sibbald's Rorqual, the Whalebone Whale, and the Spermaceti Whale), the former surpassing in bulk anything known in former epochs of the world's history.* The vast size of some is a feature of moment, since amongst mammals it often happens that the primæval forms exceeded in bulk those now living. Thus the gigantic Mammoth (*Elephas primigenius*) from the frozen soil of the alluvial plains of Siberia, and the giant Ground-Sloths (*Megatherium* and *Mylodon*) of the ancient tropical forests of South America much exceeded in size the living representatives of the respective groups. Unfortunately, also, the same may now be said of the Sirenians, since Steller's *Rhytina*—discovered at Behring's Island only in 1741—perished utterly in 1782, or in little more than forty years. This huge Sea-Cow, 25 ft. in length and weighing three or four tons, browsed on the tangles in the shallows along the seashore, and

* Though some Zeuglodonts reached 70 ft. in length.

collected in herds like cattle. Mild and inoffensive in disposition, the *Rhytinæ* soon fell before eager crews, who ruthlessly slaughtered them for their savoury flesh. The smaller Dugongs and Manatees are the only Sirenians now living.

Besides mere bulk, however, the Cetaceans have enormous strength and activity, making their pursuit occasionally both difficult and dangerous. The comparatively large and much convoluted brain, even in the smaller Cetaceans, shows that intelligence is not less than is usually supposed; indeed, those who have long come in contact with the living forms in our own seas can sufficiently vouch for this. Again, the large amount of oil obtained from the subcutaneous fat or "blubber," and the value of the whalebone of the Right Whale (a single long blade of which may bring from £12 to £14), all combine to render the group as valuable to the public as interesting to the scientific inquirer.

Some of the Cetaceans, just as the Zeuglodonts and their allies did in the Eocene, Miocene, and Pliocene, range over a very wide area—species which are indistinguishable from each other being found in the North Atlantic, as well as on the coast of New Zealand and the neighbouring Pacific. Others have a more restricted area, though in regard to distribution much yet remains to be done even on our own shores, as the recently established whaling stations show. Not a few species occur on the British shores in the living condition, while others have been beached either immediately after death or when the gases of decomposition have floated the carcasses shorewards. A few forms are confined solely to fresh water, *viz.* to the great rivers of Asia and South America.

The Cetaceans, or Whales,* in which term the small as well

* It is unnecessary in this brief outline to refer to the extensive literature of the subject, but the writings of our countrymen, John Hunter, Robert Knox, Sir R. Owen, Dr. Gray, Sir William Flower, Sir William Turner, Dr. Murie, Dr. Carte, Prof. Macalister, Prof. Cleland, Prof. D. J. Cunningham, Prof. Clark, Sir John Struthers, Mr. Lydekker, and Mr. Beddard merit special mention; whilst abroad the labours of the elder Prof. van Beneden, Prof. Sars, Professors Eschricht and Reinhardt, Prof. Lilljeborg, Prof. Collett, MM. Pouchet and Beauregard, Mr. True, Mr. Beale, Prof. Cope, Capt. Scammon, F. Cuvier, Prof. Gervais, M. Lacepède, and Prof. Nansen are equally important.

as the large forms are included as a group of mammals, are readily distinguished by their wholly aquatic existence, the only other mammals having a similar habit being the Sirenians, *viz.* the Manatees and Dugongs, which, however, diverge considerably in structure from the whales. So truly aquatic are the Cetaceans that deposition on land is usually fatal, and therefore they materially differ from such as the seals, which frequently leave the water of their own accord and bask on the rocks and sand. An exception, however, was the Californian Grey Whale (*Rhachionectes glaucus*), which was often found amidst the surf. This interesting species is said to be now exterminated by the persistent pursuit of man. While thus they resemble the fishes in being confined throughout their existence to the water, they are as characteristically mammalian in structure as the most typical member of that class, though it is true their framework as well as their various organs are modified to suit their aquatic life, and some parts are absent or rudimentary.

In the form of the body the Cetacean is fish-like, being spindle-shaped or club-shaped in outline, without a definite neck, though in one or two a trace exists, tapered more posteriorly than anteriorly, and having a powerful tail composed of two divisions or "flukes," placed horizontally, and thus differing from the vertical tail of all fishes and the gigantic Ichthyosaurians. The body is covered with the mammalian skin, the surface or cuticle being smooth, and with comparatively few hairs, so characteristic of other mammals. This scarcity of hairs might at first sight be considered a most exceptional feature, since one of the leading characters of mammals is the presence of such a covering. A closer scrutiny, however, shows that hairs are by no means absent in the whales. Thus, for instance, the newly born Right or Whalebone Whale has numerous bristles on the upper and lower lips* and near the blow-holes. Moreover, Mr. Lillie† has recently shown that in the adult examples of *Balænoptera musculus* and *B. sibbaldii* a definite distribution of hairs could be made out in the shape of four rows of straight, white, bristle-like hairs on

* Sixty-six near extremity of upper jaw; about fifty on each side of lower lip; a few near blow-holes.

† Proc. Zool. Soc. 1910, p. 773, with text-figs., May, 1910.

the dorsal surface of the snout, and on the outer edge of each ramus of the mandible from the tip to near the eye is another row of hairs. Most of the Toothed Whales, such as the Pilot-Whale, White-backed Dolphin, Porpoise, and Common Dolphin,* in their embryonic condition, show similar hairs, but *Delphinapterus* and *Monodon* do not. In some again a series of pits (forming a circlet) are also present in the upper jaw, passing through the coloured or pigmented region of the horny layer of the skin, but whether these represent hair-follicles is unknown. The late Sir William Flower, one of the most distinguished authorities on the whales in this country, as well as recent Continental observers, such as Kükenthal and others, consider that the presence of such hairs indicates that probably the ancestors of the modern whales were much more hirsute. Besides hairs, two species of porpoise, namely, the common form and *P. spinipinnis*, from the western shores of South America, present spines on the dorsal fin, the latter on the back as well as on the front of the fin; whilst *Neomeris*, a porpoise from the Southern Atlantic, Indian and Pacific Seas, has a series of dermal ossicles in several rows along the dorsum throughout the greater part of its length. So far as observed in young porpoises at St. Andrews, the spines or tubercles are much less developed than in the adult, so that this species does not fall in with the notion of "inheritance from a more completely armoured ancestor."† The figure of the dorsal fin of the Common Porpoise, as copied from Kükenthal, differs materially in its posterior outline from anything observed in Scotland.

In regard to the structure of the skin, a well-developed corium (true skin, *cutis vera*) is absent in most Cetaceans which have a thin horny layer, and the Malpighian layer is much developed and has long papillæ. The glands of the skin are generally absent, as are also the muscles, while the cutaneous nerves are sparingly developed. The smoothness of the surface of the whales is probably associated with their surroundings, since a mammal with a smooth skin seems to be better adapted for a purely aquatic life than a hairy one. The further structure of the skin will come under notice when dealing with the

* Prof. D. J. Cunningham.

† Beddard (after Kükenthal), *vide* 'A Book of Whales,' pl. ii. fig. 6.

Toothed Whales, so that the only general features that call for mention are the anterior limbs, which have the form of flattened paddles—called flippers—in which the bones of the arm and hand are covered with the dense integument without nails, the absence of hind limbs and external ears.

Whales may very naturally be divided into two great groups, *viz.* the Whalebone Whales and the Toothed Whales (*Delphinidæ*), whilst the Physeterine Whales (called after the Spermaceti Whale), and the Ziphoids, also Toothed Whales, have an intermediate position. These Toothed Whales are less specialized than the Whalebone Whales, for in the latter whalebone appears to be a peculiar development of the gum in animals which formerly had teeth. Thus in the very young or embryonic whale (*e. g.* a Finner), teeth appear and afterwards disappear in the jaw long before the whalebone grows, indicating that the toothed condition is the primary, the brush-like arrangement of whalebone the secondary, condition.

This group (Odontoceti), while presenting teeth in most instances (though in some there are none), as in other mammals, yet exhibits certain aberrant features: in the asymmetry of the skull,* the single external nostril, which is situated far back and with peculiar knob-like nasal bones, the absence or rudimentary condition of an organ of smell, the attachment of the periotic to the skull (the tympanic not being ankylosed to the periotic), the flattened plate of the maxillary, lachrymal inseparable, the complex stomach, absence of a cæcum (except in *Platanista*), the aberrant condition of the hand, which, however, is pentadactylous, the nearly straight condition of the halves of the mandible, the presence of true capitular processes on several of the anterior ribs for articulation with the bodies of the vertebræ, the division of the sternum into various pieces, and the attachment to it of several pairs of ribs by cartilaginous or ossified sternal ribs.

* Lillie has lately attempted to account for the asymmetry of the Odontocete skull by the position of the pipe-like continuation of the larynx, which, instead of being in the middle line as in the *Mystacocetes*, is placed close to the left wall of the pharynx (*Proc. Zool. Soc.*, May, 1910, p. 781, text-figs. 73 and 74). Yet there is no asymmetry in the hyoidean skeleton of any Odontocete.

In external form the Toothed Whales vary, from the massive club-shape of the Spermaceti Whale, the head of which resembles an enormous battering-ram, to the more elegant curves of the active Dolphins. Some (as the Killer) have, and others (as the White Whale and *Neomeris*) do not have, dorsal fins, and the flippers are either short and broad, as in the Spermaceti and Susu (*Platanista*), or elongated, as in the Pilot-Whale. They vary in external coloration, from the deep black of the Pilot-Whale to the yellowish white of the Beluga, and the bluish colour of *Orcella fluviatilis* of the Irrawaddy, some being variegated with black and white, as the Killer and several Dolphins, or speckled, as in the Narwhal. Moreover, in such as *Mesoplodon*, a pair of gular grooves are present.

In the structure of the skin they agree with the general type already mentioned, *viz.* in having an epidermis of variable thickness, the surface being formed of the corneous layer which usually shows flattened cells, while the Malpighian layer beneath presents polygonal nucleated cells with interstitial fibres, and contains the pigment. Chemically, the skin shows keratin, and in certain forms, as the White Whale, is manufactured into excellent leather, and there is no reason why the skins of others should not be similarly utilized, especially when it is remembered that the skin of the Spotted Wolf-fish is made into excellent leather in Norway. In connection with the layers just mentioned, it is an interesting fact that the young (yearling) White Whale is of a leaden or bluish black hue, from the greater development of pigment at the inner border of the Malpighian layer, but as it grows older it becomes mottled, and finally assumes the soft cream-like tint or yellowish white of the adult, and the nearly pure white of the old animals. This perhaps indicates that the white is an acquired character. The pigmented layer in the skin of the Cachalot is alkaline from free soda, a great convenience to the whaler by enabling him to cleanse the ship and his clothes from the oil with which the alkali readily combines.

Beneath the Malpighian layer of the skin is a thin membrane, *e.g.* in such as Beluga, which probably represents the true skin (corium). Then come the connective tissue and fat, varying from one to several inches, 4 to 8 to 14 in. in Cachalot,

and usually termed "blubber," the main cause of the relentless persecution which these animals suffer at the hands of man. This fatty tissue attains great depth—for instance, on the snout of the Pilot-Whale, and in the same region of the Cachalot, where the soft, yellow, and oily mass ("junk") based on the upper jaw weighs between two and three tons. Besides this, however, and resting on it, is a large area, to which the term "case" is applied by the whalers, abutting on the nasal canal, the whole of which is filled with an intricate web of cellular tissue, containing in the interstices a clear oily fluid (chiefly spermaceti). Twelve barrels, or about three hundred and seventy gallons, of this material have been collected from the "case" of a single example. The great accumulation of these relatively light substances in the huge head of this species is, in the opinion of some observers, a provision for rendering the region buoyant.*

The dorsal humps and dorsal fins seen in many of the whales of this group (*i. e.* the Toothed Whales) have a large quantity of the same fatty tissue or blubber. They are simple integumentary folds with tough connective tissue and fat, as in the hump of the camel (Dr. Murie). It is interesting that these fins begin to develop in the young only after the formation of the flukes, showing perhaps that they have been acquired more recently.

As might be anticipated in animals so powerful and so active as the Cetaceans, the muscular system, which lies beneath the former tissues, is highly developed. An examination of the plates in the elaborate paper of an old friend, Dr. Murie,† shows that several powerful sheets act on the flippers, while a still more remarkable series of muscles give great power to the flukes of the tail. The more complex arrangements of this system need not be dwelt on, but a glance at these anatomical figures shows that structure in this respect conforms to function, and that the swift propulsion of the huge body through the water, the balancing and sounding actions of the flippers, and the sculling and balancing movements of the tail, so admirably told by a late colleague, Prof. Pettigrew, and which in ordinary

* F. D. Bennett, surgeon, 'A Whaling Voyage round the Globe,' 1840.

† Trans. Zool. Soc. vol. viii. p. 238, pls. 36 and 37.

progression cause the water behind the Killer, for instance, to be violently churned as from the screw of a powerful steamer, are all provided for in the smallest possible compass.

The posterior extremity of the body of the Cetacean is furnished with the flukes, which consist of strong fibrous tissue covered with skin—in some forms, symmetrically fimbriated—and with which certain of the muscles just mentioned are connected. The “blubber” again becomes very thin as it approaches the root of the tail, and finally is lost in the fibrous substance of the organ. The strength of the muscles moving the tail enables the animal to strike the water with great power vertically and at any angle. The larger toothed forms—such as the Sperm Whale—crush strong whale-boats into fragments with a single blow, or occasionally send a harpooner through the air to a distance, and the Californian Grey Whale was equally dextrous with its tail. By its aid also these huge animals spring clear of the water with all the agility of a Salmon, a feature likewise very characteristic of the smaller forms, such as Dolphins, groups of which now and then leap from the slopes of the great waves in the North Sea, making a loud noise as they again strike the water.

Two prominent views are held with regard to the homologies of the caudal flukes. Thus Owen, Flower, Huxley, Claus, and Parker suppose that the whole hind limb has been suppressed or atrophied externally, and that the flukes, like the dorsal fin, have been secondarily acquired. Ryder, again, thinks that the flukes are probably degenerate homologues of hind feet; while Gray and even earlier authors held that they represent the whole hind limb. Ryder supports his view by pointing out that the skeletal elements of the posterior limb have been atrophied from without inward, and that only traces of the femur and pelvic arch remain in certain forms. Further, that the muscles of the tail are connected with the flukes, the blood-vessels of which are arranged in a dorsal and in a plantar set as in the foot; that there is a tendency in the nerves of the lumbar plexus to be prolonged toward the tail to supply caudal muscles; that the direction of the crus, when developed, is in the line of the flukes; and, lastly, that the flukes are developed as in other limbs. Ryder is supported by Prof. Gill, who also con-

siders that the flukes are developed from the greatly hypertrophied integuments of the hind limbs, analogous to such as are present, for instance, in the hind limbs of the eared Seals, while the osseous elements have been inversely atrophied, pulled forward and reduced to supports for muscles. With all respect for this ingenious theory, the view of the anatomists first mentioned seems most to accord with fact, as also are the views of Mr. Beddard, who points out that *Ichthyosaurus*, as shown by Prof. Ahlborn, had a heterocercal tail with the vertebræ along the lower border, and yet had hind limbs.

The anterior limbs form a pair of paddle-like organs or flippers (comparable in some respects with those of the *Ichthyosauria*), which consist of the shortened arm, fore-arm, and hand, enveloped in tough integument. These limbs are attached to a shoulder-girdle formed of a flattened scapula with a forward process, the coracoid, and above it the acronicon. In the Sperm-Whale the flippers are short, broad, and truncated, in the Ziphoids small and ovate, in the Susu broad and truncated,* and the same in certain Dolphins, such as the Narwhal and White Whale (*Delphinapterus*), longer in the Porpoise, large and ovate—nearly as broad as long—in the Killer, narrow and pointed in *Pseudorca*, very long and narrow in the Pilot-White, of moderate size, narrow, pointed, and somewhat flattened in the Dolphin. These organs are used in balancing, and it may be in certain instances in sounding, as in the Ca'ing Whale, and still more in *Megaptera*, one of the Whalebone Whales, an example of which the whalers endeavoured, after it was harpooned, to drive on the beach at Scotsraig, near the mouth of the Tay, but it sounded with its long white flippers, and turned to deep water.

As indicated in the remarks on the tail, no traces of posterior limbs appear externally, but a rudimentary pelvic bone (ischium, though Delage considers that it represents the ilium and pubes as well) exists on each side for the attachment of certain muscles, except in the Susu (*Platanista*), in which it is absent.

The skeleton of the Toothed Whales presents certain distinctions when compared with that of the Whalebone Whales,

* See an important memoir on the manus of this form by Sir William Turner (Proc. Roy. Soc. Edin. vol. xxx. p. 508, with text-figs., 1910).

the most conspicuous differences existing in the skull, which is asymmetrical in the toothed forms. Moreover, considerable differences exist between the various Odontoceti themselves—for instance, between the skull of *Hyperoodon*, with its great maxillary crests, and the flattened skulls of *Monodon* and *Delphinapterus*. In the Ziphoid Whales and *Platanista* (Susu) there are great maxillary crests. The skull in the Toothed Whales is often broad and depressed, but the snout may be much elongated, as in the Dolphins, the Ziphoids, and the Susu. The nasal bones occur as “nodules or flattened plates applied closely to the frontals” (Flower), and not taking any share in the roof of the nostril.* The lachrymal is either fused with the jugal, “or, when distinct, very large, and covering the greater part of the orbital plate of the frontal” (Flower). The tympanic bone is not fused with the periotic, which is only held in position by ligament. The parietals do not meet above, but the space is occupied by the large supra-occipital. The pterygoids are short, thin, involuted, and form with the palatine process the outer wall of the posterior palatine air-sinus. In Physeteroids these bones are only hollowed on the outer side. In *Ziphius* the premaxillaries are expanded at the sides of the nares, hollowed, and with elevated margins, while the right is more developed than the left. These bones in the Toothed Whales generally bear no teeth, and are characterized by their great length; moreover, they are ensheathed laterally by the maxillæ. In the Ziphoids also there are distinct malar bones, and the pterygoids are large and meet in the middle line. The meso-ethmoid is densely ossified, and in *Mesoplodon* it coalesces with the others.† The premaxillaries are convex in front of the nares in the White Whale (*Delphinapterus*). The halves of the mandible are almost straight, deep posteriorly, and they form a true symphysis anteriorly. The symphysis is generally short, except

* Short nasals occur in the Saiga, and the spiracular sinuses of this form and the Tapir are, according to Dr. Murie, homologous with those of the Cetaceans (Trans. Zool. Soc. vol. viii. p. 242, &c., text-fig.).

† Principal Sir William Turner’s able account of the skeleton of this form may specially be referred to. He observes that “the meso-ethmoid septum was prolonged into the upper end of the medio-rostral gutter for 8 cm., and was embraced anteriorly by the medio- (meso-) rostral bone” (Proc. Roy. Soc. Edin. vol. xxix. p. 687, with text-figs., 1909).

in the Sperm-Whale, and in *Mesoplodon* the halves of the mandible may not be fused at all.

The cervical vertebræ are free in the Susu, White Whale, and in *Monodon* also, or with irregular unions, the atlas and axis being free; in *Physeter* the atlas alone is free, in *Ziphius* the three anterior vertebræ are united, the rest are free; in the Porpoise the first to the sixth have coalesced, and sometimes the seventh joins them. In *Orca* the bodies of the first and second and sometimes the third are united; while in *Globiocephalus* the anterior five or six are united. In *Pseudorca* the first to sixth or seventh are united, and the bodies of the lumbar vertebræ are more elongated than in *Orca*.

One of the most interesting features in connection with the whales is their method of respiration, and it has been more or less carefully investigated in the group now under consideration. Air-breathing animals entirely confined to the water, where they find their food and, moreover, have in its depths freedom from pursuit, must of necessity present special modifications of the typical mammalian organs. Externally, the Toothed Whales have a single blow-hole or nostril, which is generally transverse and crescentic, with the horns of the crescent pointing forward, though in the Susu it is longitudinal, linear, and median, and in the Sperm-Whale longitudinal, *f*-shaped, and to the left of the median line. The blow-hole closes by its own elasticity, but opens by muscles. Except in the Sperm-Whale the aperture is on the top of the head, far removed from the usual position in mammals. The air is conveyed by the nasal passages, which have sinuses or spaces, to the laryngeal apparatus, the distal portion of which (arytenoid cartilages and epiglottis) is remarkably elongated—forming, indeed, a tube with an enlarged end—which is grasped by the muscles of the soft palate, very much as in the young marsupial in the pouch. Thus, when the blow-hole is closed and the larynx grasped, the whales can swallow their food without the danger of admitting water into the windpipe. They rise to the surface for air, projecting the blow-hole and blowing—that is, expiring the air from the lungs and rapidly drawing in fresh air. The condensation of the warm moist air from the lungs forms a column of vapour, which shoots to a greater or less height in the air. In the case

of the larger whales this expired air is sometimes so impure as to have a foetid odour, and blackens lead paint. The lungs are capacious so as to enable the animals to sustain immersion for a considerable time, but the ribs are less free than in the Right Whale. A comparison of the thoracic chambers of the Whalebone Whales with those of the Toothed Whales certainly gives the impression of greater powers of expansion in the former, the skeleton of the thorax in the Toothed Whales approaching more nearly that of the Seals. Yet a large Sperm-Whale remains about an hour below water, sometimes even longer. When it comes to the surface, it sends off obliquely upward and forward a succession of spouts at intervals of ten or fifteen seconds, the expirations, according to Bennett,* making a rushing noise like surf-waves, but no sound connected with inspiration is heard. The smaller Toothed Whales would appear to remain a much shorter time under water, and such as the Ca'ing Whales in respiring make a considerable noise, somewhat like the sudden escape of steam from a valve, or still more like the puff of a gas- or oil-engine. Yet it sometimes happens that a large Finner will thrust its head above water, as at the entrance to Lochmaddy, within a few feet of a boat, perhaps for observation, and no sound be heard or vapour seen. The boatman, in alarm, in this case, shouted that his frail craft would be swamped by the tail as the Whale went under, but, as it happened, the Finner, after inspecting the boat for some seconds, quietly slid below the surface, and, being suspicious, had turned its head seaward and passed out of the loch into the Minch. As on this occasion the sea was as smooth as glass, the blowing of a Whale in the loch would have been seen for miles; indeed, the heads of the Seals were everywhere conspicuous. Seeing that such forms must come to the surface to breathe, the mode in which they respire during sleep, and, indeed, the position during the latter condition, are at present obscure. Some whalers are of opinion that the Right Whale sleeps head downward for hours in the water, or at least below the surface, while its tail is at the surface,† and that one has been harpooned in this position. A recent writer, indeed, supports this view by the case of a

* 'Narrative of a Whaling Voyage, 1840.'

† D. Gray, 'Scottish Fishery Board's Report, 1889.'

Narwhal which he found quiescent, and apparently asleep at the surface with its head immersed, and is of opinion that in Whales respiration is suspended during sleep. As stated, however, in 1885, when the matter was first brought forward at the Aberdeen Meeting of the British Association (where Mr. Gray read his paper), further observations are necessary. Collett* and Lillie† both refer to the views of whalers, who think that after storing their lungs with air the Finners can remain eight or ten hours under water.

The organs of the circulatory system are so similar in most respects to those in ordinary mammals that they need not be alluded to, save on one point, *viz.* the presence of numerous spongy networks of blood-vessels (*retia mirabilia*), such as those in the region of the spine, which by some are supposed to be connected with respiration, but which may also serve for the interchange of material between the lymph and blood, and therefore connected with nutrition; or the network may supply pure blood to the spinal cord and brain during immersion, and when great pressure on the lungs exists.

As parts of the digestive system (the next subject for consideration), the teeth form a characteristic feature. They are of the kind called "homodont"—that is, nearly alike, the only exception being the Zeuglodonts (of which the skull and vertebræ only are known) of the Eocene period of North America.‡ The Zeuglodonts, however, differ considerably from the living Toothed Whales—in fact, they hold an intermediate position between the Toothed and the Whalebone Whales. The teeth anteriorly are simple and conical—the first three in the premaxillary, and therefore corresponding with incisors, the next is also simple and conical, but it does not exceed the others in size. Then follow five teeth with two roots, and compressed, pointed, denticulated crowns. The teeth in the Dolphins are held by Kükenthal and others to belong to the milk-dentition, and therefore that they are truly diphyodont, like most terrestrial mammals.

* Proc. Zool. Soc. 1886, p. 263.

† *Ibid.*, 1910, p. 790.

‡ Giebel, Jourdan, and D'Arcy Thompson think Zeuglodonts are allied to Seals and Carnivores, not to Cetaceans.

In the Sperm-Whale the massive teeth, which some (with a tinge of romance) say the animal uses as lures for the cuttle-fishes on which it feeds, have no enamel, only dentine covered with cement, and they form good ivory. In the allied *Ziphius*, again, only one tooth occurs on each side near the anterior end of the mandible. In *Mesoplodon* these form strong tusks (one on each side), larger in the male than in the female—indeed, it has more than once happened that this form has been described as edentulous, since they are sometimes hidden in the gum, or may have been lost. In the Bottle-nose (*Hyperoodon*) they are minute and entirely concealed in the gum, so that the animal is practically toothless.* In the Susu they are numerous, sharp in the young, worn in the old. Amongst the Dolphins the teeth, as a rule, are more or less numerous in both jaws. In the Narwhal, however, besides some irregular rudiments, only a pair occur in the upper jaw-bones (maxillaries). These are concealed in the female, but in the male the left tusk is more than half the length of the animal, with a sinistral spire.† The teeth of the Killer are powerful organs for prehension—sharp in the young, blunt and sometimes angled from friction in the old animals. The crowns are coated with enamel.

The stomach in the Toothed Whales is complex, some authors attributing no fewer than six or seven chambers to that of the Bottle-nose. Others, again, are of opinion that only two compartments exist in the stomach of the Pilot-Whale, but, as Dr. Murie, in his able memoir, states, there are at least four. The first cavity in this species (Pilot-Whale) is the largest—and this in the Porpoise is characterized by its pale, tough, non-vascular lobulated folds; the second a globular sac, with highly vascular ridges in the Porpoise; the third also rounded; while the fourth is an elongated cavity with the pylorus at the end of it. There is thus a certain resemblance to the condition in the Sirenians and in the ruminant ungulates, such as the ox and sheep.

It is an interesting fact that these huge inhabitants of the

* As in the examples in many museums.

† Some suppose it pierces the ice with its tusk to breathe; others that it uses it as a spear for fishes. Occasionally two tusks of nearly equal length are present.

ocean prey to a large extent on cuttle-fishes. Thus the Sperm-Whale feeds on these for the most part, though it also swallows fishes, such as the cod, albicore, and bonito. It has been supposed that this whale descends in the water and opens its mouth widely, so as to expose the teeth as a lure, as already indicated, but the great numbers and often large size of the cuttle-fishes in the regions frequented by the Sperm-Whale make capture by the ordinary method probable, and Lillie has supposed that certain marks and abrasions on the skin of the head of this whale are due to the suckers of gigantic cuttle-fishes. That teeth are not absolutely necessary for the capture of the squids and other cuttle-fishes, the case of the Bottle-noses (*Hyperoodon*) sufficiently proves, since they are practically toothless; yet to a large extent they live on these creatures (e. g. *Gonatus fabricii*). Holothurians are also found in their stomachs.* The Narwhal feeds on similar forms, besides small fishes and crabs. The Susu of India, again, preys on fishes, such as *Wallago*, *Saccobranchus*, and species of *Clupea*, and Dr. John Anderson, who has written an important memoir on this form, finds that it pursues the fishes into the paddy-fields, and thus grains of rice may readily get into its stomach. The Porpoise, White Whale, and the Dolphins, again, live mainly on fishes, the destruction of food-fishes by the Porpoises alone on our shores being noteworthy; and, as digestion goes on rapidly, the lenses of the eyes and the otoliths are soon the only recognizable parts in the first stomach. No provision, indeed, exists for the passage of other than semi-fluid material into the gut, for the pyloric opening is minute. The most predatory of the whole series, however, is the Killer (*Orca*), the only one which feeds on animals with warm blood, though it varies its diet by occasionally devouring fishes. This powerful Whale swiftly pursues Porpoises and Dolphins, seizes them with its powerful teeth, and swallows them entire. The same fate befalls the nimble Seals, the skins of which, turned inside out, it ejects by-and-by from its stomach, after the manner of birds of prey with balls of hair, or like the

* It is curious that the Teleostean "dolphin" (*Coryphæna*) also feeds on cuttle-fishes. This may be of interest to those, like Dr. Jungklaus, who think that the absence of the first stomach in the Ziphoids is associated with their diet of cuttle-fishes.

Chimpanzee, with the feathers of the birds it eats. The Killers, indeed, are the terror of their neighbours in the ocean, for a few of them will drive a herd of White Whales shorewards in terror, and they even beach themselves in their efforts to escape these predaceous animals, which bite large portions from their fleeing prey, so that the surface of the water is covered with oil and blubber, for, like other carnivorous forms, they kill and lacerate more than they can possibly eat. The fondness of *Orca* for the White Whale seems to be the explanation of the pursuit of a white-painted boat off the Outer Hebrides by a large example. The fishermen on board had great difficulty in beating it off with oars and a boat-hook, and as quickly as possible gained the shore. The larger Whales, such as the Blue Whale (Sibbald's Rorqual) and the Hump-backed Whale (*Megaptera*), are also attacked by the Killers, and severely lacerated or killed. The great voracity of these animals is well shown in the careful description of a specimen, 21 ft. long, by Prof. Eschricht, who found that the first stomach was about 6 ft. long and 4 ft. broad. On opening it he at once discovered five or six Seals, some large, others small, all flayed, and so closely intertwined that it was necessary to pull them out one by one to count them. But this was not all; gradually Porpoises were disclosed, one entire, the rest more or less digested, or represented only by bones. The examination by this competent anatomist showed that when the contents were carefully assorted no fewer than fourteen Seals and thirteen Porpoises had recently been devoured. The Killers frequently attacked the young Californian Grey Whales, and have been known to pull down a captured Whale when boats were towing it to the ship.

The sense of sight in most of the Toothed Whales is tolerably acute, and, indeed, the eye of such as the Killer is larger in proportion than that of the Whalebone Whale. Many of the larger forms have a habit of thrusting their heads above water to reconnoitre when they suspect danger, as, for instance, the Pilot-Whales when they have been embayed, or the Sperm-Whale when hunted. Though the auditory canal is small and there is no external ear, the sense of hearing is fairly developed. The organs of smell are, on the other hand, in a rudimentary condition or apparently absent, and in this respect they are inferior

to the Whalebone Whales. Taste would not appear to be highly developed, and the tongue is more or less fixed to the floor of the mouth. Many of the Toothed Whales are extremely sensitive to their surroundings, and some observers have supposed that, for instance, the Sperm-Whales are enabled to communicate with their fellows at long distances, or at least that the latter, especially the females, become aware of danger to their fellows, and endeavour to succour them.

The general acuteness and the social instincts of the Toothed Whales are highly developed. The dexterity of a pair of Ca'ing Whales in surveying a series of salmon-stake nets is noteworthy. Their strong social instincts often lead to their destruction, the whole "school" or herd keeping together and being driven by encircling boats on shore. It would be difficult to find a better illustration than that which occurred in Scalloway Harbour (Shetland) a season or two before 1871. More than two hundred of these Whales had been driven by a chain of boats into the harbour of Scalloway, which formed a fatal *cul-de-sac*, communicating with the outer sea only by a narrow inlet. The slaughter of the unfortunate animals was at its height in the confined area, in which the Whales were so packed that boats and men were upset in the deeply dyed water, when a large old male, approaching 30 ft. in length, broke through the boats on guard, passed along the narrow inlet, and, in spite of opposition, reached the open sea. There he swam about a short time, but, finding himself alone, he once more headed for the inlet, passed the boats, and was killed in the centre of the others in Scalloway Harbour. The men justly regarded him as the leader of the herd.*

In connection with the reproduction of the Cetaceans, a feature of moment in the structure of the adult male Porpoise is the great size of the testes, which in July occupy a large share of the abdominal cavity, and at first sight are apparently out of proportion to the needs of the animal, which is often seen in pairs all round the coasts of Britain. It is true, at a glance, in Shetland one hundred and fifty or more may be observed during the same month, disporting themselves (pro-

* The skulls of the Ca'ing Whales are generally used as props for boats at Scalloway, a purpose for which their shape peculiarly fits them.

bably feeding) along the margin of a voe or bay, the black specks at a distance resembling a swarm of ducks. The penis is large in most Cetaceans, and especially in the Porpoise, in which the tip is slender, almost probe-pointed, with the aperture of the urethra just within the extremity. The size of the testes, which greatly exceed in proportion those of the polygamous ram, would point to similar habits in the case of the Porpoise, yet there is no clear evidence on this head.

Further, at St. Andrews, in July, single Porpoises have often been noticed swimming quietly in a circle near the commencement of the East Rocks, and they have been found to be adult females accompanied by their young, which may be observed, as the mother rolls on its side, snapping at the mammæ. Moreover, it has happened that the suckling has been captured in a salmon stake-net, or stranded on the beach, whilst on one occasion an adult female was caught in a neighbouring stake-net with the milk flowing from the teats* on slight pressure, as when laid on a slab. Like certain other forms, the Porpoise therefore seeks the shore for reproduction. Such may also have been the reason why a Ca'ing Whale of 12-14 ft. sought the beach at the laboratory in October some years ago, and was almost stranded, until, by a desperate effort, it reached deeper water, and in its fright headed for the open sea with all speed.

Like the Whalebone Whales, the toothed forms are for the most part captured by the harpoon, the harpoon-gun of modern times being so efficient a weapon as sometimes to kill the smaller forms by a single discharge. The modern harpoon is fired from a gun fixed to the bow of the whaling-boat, and has a screwed point containing an explosive, which is fired by a seconds fuse. While dealing destruction, for instance, in the thorax behind the flipper it does not disengage the flukes of the harpoon from the tissues, so that the "line" (rope) from the boat still holds. Whether the Toothed Whales can be profitably caught by the Japanese method of throwing a large rope-net over them and towing them to shore alive remains to be seen. The large Whalebone Whales are thus captured. The most

* *Vide* "Chemical Composition of the Milk of the Porpoise," by Prof. Purdie, F.R.S., 'Ann. Nat. Hist.' December, 1885, and 'Chemical News,' October 2nd, 1885.

valuable species is the Sperm-Whale, the fishing for which was begun by the British in 1775, and ceased when it became no longer remunerative in 1853. The fishery was instituted much earlier by the Americans, who still carry it on. The pursuit of the Sperm-Whale differs in some respects from that of the Greenland or Right Whale, since it occasionally charges the boats, striking the men out of them with its tail, or rolling over on its back so as to bring its lower jaw more readily into action, it bites the boats. Even the ships themselves, it is said, have been attacked and sunk. A good whale yields ten tons of oil (= sixty barrels), besides spermaceti. Moreover, the intestine frequently contains a valuable concretion called ambergris—a bezoar. This species ranges over most seas, the fishery being chiefly conducted in the warmer parts of the Atlantic and Pacific. They go about in “schools” of males, females, and young, though old males are frequently solitary. It is occasionally stranded on our shores, and is captured with other forms at the British whaling stations.

The Bottle-nose (*Hyperoodon rostratus*) abounds in the Polar regions, and is supposed to come southwards in autumn and winter. It is hunted near the ice-edge from the coast of Labrador to Nova Zembla, chiefly in May, June, and July. It is not very long, however, since attention has been directed to it; the first clue was given by a ship from Peterhead in 1877, for, failing to catch Seals, it turned its attention to the Bottle-noses. They have been specially hunted since 1882, in which year two hundred and three were captured by the late Capt. David Gray, of Peterhead. The Norwegians still pursue them, but the British whalers have not found them remunerative. An average specimen yields 22 cwt. of oil, five per cent. of which is spermaceti.

Of the fresh-water forms, the remarkable *Platanista*, or Susu, is confined to the Brahmaputra, Indus, and Ganges, as far up the rivers as the water will float it. It is caught by a bamboo shaft with an iron barb loosely let into the end, and to which is attached a long line wound round the bamboo. It is eaten by many of the low caste Hindoos, the Sansee women being particularly fond of it. Its oil is used as an embrocation for rheumatism, for burning in lamps, and for coating leather.

The White Whale is captured for its blubber, chiefly in the Arctic Seas, though it sometimes travels southwards, and several have been stranded or captured on our shores. One passed the Gatty Marine Laboratory on a Sunday a year or two ago, and was probably that caught shortly afterwards at Cullercoats, and described by Prof. Meek. The whalers occasionally drive them into shallow water, especially when they see Killers after them, and kill them with lances, or into narrow bays, when their escape is prevented by strong nets. One ship in 1883 secured twelve hundred.

Besides the interest directly connected with the commercial value of the Toothed Whales, the natives along the banks of the Irrawaddy believe that a bluish fresh-water Dolphin (*Orcella fluviatilis*), described by Dr. John Anderson, purposely draws fishes into their nets, and each fishing village has its particular guardian Dolphin, which receives a special name. Moreover, suits are not infrequently brought into the native courts to recover a share in the capture of fishes in which a plaintiff's Dolphin has been held to have filled the nets of a rival fisherman. It need hardly be said that this superstition makes it difficult to obtain specimens.

A few remarks may be added about the homologies and the probable origin of the peculiar mammals just considered. Unfortunately Palæontology gives comparatively little help in the solution of these problems, though, as Sir William Flower suggests, it is possible that their absence from the Cretaceous seas may be accounted for by the supposition that the group was originally a fresh-water one, like *Platanista* of the Ganges, and the *Inia* of the Amazon, both of which retain certain generalized characters.

From the complex stomach of the Toothed Whales, the simple condition of the liver, and the structure of the respiratory organs, the great anatomist, John Hunter, was of opinion that they approached the Ungulates, or hoofed animals, the primary form of which was probably omnivorous, like the pig. Others, again, think that they have been derived from the carnivorous animals through the Seals and Walruses. Prof. Huxley sees in the teeth of *Zeuglodon* the connecting-link between the Cetaceans

and the latter group (*viz.* the Seals and Walruses). Prof. Ryder, of the University of Pennsylvania, agrees with him, and, further, believes that the terminal parts of the posterior limbs are represented externally by the flukes. Prof. Albrecht links them with his hypothetical Promammalia. Sir William Flower, again, who thinks the Whales were derived from terrestrial mammals with four limbs, with a hairy covering, with sense-organs—especially smell—adapted for living on land, strongly objects to the views just mentioned, since the Seal has been adapted for its aquatic life by the peculiar development of its hind limbs, while the tail is rudimentary. The greatly developed hind feet functionally represent the tail of the Cetaceans in which the hind limbs are absent. He thinks it difficult to suppose that when the hind limbs had once been so well adapted for swimming they could ever have been reduced and their action transferred to the tail. The animal must have been in too helpless a condition to maintain its existence during the transference. He considers it more reasonable to suppose that the Whales were derived from animals with large tails, which were used in swimming, and eventually with such effect that the hind limbs became no longer necessary. He instances such tails, for example, as in the American Sea-Otter (*Pteroneura sandbachii*), or the Beaver.

These theories, however, leave the inquirer very much where they found him, and there is still a want of anything approaching a complete ancestry of the remarkable animals which have formed the subject of these remarks. The absence of such explanations, however, detracts little from the interest associated with the striking modifications of mammalian structure, the social and other instincts, the economic value, and the peculiar habits which make them traverse the seas from the icy Polar regions to temperate latitudes on the one hand, and on the other pass up fresh-water rivers for more than a thousand miles. Their whole organization marvellously adapts them for their special existence, and it can only be a cause for regret that their persevering pursuit by man, aided by every modern invention, is in many cases rapidly thinning the ranks of animals so full of scientific as well as general interest.

Finally, few, even among zoologists, have devoted attention

to the relations which the Cetaceans—large and small—have to the marine fishes. Most of the Toothed Whales devour fishes or cuttle-fishes; certainly those of our coasts are chiefly piscivorous or carnivorous. The effect of removing from two to five hundred of these large fish-destroyers in a single season must, from the standpoint of those who believe in the impoverishment of the sea, give the food-fishes a better chance of survival. Yet no change has ever been noticed in regard to increase or diminution. The swarms of Herrings and white fishes and the abundance of Salmon remain as before. The same reflections arise in considering the recent captures, at the various stations in the British area, of the great Finners and Humpbacks (Whalebone Whales) in hundreds. Whilst some of these live largely on crustaceans, such as the *Euphausiacea*, or “Krill” (those on our coasts taking *Meganyctiphanes norvegica*), others frequently devour Herrings and other fishes in quantities, the annual aggregate being enormous. It has not been shown that the removal of these has in any way modified the abundance or scarcity of the sea-fishes, though their capture is unpopular with the fishermen, perhaps on the ground of doing them service by driving the shoals of Herrings nearer the coast. The destruction of the food-fishes by the two groups (Toothed and Whalebone Whales) probably equals that accomplished by man with all his modern apparatus. Yet the wholesale removal of such numbers of both kinds of fish-destroyers makes no change in the fish-supply. The resources of Nature are of so gigantic a kind as to be practically unaffected. It is no refutation of this view to point to the fact that in every civilized country the food-fishes near the shore are fewer or more difficult to capture than before, and this in countries where no trawling has occurred. Every food-fish when molested becomes more wary, and, though the larger forms are fewer in a given area which has been much fished, yet there is no scarcity of fishes. Just as the resources of the sea are not materially affected by the presence or absence of the great fish-destroyers, so the persistent and widespread efforts of man do not impoverish the sea to a serious extent. The negative results of the present costly International Fisheries’ work and the now ominous silence on the head of the impoverishment of the sea (the mainspring of the undertaking)

speak for themselves, and corroborate the opinions expressed eight years ago as to the International Scheme* :— “The Government having elected to test, for instance, whether the views stated in the ‘Resources of the Sea’ hold, or if the opinions of the vast majority of the fishing population and others are more worthy of confidence, *viz.* that great deterioration [in the sea] has been caused by man, and that man can by various measures control that deterioration, it may after all be best patiently to wait for the result. Though the experience may be costly, it may likewise be salutary. Yet there is no fear of extinction of any species, especially of those important to man.” Before and since that was written hatcheries for sea-fishes have striven for the cure of this “impoverishment,” yet they have not convinced many experienced observers of their necessity, and have not yet given undoubted proof of their benefits, though there is no objection to affording a longer period of probation if that were demanded. A few “schools” of Porpoises or of the larger Whales would rapidly dispose of the comparatively small (though costly) additions on this head without affecting the general supply. Again, the ovarian contents of a few fishmongers’ shops in March would far outnumber the total of the larvæ placed in the sea by the laborious efforts of all the hatcheries, yet the balance is unaltered. The scale of Nature’s work in the ocean is beyond the action of such pigmy measures, and the study of the relation of the fish-eating Whales to the fisheries shows how completely beyond man’s power it is to affect the survival of the ordinary food-fishes in the sea.

* ‘British Fisheries’ Investigations and the International Scheme,’ Dundee, April, 1903, p. 33.

AN OBSERVATIONAL DIARY ON THE DOMESTIC
HABITS OF THE SPARROW-HAWK (*ACCIPITER*
NISUS).

BY EDMUND SELOUS.

(Continued from p. 68.)

BACK again at 4.40 p.m. and find the female Sparrow-Hawk covering the young as usual. She now sits so high that I can see her almost to the ventral surface. Just upon 5 she stands up in the nest, and, the next moment, flies off it, whilst almost as she does so I hear the cry of the male, and then see him obscurely amidst the branches. The female hawk makes one long graceful curve down upon him, then sweeps away, and, the next moment the male has flown out and dropped on to a branch well in my view—I get the glasses on to him and can see that there is nothing in his claws. The female has settled somewhat beyond him, and I cannot see her. Just upon 5.5, however, she flies to the nest, and as she comes down upon the rim (usual place) what looks like a small bird makes, if I am not mistaken (but in this I well may be), some movement as though to escape. In any case it is instantly eviscerated, as I gather, and distributed to the chicks, who are now seen leaping up in the nest, and seizing each mouthful ravenously. There is no pluming, red meat being instantly torn from the body, nor had I noticed any appearance of this having been plucked before. This last, however, does not go for much, since the distance and partial or complete interposition of the structure of the nest itself makes certainty here almost impossible—at any rate, something which I have not yet attained unto. From her leaving the nest to her coming down upon it again the hawk was away a bare five minutes. As far as I can interpret the matter, she must have flown direct to the male and received the prey from him almost, if not quite, in passing. Then settling, she probably made a hasty meal herself, before flying on with it to the nest. I hope, therefore, that I was mistaken (as is indeed probable) in my

suspicion that the bird moved of its own motion, after being thus brought in. The mind strives unconsciously to minimise and render inconsiderable the suffering that exists in Nature; but this is a mere weak—nay, a cowardly—concession to benevolent feelings. The feeding takes just five minutes, and the hawk almost immediately upon its close passes to the other side of the nest, and after standing there for a minute or two, covers the nest.

I now go to one corner of the plantation near to where the rendezvous between the male and female hawk usually takes place, in hopes of seeing the actual delivery of the booty on the next occasion, but the concealing properties of the foliage (more apparent to the field than to the theoretical naturalist) make this, I fear, a rather forlorn hope. I am, however, luckier than I expected, for just as I finish the above sentence (about 5.55), there is the cry of the male just above me. It is repeated, and the bird then flies amongst the beeches and settles in my sight. Almost as he does so the female comes flying up to him, and though the movements are so light and rapid that I cannot actually see the booty passed to and received by her, yet it evidently is so, for after settling for a moment quite near the male, with that curious plaintive cry which I have noted before, she flies to another branch, in splendid view, and I see that she has something in one of her claws only. It is not a whole bird, but no more than the fragment of one; it looks like the breastbone torn off from the rest, and, through the glasses, I see her now, for the first time, denude this of the feathers still clothing it, for it has certainly, I think, been partially plumed already. Then she flies with this to another tree, where I can still see her continuing the process, but, the next moment, goes straight to the nest with it—for though I cannot actually see the nest from here, I can locate it exactly. The male, therefore, not only brings in and delivers the quarry, but he delivers it, sometimes at any rate, both plucked (more or less) and in fragments, and this accords with the appearance of the object which I saw him carrying some time ago in the free air, outside the plantation, as noted. That, too, in its disc-like appearance, was suggestive either of the naked back or breast of some small bird torn both from the head and the rest of the body.

At 6.25 there is exactly the same scene over again—as far at least as I can follow it. The male flies in to the same or nearly the same place, the female comes flying up to him, seems just to pass him merely, then settles and utters the plaintive-sounding but in reality satisfied note—for whereas I had thought this a demand or petition for the morsel, it seems in reality to be the note of contentment, after having received it. In what follows, however, I am less lucky, not being able to see the hawk pluming or otherwise manipulating what she has got; but I see her, shortly, fly back towards the nest and disappear amidst the branches in which it is situated. Soon afterwards the male leaves his perch, and settles somewhere near. An interesting point to note is that, each time, the male has flown in to one point in a corner of the plantation—perhaps into the same tree, and this is either the actual one or the one next to it, in which, low down, is the deserted Jay's nest, where a dead bird—a young but fully-feathered Redstart—was placed by one of the hawks, and taken by the female on the following morning.

June 30th.—To-day, I only got to the plantation at 11.15 a.m., and disturbed the female hawk (I think) sitting on one of the trees near where I was going to take up my position. I walked to look at the nest—finding it empty—and then sat down where I had yesterday, wishing to make the same observations. In ten minutes or a quarter of an hour, there was a rushing in the air and the female hawk came sweeping through the trees towards the male, whom I caught sight of almost at the same time. It was the same as yesterday, except that the female seemed more fiercely insistent, her cry more importunate, even aggressive—indeed, it was very much like the swoop of a Lesser Skua after Gull or Tern, to force them to disgorge their fish. As before I found it impossible to see the actual delivery, and afterwards, though I got two or three views of the female hawk, I could never make out whether she carried anything, so that, getting impatient, I stalked her, as she flew from tree to tree, and, at last, out of the plantation, without being any the wiser. I then went to my usual observatory for the nest, and, in a few minutes time, she flew in, tore up something and distributed it to the young. My reading of the whole thing is as follows:—The female hawk had become impatient for supplies and left the

nest, not to hunt for them herself, but to wait about, in this tree or that, for the male. When the latter arrived she was more than usually eager, and seized the booty from him almost fiercely. Some of it she then perhaps ate, and would have flown sooner to the nest with the rest, had I not followed her about, to escape which annoyance she flew away, but shortly returned with it as related.

I now left and on returning, at about 4.30 p.m., found the hawk feeding her young. I saw her very plainly satisfy two, not in several alternate distributions but by cramming first one and then the other with a number of bits, the meal ending with the second cramming. I then went to watch at the corner of the plantation where the male usually comes in. After half an hour or so there was his cry and, in another moment, he sailed in, and hung suspended, on spread wings just under the roof of the beeches (all quite young trees and, by consequence, not very high), presenting a most graceful and elegant appearance. His legs were stretched downwards, and in both the clawed feet he held something which was clearly a portion and not the whole body of the prey. It was, I think, as before, the breast or breastal portion of a small bird, but there was not time to consider it or to put up the glasses. The male had not hung thus for more than a second or two, when the female hawk, coming straight from the nest, accosted him in the air, yet without appearing to touch him, and as he flew out from her what he had been carrying had disappeared. So, too, the next moment, had both the birds, and so quick and *mouvementé* was it that I could not tell which was which, as they vanished amidst the foliage, in opposite directions. Not being able to do any better I sat down to watch the nest, and at 5.25, the female hawk flew on to it with her acquisition with which she, at once, fed the chicks. This lasted six minutes, and she then stood statuesquely, for some time, after her wonted manner. She had been absent from the nest, since leaving it to join the male, about five minutes, during which time she had probably been occupied in eating a part of what she had received or in plucking or completing the plucking of it, as I have previously seen her do. About 6 the male hawk again entered the plantation, but the female did not leave the nest nearly so soon, and when she did I

was unsuccessful in seeing anything except that the two were together. She stayed longer away this time, and, on her return, stood for a little while on the nest's edge without making any distribution. After that she did feed the chicks, but not in so interested a manner as usual, nor were they, on their parts, nearly so eager; also it was soon over, all which facts are explained by the interval between this and the last meal not having been a long one, so that neither mother nor children were hungry. Leave at 6.35 p.m.

In this distribution, as well as the last one, and one or two preceding it, it is to be noted that the hawk has stood upon the opposite side of the rim of the nest to that on which, from the beginning, it has been her custom to, and in afterwards covering the chicks has stepped over them in the opposite direction, and settled herself from that side. This a curious reversal, for it is not at all as if the bird stood now on one part of the nest, and now another, indifferently. On the contrary, there has been uniformity for a long time, and now, when a change comes, it is the exact converse of what was, whilst the uniformity continues.

July 1st.—Got to the plantation before 3.30 a.m. and waited in a part of it that the male hawk usually comes to. At a few minutes past 4 I heard his cry, and a little afterwards there was the cry of the female, after which it was evident that the two birds were together. A few minutes later the female flew back into the home-tree, but I did not see her on the nest when I had walked within view of it. In another five minutes or so, however, upon the renewal of the call of the male hawk, she flew, apparently, from off it—perhaps from a part of the rim where she was invisible or hardly to be seen in the still gloomy plantation. She could not, however, have been feeding the chicks, or I must have seen her. After this exit—no doubt the second one—there were the usual cries, and I saw the female fly from one tree to another, and, the last time, either into the home-tree itself or one whose branches adjoined it. From wherever she settled came the usual cry, which is uttered at intervals during a meal, discussed in this manner, for she has always fed silently on the nest. Very probably, therefore, she was feeding on what the male had brought her, but if so, she continued her meal upon the nest after she had flown to it again, at 4.30. At first she

ate, only, herself, nor did I see anything of the chicks, but, after a time, she began to give them a little, and they then became very conspicuous—like little white ghosts or hobgoblins—so that it would have been impossible to have missed them, had they been fed before—even more so than the grown bird were there degrees in impossibility. I could only see two, however, and begin to think that this may be the full number. The above tallies with a previous observation (June 24th) when the hen (from the first lightening) came twice to the nest and, each time, tore up and devoured something herself, but I could not make out that she fed the chicks before the third visit, with booty (remarkable as being brought by the male) at 8.25. Then, however, the chicks were younger, and, might have done perhaps with more sleep and less early feeding.

It was not till after 6.30 that I again heard the cry of the male hawk (as I supposed) in the plantation—but very subdued. I was then away from the home-tree, but the female had kept on the nest up to a few minutes before this, and on returning to my post again—still hearing this very subdued weak note—I found the nest empty. I now walked into the open and saw one of the hawks flying, as before, over small trees and tree-bushes, into one of which he went down. When he rose from it again, a little later, he came flying swiftly down towards me, and, as he neared me, I saw that he carried something—a fragment, smaller I thought than on other occasions, but unmistakable. He flew into the plantation, whither I followed and saw either him again still flying with it, amongst the trees, or else the female who had received it from him. I thought, at the time, it was the female, and there had been ample time for the delivery, which, as has been seen, is a very quick affair. Walking to observe the nest, I found it still empty, but, in a moment or two, the female flew on to it and began to tear up and distribute to the chicks. I think now that the subdued cry which I heard in the plantation was not that of the male but of the female hawk who had left the nest, probably impatient for her partner's arrival. I had, indeed, received the impression of another hawk flying outside the plantation, besides the one I have mentioned. Of this, however, I could not be sure. There is no reason why the female, having thus left the nest,

should not have flown abroad, but had she caught her prey, she should have been at the nest with it before and not after the advent of the male. Moreover, the usual method must now, in all cases, be assumed where there is not sufficient evidence to prove its having been in abeyance. I now left.

Coming again at 4.15 p.m. I find the bird standing on the rim of the nest as though she had fed the young, not long since. Some time between 4.30 and 5 I heard the cry in the plantation, but I could only see one bird amongst the trees, and as the female had then left the nest, it may have been hers. This bird was still there when I went back to watch the nest at 4.55, and it was not till 5.25 that the female returned to it, but instead of feeding the chicks merely sat statuesquely on the rim. There was no importunacy on the part of the chicks. In this case there has been no good evidence of the presence of the male in the plantation—the facts point rather the other way—and accordingly the female, though she is some three quarters of an hour away brings nothing back with her. This, again, looks as though she were dependent on the male for her food supply—or, at least, as though the habit of awaiting him for it, were so confirmed as not to be easily broken through.

(To be continued.)

NOTES AND QUERIES.

MAMMALIA.

Variety of the Badger.—I have just seen, in my brother's possession, a variety of an adult male Badger, taken at Broxton, Cheshire. The black in the type is replaced by a rich fawn, and the grey is faintly tinged with the same colour. Eyes and irides dark pink; nails brownish black.—ALFRED NEWSTEAD (Chester).

Grey Seal (*Halichærus grypus*) in the Dee: a Correction.—On Feb. 20th last I examined a Seal (which was captured in the Dee at Chester on Nov. 19th, 1905), in the Grosvenor Museum, Chester. I was struck by its flat head, broad muzzle, dark pelage, and the comparatively wide space between its nostrils. Feeling sure that its label—Common Seal (*Phoca vitulina*)—was erroneous, I extracted some of its teeth, premolars and molars, and found that they had the simple crowns, and the premolars the connate roots of *Halichærus*. I compared these teeth with the description and plate in Owen's 'Odontography,' and with the grinders of a Common Seal and the Grey Seal which was captured at Warrington in 1908. I am satisfied that the animal has been incorrectly identified, and that it is a young Grey Seal. Unfortunately the error has been perpetuated in Forrest's 'Vertebrate Fauna of North Wales,' p. 42, and in the 'Vertebrate Fauna of Cheshire,' p. 42, for which Mr. Oldham and I are responsible. I wish to draw attention to this correction, which supports my belief that the Grey Seal, being probably resident, is of more frequent occurrence on the coast of North Wales, and consequently in Cheshire and Lancashire waters, than the Common Seal. — T. A. COWARD (Bowdon, Cheshire).

AVES.

Man Mobbed by a Ring-Ouzel (*Turdus torquatus*).—When crossing one of our local moors some time ago I could hear at a distance the scolding notes of a Ring-Ouzel, which increased in violence as I approached. Whilst still at a respectable distance, on my making a pause, the bird—a female—came and dashed at me with some vigour. Presuming it had a nest or fledged young, I started off in the direction where it was first seen. No sooner had I commenced my journey

than it precipitated and swooped in a most violent manner, disputing my passage at every step, and I was fearful at times lest it should hurl itself against my head, but this it did avoid, though at the least possible margin of actuality. I ascertained that the young had fledged, and noticed that the male bird kept at a safe distance. When this species has young it is usually noisy and even bold in its attack on any intruder into its haunts, but this I consider mildness itself in comparison with the fierceness and vehemence displayed in the above incident.—E. P. BUTTERFIELD (Wilsden, Bradford).

Are House-Martins Decreasing?—Of late years there has been no little controversy as to whether *Chelidon urbica* is decreasing, but from observations extending over a considerable number of years it would be difficult for us to predicate with certainty that such is the case. There is little doubt but that it can be affirmed to be less numerous in many of its old haunts than formerly, but, on the other hand, it is much more numerous—especially is such the case—in its more natural habitats. The Sparrow is one of its greatest enemies, and is undoubtedly responsible for its decrease in many localities. Some property here within the last two or three years has undergone considerable repairs, which has presumably decreased the nesting facilities of the House-Sparrow, and it is astonishing how the House-Martin has multiplied in the meantime. It may be that this species is returning to some extent to its more primitive breeding haunts, where it feels more secure.—E. P. BUTTERFIELD (Wilsden, Bradford).

Distribution of the Linnet.—I do not think it is possible that White made the mistake of confounding the Twite with the Linnet when he wrote that there were “in winter vast flocks of Common Linnets,” as suggested (*ante*, p. 69). Nor is it wonderful that the Twite is not mentioned in White’s letters, for it is extremely probable it never occurred at Selborne; even on the coast of Hampshire it is a rare bird (‘Birds of Hampshire,’ p. 67), and I believe it is so everywhere inland in England, except in its northern breeding grounds. To the coast of England, as a winter visitor, it seems to be rare except in the eastern counties, where I have seen numbers in autumn and early winter. I have no authentic record of the occurrence of the Twite in Oxfordshire. With regard to the Linnet in winter, although it is true that it leaves Oxfordshire to some extent in winter, and that the great flocks we see in autumn usually leave us before winter, yet this is not always so. On Dec. 1st, 1903, I saw on a wheat-stubble the largest flock of Linnets I ever met with—it must have comprised several thousands. And on Jan. 22nd, 1904, I saw a

big flock in a clover-field on high ground. It is unlikely that these were very early returning migrants (for they commonly return in February and March), and it is noted in my journal for that day that Linnets had been numerous all the winter.—O. V. APLIN (Bloxham, Oxon).

Hen-Harrier (*Circus cyaneus*).—An immature female of this species was presented by Mr. Hugh Aldersey to the Chester Museum, by whom it was shot on the Aldersey Hall Estate, near Broxton, Cheshire; date doubtful. As this bird is now only a rare visitor to the county of Cheshire, I thought it advisable to send this record for publication. The donor told me that there is no mistake as to its being a Cheshire specimen, and shot on his estate, but unfortunately he had forgotten the date.—ALFRED NEWSTEAD (Chester).

Domestic Habits of the Sparrow-Hawk.—While reading Mr. Selous's interesting notes on Sparrow-Hawks, I was much surprised to see his suggestion (*ante*, p. 53) that a bird whose eggs had been taken about mid-May would have had time to deposit a second laying, and hatch them out by June 23rd. A little consideration would have shown that the boy's statement was almost certainly correct, and I can only suppose that Mr. Selous is unaware of the fact that the period of incubation in this species is very prolonged. Additional observations on this subject are much needed, but I believe that incubation always lasts more than four weeks, and in some cases apparently exceeds five weeks in duration. The time, too (mid-May), would be about the average date for a full clutch, while, if the eggs in question had been a second laying, they would probably not have been hatched out before the first week in August, or late in July at the earliest. In England, where four or five old nests may often be seen within a short distance of one another, it is well known that they are used as larders, and it is interesting to find that when old nests were not available, that of some other bird (in this case a Jay's) may be used for this purpose.—F. C. R. JOURDAIN (Clifton Vicarage, Ashburne, Derbyshire).

The Honey-Buzzard (*Pernis apivorus*).—The Honey-Buzzard has long been known to breed in England, but, except in Hampshire, the eggs or nestlings in the nest have been discovered only in a very few instances. I have only been able to find records of eggs or nestlings being found in Northumberland, Northamptonshire (nest of *four* eggs), Oxfordshire, and Herefordshire; but I have not yet looked up the Burnham Beeches record of breeding annually for more exact

particulars. The reputed Yorkshire eggs seem to rest on an item in a sale catalogue. There are also two old records, not exactly localized. Willughby's nestlings, found in a nest which had formerly been a Kite's, were perhaps found near his house in Warwickshire (a county in which the Honey-Buzzard has twice since tried to nest), but there is nothing to prove that this is so. The other case, I think, may be consigned to Shropshire with some show of reason. Pennant figured a bird, supposed to be a female, shot on a nest containing two eggs, "blotched over with two reds something darker than those of the Kestrel," a good description of the eggs of the Honey-Buzzard. Pennant says, in his article on this bird in the 'British Zoology,' merely that he was favoured with this specimen by Mr. Plymly; but I find in the preface to that work that Mr. Plymly is described as of Longnor, Shropshire, in the list of learned and ingenious friends from whom Pennant had received information; and, as country gentlemen in the eighteenth century did not go much from home, it is more than likely Mr. Plymly got the birds and eggs in question from his own neighbourhood.—O. V. APLIN (Bloxham, Oxon).

Decrease of the Corn-Crake, Wryneck, and Nuthatch.—The decrease of the Corn-Crake as a breeding species, alluded to by Mr. J. Steele Elliott (*ante*, p. 74), is, I fear, general in England. But the fact must not be overlooked that the numbers of this bird have fluctuated in years gone by, even in Ireland—a country always favoured by this bird. Thompson, in his 'Natural History of Ireland' (one of the best books on our birds ever written), says that in the north of Ireland the Land-Rail became very much scarcer about the same time as the Partridge, and continued so for fifteen years. They were never more scarce than in 1843, "but within the last very few summers they have, like that species, rapidly increased." This volume was published in 1850. At no time had Thompson heard Corn-Crakes more plentiful than in 1848, and they were equally abundant in 1849. Mr. Ussher, in 1900, wrote of it as common and widespread, but states that it varies considerably in numbers from season to season, and from one locality to another ('Birds of Ireland'). Sir Wm. Jardine stated that it had decreased in the south of Scotland when he wrote. Ten years previously, in the Vale of Annan, the bird was extremely common, but "during last summer (1841) only one or two pairs being heard within a stretch of several miles" ('British Birds,' vol. iii. p. 331). So that there is a remote chance of the Corn-Crake again becoming common as a breeding species in England. The chance is remote, I fear, for the scarcity

has now lasted for a very long time. My notes on the former and present status of the Corn-Crake in Oxfordshire will be found in 'The Zoologist' for 1903, p. 451, and I do not think the state of affairs has altered much or at all since then. We hear of one sometimes, but may go through a summer without hearing the bird's delightful craking. It is probably less rare in the wide meadows bordering the upper Isis than elsewhere in the county. Last summer, however, I had a treat. A Corn-Crake established itself in a clover-field on the east side of this village, where one had not been heard for years, and I enjoyed the rare pleasure (formerly a common one) of hearing the Corn-Crake's call at night from the house. I had not done so since 1904. The bird was seen when the clover was cut in the second week in July, but no nest was found, although I offered a reward for a report of it if discovered. We still get passing migrants in autumn, and if there are any standing crops in the first half of September a fair number of them get shot. This year I shot two on the 3rd, and another was killed in standing barley and not recovered. I saw another shot on the 10th. There were such great breadths of barley and beans standing on the 3rd, and these were beaten so loosely, that it is a wonder any Land-Rails were flushed. I wonder what the proportion of birds was that were *not* put up, for the Land-Rail is a hard bird to flush from heavy cover. I saw one bird in September which had pitched in a bit of barley, too badly "laid" for the machine to cut it, run out of this, and make its way in a crouching attitude over the rest of the field, hiding under one of the barley-sheaves, which lay on the ground, from time to time. This is only the second time, as far as I remember, that I have seen a live Corn-Crake on the ground in autumn.

There is evidence that the Wryneck was common in Oxfordshire at one time, and it was certainly well enough known to be called by its common name of "Cuckoo's Mate," as well as by another local name. But it has been almost a rare bird for many years, and we do not look for its regular arrival in spring. In 1903—a very wet year—it looked as if the Wryneck was coming back to us. There was a bird on the outskirts of the village during the first week in May, and on the 9th I made a note of the fact that we had three, if not four, about. I left home for a month three days later, and I never saw or heard any more of them. The next year I heard one and saw a pair at the end of April. Since that date I have only noticed occasional birds. The Nuthatch is another bird which has decreased greatly of late years. It used to be quite common here, and its sweet whistling notes were a familiar sound in the early part of the year. It is not

quite extinct, for we have had a pair coming to the drawing-room window-sill for nuts for some weeks recently (February, 1911). The only cause for their decrease that I can think of is the great increase in Starlings, which came to a head a few years ago, and has, I am glad to say, abated a little lately.—O. V. APLIN (Bloxham, Oxon).

Decrease of Corn-Crake and Wryneck.—Mr. Steele Elliott is, I believe, quite right as regards the decrease in the numbers of the Corn-Crake. I can corroborate his statement, so far as this county is concerned, that thirty years ago a pair at least of Corn-Crakes were to be found nesting in almost every large meadow. Last summer I thought I heard the familiar "crake, crake" rather more frequently than in 1909, and the delay in the hay-harvest about here, owing to wet weather, I hope may have saved some nests. I put down the serious diminution of the species principally to two causes:—(1) the destruction of the birds and their nests by mowing-machines, and (2) Corn-Crakes being killed by flying against telegraph- and telephone-wires. The destruction of bird-life from the second cause I have mentioned is sadly increasing, owing to the increase in the number of these wires. On many, if not most, railways these wires are now erected on *both* sides of the lines, and often, being at different heights, form a network of wires eight to ten feet deep, which it is impossible for wild birds to avoid on foggy nights. Platelayers find dozens of birds killed from this cause on their morning patrol of the railways. The time has now come, in my opinion, when the Corn-Crake and its eggs should be absolutely protected for, say, a term of five years at least, in the hope of saving this useful bird from its threatened extermination. Only on Saturday last (Feb. 17th) a postman not far from here put up a Partridge, which, swerving from its direct flight, came in contact with telegraph-wires, and fell dead.

I cannot speak as to the present status of the Wryneck generally, but it is now an extremely rare bird in this county. The last occurrence of the species that I have heard of in North Staffordshire was one picked up at Ellastone on Sept. 26th, 1909, injured through flying against wires. As this is a purely insectivorous species, it should also, I think, be absolutely protected, as well as its nest and eggs. In our new Staffordshire Wild Birds Protection Order, which extends protection to all our rarer and most useful birds, is included a close-season for the Woodcock after Feb. 1st, and it makes it illegal to take Plover's eggs after April 7th in any year. — JOHN R. B. MASEFIELD (Rosehill, Cheadle, Staffordshire).

“**Decrease of the Corn-Crake and Wryneck.**”—Referring to Mr. Steele Elliott’s remarks under this heading (*ante*, p. 74), very much the same state of things prevails in South-west Surrey.

Corn-Crake.—During the last seven or eight years I have personally only had three records of this bird :—(1) A nest in the village of Hambledon about the year 1901 ; from this I have an egg in my possession. (2) Three specimens were caught alive, but injured by telegraph-wires, by a man working on the line at Guildford in July, 1902. I have one of these birds in my collection. (3) A nest in the neighbourhood of Dorking in 1907. As to the probable cause of the scarcity of the Corn-Crake, I can offer no definite reason, but would suggest a succession of unseasonable summers, and possibly the new reaping-machines killing the birds, old and young, from their skulking habits. Also the reclaiming of old haunts for building purposes. It is many years now since I have heard the familiar cry. Bucknill (‘Birds of Surrey’), writing in 1900, says :—“In some years it is very much more common than in others, but over the whole of the rural district of the county is generally freely distributed.”

Wryneck.—It is worth noting that, although abundant in the parishes of Milford and Witley, the Wryneck is entirely absent from Brook (which joins Witley parish), and for the past four years I have listened in vain for its note. This is all the more extraordinary, because the bird is so plentiful not only in the parishes named but throughout the whole south-western portion of Surrey. I can offer no explanation, for the country in Brook is so well wooded, and differs in no way from neighbouring villages, being, if possible, even more rural.—GORDON DALGLIESH (Midhurst, Sussex).

Immature Glaucous Gull (*Larus glaucus*).—A specimen was shot on the shore at Deganwy on Thursday, Feb. 23rd, 1911, and presented to the Chester Museum by Dr. A. Hamilton. The stomach contained a few shore-pebbles only. Sex undeterminable. The donor writes :—“Since I first saw it, it has always more or less been amongst the large flock of Herring and other Gulls which frequent the beach in front of my house, and feed largely on the garbage deposited there.”—ALFRED NEWSTEAD (Chester).

MOLLUSCA.

A Large Squid on the Northumberland Coast.—A fine example of the large species of Squid (*Sthenoteuthis pteropus*, Verr.) was cast ashore recently on the coast of Northumberland. It was found on Jan. 8th, 1911, by Mr. H. V. Charlton, on the sandy beach between

Whitley Bay and St. Mary's Island, about three miles north of the mouth of the Tyne. Though dead it was quite fresh, and the only damage it had suffered was the loss of one eye. Mr. Charlton has presented it to the Hancock Museum, Newcastle-on-Tyne, where it is now preserved. It is unnecessary to give many particulars of this specimen, as a good description of the species has been published already (Goodrich, Journ. Marine Biol. Assoc. 1892, vol. 2, n. s. p. 314). There appear to be only about half a dozen records of its occurrence on the coasts of Britain, and apparently in only two instances has the animal been preserved. The last record that I know of is that of an example thrown up at Redcar in December, 1907, described and figured in the 'Naturalist' for April, 1908 (Hoyle, "A Large Squid at Redcar"). Our example is of about the average size. Its total length is 5 ft. 6½ in.; from mouth to hinder extremity of body, 2 ft. 9½ in.; length of tentacles, 3 ft.—E. LEONARD GILL (Hancock Museum, Newcastle-on-Tyne).

OBITUARY.

ROLAND MAURICE DIXON, B.A.

THE story of a simple, straightforward life (born Nov. 22nd, 1858; died Nov. 26th, 1910) is soon told. Mr. Dixon received his early education in Bombay, and graduated as B.A. from the University there in the year 1880, taking Botany and Zoology as his optional subjects. In the year 1884 he joined the Government Service in the Educational Department as an Assistant at the Victoria and Albert Museum, Bombay. The next year his services were placed at the disposal of the Government of India, and he was attached to the Indian Museum, Calcutta, to assist Dr. Watt in preparing a collection of raw products in connection with the London and Bombay Exhibitions. On his return to Bombay he was appointed Assistant Curator of the Victoria and Albert Museum. The following year the Museum was transferred to the Bombay Municipality, and in 1894 he was appointed to act as Curator of the Museum, and at the same time acted as Professor of Biology at the Elphinstone College, Bombay. In 1902 he was appointed *sub pro temp.* Curator of the Museum. In 1905 his services were replaced at the disposal of Government in the Revenue Department, and Mr. Dixon was transferred to Poona as Assistant Entomologist to Government. With the inauguration of the New Agricultural College scheme he was gazetted Professor of Entomology, and gave lectures in Zoology in addition to his own duties. He was the first Examiner in Entomology for the B. Agr. Degree to the University of Bombay. These appointments he held till his death at Khandala.

Mr. Dixon was a man of letters, but essentially a man of science. He was an authority on the flora and fauna of Western India. He published several original papers on the less known plants of the Bombay Presidency. But entomology was his special subject. In his earnest desire to advance the cause of science he toured all over India, both officially and unofficially, very often at great personal inconvenience. He assisted Mr. W. L. Distant with considerable material in preparing his volumes on Rhynchota in the 'Fauna of British India Series,' and also took a special interest in snakes, and made important contributions to the knowledge of their life-history.

Mr. Dixon was a man of a very kind and gentle nature and genial temperament. He was loved and admired by all who had anything to do with him. His sanctum was at all times open to any student who honestly desired information, while he took almost a paternal interest in his students.

Mr. Dixon was a member of several scientific and learned societies, both in Europe and in India. At congresses of zoologists or entomologists or botanists in India, Mr. Dixon would be asked to contribute a paper, and he nearly always had some original subject to bring forward. *Actis ævum implet non sequibus annis* was Mr. Dixon's motto, and his life was its concrete example.

JAMES DIXON.

NOTICES OF NEW BOOKS.

Convergence in Evolution. By ARTHUR WILLEY, D.Sc., F.R.S., &c.
John Murray.

THIS is an important contribution to evolutionary literature, and is an example of the Darwinian method applied to the further development of Darwinian philosophy. Convergence in evolution is no new term, but it represented more or less an idea; Dr. Willey has endeavoured in this small volume to make it a reality. His thesis is "that convergence is neither identical with homoplasmy* nor with cenogenesis,† but that it includes these and something else besides. All homoplasmy is convergence, but all convergence is not homoplasmy; and the same dictum may be repeated, *mutatis mutandis*, for cenogenesis."

* "Homoplasmy," a term proposed by Sir Ray Lankester to signify similarity of form unaccompanied by community of pedigree.

† "Cenogenesis" implies the origin of structural features by relatively recent adaptation, in contrast with "palingenesis," or primordial adaptation; both terms proposed by Prof. Haeckel.

The above quotation, with its formidable though necessary terminology, may unintentionally give an impression that this publication is of a more or less scholastic nature, an inference to be repudiated once for all, as it abounds with interesting observations, many of which are quite original. The field naturalist frequently finds an occurrence of which he is quite familiar used as a philosophical conclusion by another observer in a way that never appealed to his cognition. Thus, Dr. Willey, observing in Ceylon the flights of Crows and Flying-foxes, describes these as instances of "convergent homing," the same trees affording hospitality in regular alternation to day-flying birds and night-flying mammals. Another conclusion, well stated, is that "the basic quality underlying all animal life is the cryptic, the fear of the sun. Basking in the sun is a dangerous pastime." The chapter on "Mimicry and Homoplasmy" is fair and candid to both cautious adherents of the usual explanation of mimicry and to its advanced apostles. "*We may safely claim that the possession by noxious animals of common warning coloration is as much due to convergence as is the possession by harmless animals of a common protective coloration; and both these colour-schemes are referable to conceivable though indefinite reactions. On the other hand, the resemblances and associations between palatable and unpalatable insects are hard to explain on the tropism* theory, unless we suppose that they arose by ordinary convergence before advantage was taken of them by natural selection.*"

It is, however, impossible to do justice to Dr. Willey's enunciation of 'Convergence in Evolution' in a short notice like the present one. A great number of facts and arguments are adduced that can scarcely be appraised at their proper value except by the few; specialists will, on the contrary, be more at home with the arguments which apply to their own studies. This volume is again evidence that students of organic evolution are ceasing to believe that there is only one path through the wood.

* "Tropism means the tendency to react in a definite manner towards external stimuli."

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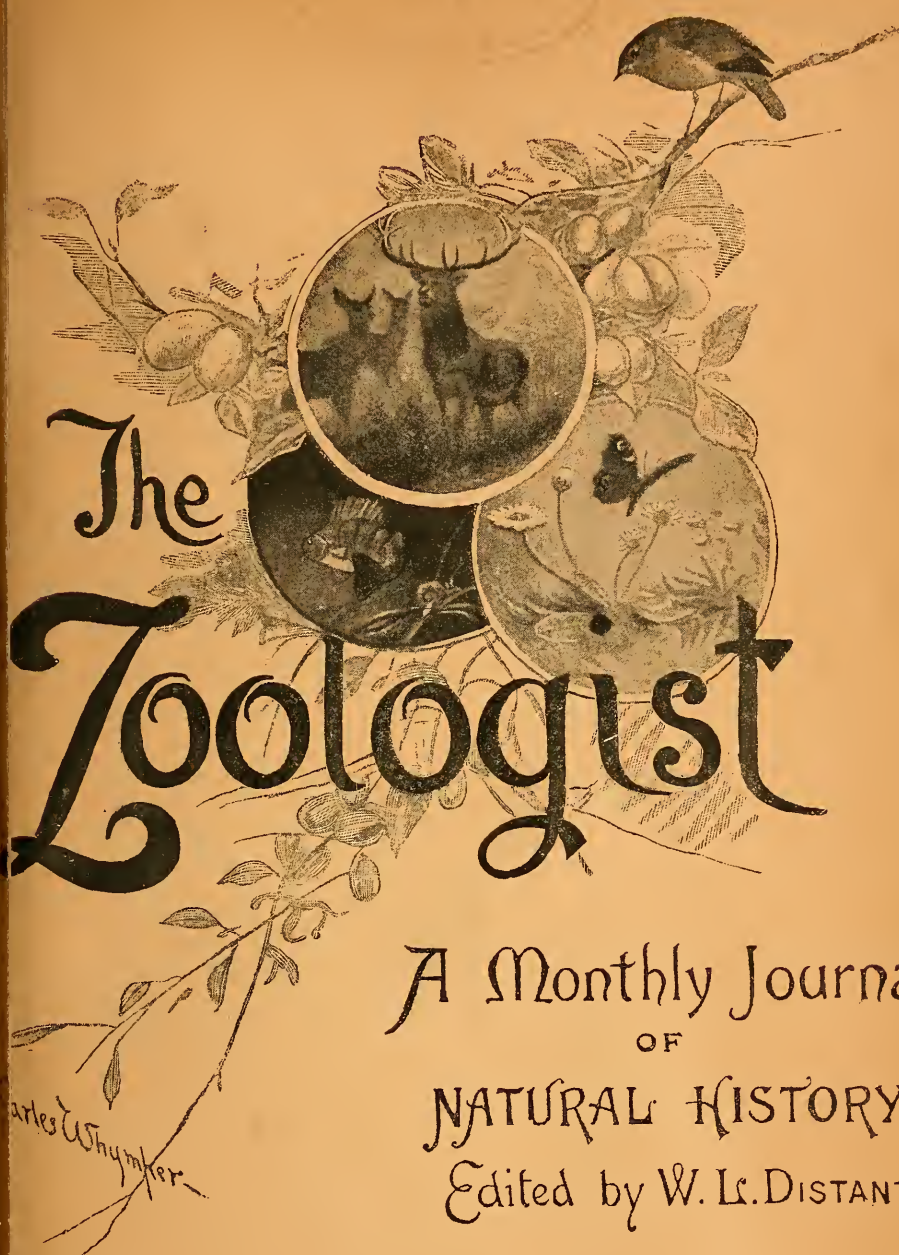
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THE ZOOLOGIST

No. 838.—April, 1911.

THE BIRDS OF THAT PORTION OF THE NORTH-EAST COAST BETWEEN TYNEMOUTH AND SEATON SLUICE, NORTHUMBERLAND.

By J. M. CHARLTON.

THE following history of the birds of this small piece of the Northumberland coast-line is of much interest, not only on account of the great number of rare species which have been shot or seen from time to time, but also because of the fact that this was one of the most favourite haunts of John Hancock, the distinguished northern ornithologist. Whenever he had the chance, Hancock used to run down from Newcastle for a few days, or an afternoon's shore-shooting along the coast between Tynemouth and St. Mary's Island. Most of these excursions took place between the years 1830 and 1876, from what I can judge by the records. He was usually accompanied by either the late Mr. C. M. Adamson or Mr. W. Hewitson, and on several occasions by Messrs. Philip Stanton, William Kell, and Thomas Harvey, who were all keen ornithologists. That these expeditions were not fruitless is shown by the large number of extracts from his 'Catalogue of the Birds of Northumberland and Durham,' which I have collected in this paper.

Many of the records for this district have been of the greatest interest and value to ornithology. First, as regards Britain: the first example of the Yellow-browed Warbler shot in the

country was obtained at Hartley by John Hancock, and the only example of the white-headed form of the Long-tailed Tit (*Acredula caudata*) obtained in England was the one found dead at Tynemouth in 1852. Secondly, with reference to Northumberland, the species which have occurred within this locality and stand alone for the county are the Yellow-browed Warbler, Rustic Bunting, Pectoral Sandpiper, Avocet, and Levantine Shearwater. One of the two Golden Orioles obtained in Northumberland was shot at Tynemouth; the fourth and last example of the Wood-Lark was procured in this district; one of the few Hoopoes was shot at Cullercoats; John Hancock mentions that the only occurrence, to his knowledge, of the Grey Plover in summer plumage was procured here; the second example of the Spotted Redshank was got here in 1831; the occurrence of the Iceland Gull is one of the few for the county. The natural hybrid between the Reed and Yellow Buntings is an unique occurrence, and the record of the Chiffchaff in winter is also of great interest, and is the only one for the county. This latter would not be of so much interest were it not for the fact that the district is so little suited to the habitation of such a frail bird in winter, when insect-life is almost entirely absent. This species frequently passes the winter in the more sheltered southern counties of England, but its occurrence so far north is extraordinary. The first record of the White Wagtail for the county was shot here.

As I have before stated, the district is very unsheltered, and affords but little seclusion to any birds which may visit it, especially of the land species. This accounts for the fact that most of the birds mentioned in the following pages have only been passing on migration, and were not making any stay in the neighbourhood. The only places which offer shelter to birds of retiring habits belonging to the Passerine species are Whitley, Briar, and Holywell denes, situated a short distance from each other, and the last two in direct communication with the sea. The rest of the country is almost devoid of trees, but here and there a few isolated clumps stand bare and rigid, facing the cutting blasts of the north-east wind. The only sheets of fresh water are at Whitley Dene and Tynemouth Park, the former, once used as a reservoir to supply the district, being

the larger. The hollow in which the water stands was formerly quarried out, and one side is almost perpendicular, which shelters the water from the wind. On the other side short, stumpy trees—elders (which tree grows better than any in this district)—grow down to the water's edge, which is shallow. This would be a very good place for wildfowl in winter, but unfortunately there are several houses on both sides, and few birds are bold enough to venture near, except perhaps an occasional Snipe or Wild Duck.

With the exception of the three valleys before mentioned the ground is flat and uninteresting, and where it is not built over is under cultivation for the greater part. But in this district, as in all others, the increasing population demands an extension of the villages, and the number of houses has increased of late tremendously. This accounts for the steady decrease in the number of bird visitors from year to year. At the present day, birds which were fairly common in John Hancock's time as breeding species are now never seen, such as the Tree-Sparrow and Quail; and it is very seldom that the large numbers of wildfowl spoken of in former days are observed. Soon, it is to be feared, a future generation will smile incredulously when we talk of the birds to be seen now. The bird-life there is a thing of the past, as is the case in many of the former haunts of the feathered world; therefore, this paper is not so much a history or description of the birds to be found there at present, but a record of former days. Still, something can yet be done to retain an occasional visitor to the coast, and this would be to stop the shooting of birds—at any rate, on Sundays—and more especially at St. Mary's Island, whither numbers of men resort, usually on the day of "rest," to slaughter anything, from a Pipit to a Cormorant, which they come across. Another fact which prevents the stay of any shore-bird in the vicinity is that the coast has no flats or slakes on which wading species usually feed. The nearest thing of the kind was formerly Jarrow Slake, but this does not come within the radius of the paper, being some miles up the Tyne, and is now, of course, owing to increased shipping, "no more." Many of the birds formerly shot on this coast would be passing to or from these flats.

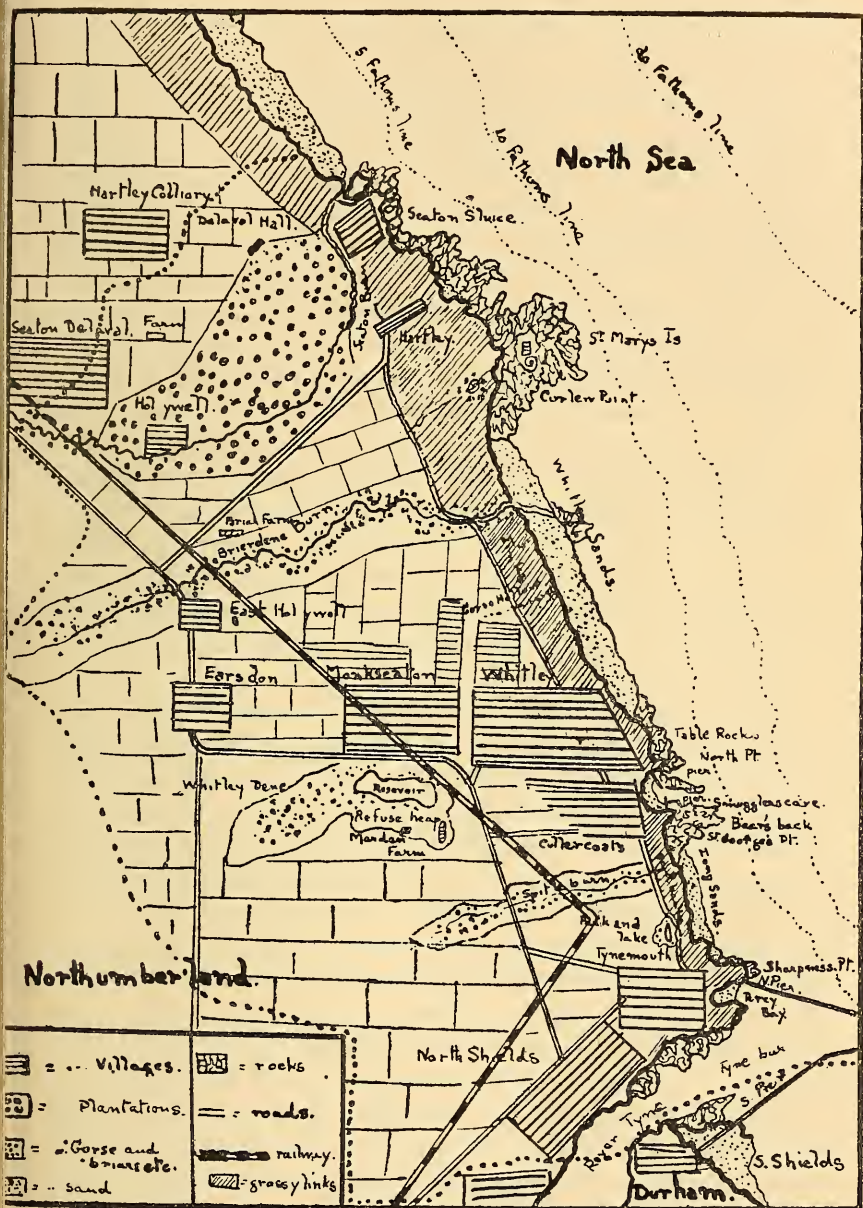
That bird-life was plentiful in former years along the coast is

well shown by an extract from Mr. C. M. Adamson's book, 'Some more Scraps about Birds':—"On the 12th Sept. 1843, I walked from Tynemouth soon after five o'clock a.m. to Hartley Island. There had been a quantity of rain, and it was very misty. On Whitley Sands a young Greenshank ran out from among some seaweed which had been walled up by the tide, and was endeavouring to fly away when I shot it. I saw some Dunlins on some wet mud, and shot into a flock of them, killing two; another bird fell wounded, which I followed, and was pleased to find a Little Stint. I afterwards saw six birds, which I thought were Dunlins, feeding in a pool of rain-water high up on the sands, which part is only covered at spring-tides. I killed three of them, and was again pleased to find them Little Stints; the others settled again amongst Dunlins, when the difference in size was easily to be seen."

Mr. Duncan has also kindly supplied me with a list of the different species he shot in a single day (Aug. 16th, 1866) at St. Mary's Island:—Sheld-Duck, Teal, Curlew, Whimbrel, Oystercatcher, Ringed Dotterel, Redshank, Knot, Common Tern, Sandwich Tern, Great Black-backed Gull—thirty specimens in all. This is a very large "bag" for such a place as this, and it goes to prove that birds were not uncommon here in former years. Mr. Duncan shot with a single-barrelled muzzle-loader on this occasion, from daylight until nearly dark.

Yet even in recent years, during very severe weather, numbers of birds have been seen in a single day. As an example, I will take a spell of very stormy weather which was experienced between Oct. 24th and 28th, 1909. On the 26th my brother observed the following birds:—Ten Golden-eyes, a Great Northern Diver, five Common Skuas, all the commoner Gulls, a Gannet, flocks of Dunlins, Purple Sandpipers and Ringed Plover, several Redshanks, Snow-Buntings, and a Brent Goose.

I will now proceed to trace the coast-line. A few hundred yards from the mouth of the Tyne the land suddenly takes a sweep inland, forming what is called Percy Bay, at the extremity of which are what are known as the "short sands." On the cliffs above this was formerly situated Willy Dean's cottage, in which Thomas Bewick lodged in 1801. The promontory to the north of this bay is known as Sharpness Point. The coast at



Jim Charlton.

Map of S.E. Northid. coast

Scale 1 inch = 1 mile.

Tynemouth is very high and rocky, but about half a mile from the mouth of the Tyne the cliffs become lower, and composed of soil and clay and covered by grass, gradually sloping to the shore, a long stretch of sand being exposed at low tide. These conditions prevail for about half a mile, until Cullercoats is reached, where the banks become steeper and rocky. The land here goes out into a point, known as George's Point, which has formerly extended for a quarter of a mile out to sea, as the rocks at the extremity testify, and part of which are known as the "Bear's Back," owing to their form. This point is, unlike any other part of this coast, composed of an outcrop of yellow sandstone. The coast-line then turns inwards, forming a small bay, at the extremity of which is situated the village of Cullercoats.

During a high tide in stormy weather the water in this bay is comparatively smooth, and consequently birds hard pressed by the wind and waves seek refuge in it. On account of this, and also because numbers of small fish frequent the waters here, there is generally a bird visitor to be seen swimming about and diving in all conditions of weather, even at the present time.

The shore then extends outwards, forming another point, which is bold and rocky; then gradually the rocks extend inland, forming what are known as the "Table Rocks." Now the cliffs, which have attained the height of about forty feet, disappear at the town of Whitley, and low grassy links and sand-banks take their place, with a stretch of sand about three hundred yards wide before them. In former days this was a favourite resting-place for the smaller migrants, among the clumps of gorse, but now that promenades have been built along the coast the birds prefer to move on without resting. About half a mile along a small stream empties itself into the sea; this is known as the "Briar Burn." If we follow it up for a short distance, as many a tiny bird migrant has done before, we will find that it runs through a small valley studded with clumps of gorse, thorns, and briars, from which latter it takes its name. In spring it presents a very pretty sight, and one which seems quite foreign to the adjacent surroundings of bricks and mortar which have sprung up in the last year or two.

About five years ago I used to come here daily during the spring migration, and note the new arrivals as I came upon them either skulking in the gorse-bushes, or uttering their feeble notes from the topmost sprays of the thorns. To me there is nothing in the observation of bird-life to compare with the pleasure and anticipation of looking out for and recognizing each new species as it arrives. In those times the dene had a notice at the bottom and top of it: "Trespassers will be prosecuted, and stray dogs shot"; and on each side: "The game and shooting rights over this land are strictly preserved. By order." What irony the latter is! I think in all my visits I have seen but two Partridges and an occasional Snipe on the land! But as far as the wild birds were concerned, this state of affairs was ideal. Whether the notices frightened them, or they did not wish to go, I do not know, but despite the fact that a public footpath ran across it at one point, I never saw anybody wandering off the beaten track.

The sand-banks prevail for about a mile and a quarter, the coast gradually turning seawards, and forming a point, at the extremity of which is a small island, by name Bates', or St. Mary's. This is not an island, strictly speaking, as the water only surrounds it at high tide. This spot is mentioned more perhaps than any other in the following paper, which is due to the fact that many of the birds passing along the coast touch at this place, and are thereby procured. There is a space of about a hundred yards between the island and the mainland, and birds passing fly through this gap. Here butts are formed at low tide, in which the gunners sit, now generally in vain. As this is one of the most commanding points on that part of the coast, it is in the direct line of flight of birds passing north or south. During later years a large lighthouse has been erected on the island, but very few migrants have been observed at it, owing, doubtless, to the fact that the duration of the flashes of light is too short, and that during the periods of darkness the birds probably pass on. St. Mary's Island may well claim to have a very remarkable record of rare birds procured or observed on or near it. For over a hundred years it has been the more or less constant haunt of one or more men with guns. To this fact the island owes its great number of records, for there has

always been someone on the spot, and within a short distance of one of the most competent ornithologists who have ever lived, namely, John Hancock. If ever any bird appeared which was "out of the ordinary," it was sent straight to him or Mr. Adamson, and although they probably often received common species to identify, yet a rare bird was sure to have careful and accurate attention. Ever since the building of a house by John Ewen, some forty years ago, on the island, the shooting was on the wane. More men came to shoot, and birds learnt to shun the locality. On the erection of the lighthouse about 1896 it was for the greater part entirely spoilt. The birds avoided the "gap," being frightened by the unnatural-looking object close by, and preferred to pass on the seaward side. A year or so ago the island was connected to the mainland by telephone, and the wire across the passage is a still further cause of fear to the birds. They see the wire before them, and rise up to avoid it, thereby passing out of range of the shooters. Birds have several times struck against this, and a Tern on one occasion flew straight into it and fell dead; Oystercatchers and Gulls have also been seen to stun themselves against it. Yet even now the commoner shore-birds are seen, and so they will be as long as birds migrate; for they must pass up and down the coast, and some must go by St. Mary's Island. But will they stop to rest as in former days, or pass close to the shore? I would hardly think so!

There is one thing which will testify to the frequency of the visits of shooters more than anything. This is that the shot used to be washed up by the tide in handfuls, and some even assert that John Ewen collected it and sold it on the island, which is entirely incorrect, although many of the shooters made use of it again for their muzzle-loaders. Even in later years my brother has frequently seen small quantities lying at high-tide mark, or in the crevices in rocks.

Opposite the island a small stream runs out, and some yards from its mouth it has opened out and formed a sort of tiny marsh. Occasionally Snipe and even an old duck used to resort here to feed as dusk came on, and a sudden approach over one of the sandhills close by often resulted in a shot.

Proceeding from Bates' Island the coast-line becomes high and rocky, and two small bays are carved out in it, with a stretch of sand at their extremities. Thus three bold points are formed, which jut out some distance into the sea, and each has its stretch of seaweed-covered rocks before and on both sides of it. On the cliffs at the north-west corner of the most northern of these two bays is the village of Seaton Sluice. Here an artificial passage has been cut to afford ingress to boats up the Holywell Burn, when the village was a flourishing port many years ago. The natural mouth of the stream runs into the sea a little further along the coast. These two passages form an island, on which were built one or two houses of the village. The water at the mouth of this burn is the haunt of any ducks which may be about, as they feed on the substance brought down by the stream.

Holywell Dene is the largest valley in the district, and extends for about two miles inland, being about four hundred yards wide at the broadest part. The stream, which in former years was pure water, is now stained a filthy brown by the mine workings at the top. If we follow it up from Seaton Sluice, after leaving the village, we find the banks very low, and the field by its side full of small pools of thick black water. To this Snipe and other waders have been known to resort, and by the spongy nature of the ground there ought to be a sufficiency of food for them. About a quarter of a mile above the town the valley becomes wooded, and continues so to the source of the stream. The trees are chiefly beech, some of them very fine specimens, and during summer they afford ample shelter to such small birds as may venture there. Unfortunately at that time of year this valley is the constant haunt of "trippers," chiefly on Saturdays and Sundays, who climb trees, harry the nests, trap and snare the old birds when possible, and make things generally disagreeable for them. Once things were different, and one could wander through the woods in the height of summer, meeting with no life but that which flew or crawled.

On the right of the dene, standing among some more beeches, is Delaval Hall, the former seat of the family of that name. If there is ever any large bird, such as a Buzzard or Eagle, in the neighbourhood, it seeks the seclusion of these woods, only to be

ruthlessly hunted out and shot! Near the top of the dene lies the pit-village of Holywell; through this runs the high road, which I have taken as my western boundary. This passes through Earsdon, Monkseaton, and thence behind Whitley and Cullercoats to Tynemouth.

To sum up the geographical details, I must mention a rather important feeding-ground of the avifauna of the district. This is a large refuse-heap in the fields of Fenwick Wilson, Esq., of Marden, a half mile or so behind Cullercoats. To it large numbers of birds used to, and sometimes now, resort, especially in winter when natural food is scarce. Starlings and Gulls are usually the commonest, while in spring and autumn large numbers of small migrants, such as Whinchats, Wheatears, and Pipits, frequent it and feed on the myriads of insects which are to be found in abundance on the decaying offal.

This is the area, the ornithology of which I write, and, considering its small extent and mostly unfavourable nature, the number and interest of its bird-visitors are, at any rate, remarkable.

It will be noticed that, wherever it is possible, I have given the earliest record I can find for the species, but, of course, as regards the very common birds this is unnecessary.

It will also be observed that the records of the smaller Passerine species, especially the Warblers, are not numerous. In all probability they have occurred on migration, but as this usually takes place at night they have passed on, and were out of the district by daybreak, especially as such little shelter is afforded to them.

For the past twelve years I have kept a close and careful log-book of the various occurrences in the district, especially with regard to the arrival and departure of the migrants, and wherever possible I have given the average date of arrival and departure of the migratory species.

I have culled some of my information from J. Hancock's 'Catalogue of the Birds of Northumberland and Durham,' and besides that from the following: Selby's 'Catalogue of Birds' of the same two counties; 'Catalogue of the Collection of Birds at the Hancock Museum, Newcastle-on-Tyne'; 'A History of Tynemouth, Cullercoats, and Whitley Bay, Northumberland,' by W.

Tomlinson, Esq. (and I must thank the author for the kindness he showed me in endeavouring to find out some information with regard to the birds of the district). Two of my most fruitful sources of information were C. M. Adamson's books, 'Scraps about Birds' and 'More Scraps.' The author of these last books was one of the most competent and careful ornithologists of the North of England, and his special study was the changes of the plumages of birds, chiefly of the wading species.

Besides the foregoing, many valuable notes have been obtained from private sources, and I must especially thank the following gentlemen for their kindness in providing me with information:—Mr. Robert Duncan (taxidermist), Newcastle-on-Tyne, who was a continual visitor to St. Mary's Island in former years, and has procured many very valuable birds there, as will be seen from my paper; Herbert Coxon, Esq., Newcastle-on-Tyne, for allowing me to examine his collection of stuffed birds, in which are several examples of much importance; Mr. J. Ewen, Whitley Bay, for kindly allowing me to examine his stuffed specimens of Sand-Grouse, Peregrine Falcon, &c., which he obtained on St. Mary's Island when he was in residence there; Mr. W. J. Monk, who was light-keeper on the island shortly after the lighthouse was installed, and remained there some nine years, for several notes on birds which he observed during his stay; Mr. G. Wright (taxidermist), Whitley Bay, for supplying me with information regarding several rare specimens which have passed through his hands; Mr. H. B. Hodgson, Whitley Bay, for several interesting facts relative to the breeding of certain species within the district; Mr. William Richardson (taxidermist), Seaton Delaval, for much information regarding occurrences at Holywell and Delaval; Mr. J. Taylor, formerly taxidermist, Cullercoats, for notes concerning the occurrence of the Bittern, &c.

(To be continued.)

THE PHARYNGEAL TEETH OF FISHES.

By COLONEL C. E. SHEPHERD (Indian Army).

(Continued from vol. xiv. p. 425.)

In the *Gadidae* we have a family that is well furnished with pharyngeal teeth, and may begin with one of the commonest of this family.

GADUS MORRHUA. The Cod.

The first branchial arch has on the outside edge eighteen horny gill-rakers on the cerato- and hypo-branchials, with nine on the epibranchial; the longest ones, the seventh and eighth of the first series, are about one-half of the depth of the gills just below them. As they progress towards the front of the mouth they gradually dwindle in size till they become rudimentary. The inner side of the first arch and both sides of the second and third arches, and the outer side of the fourth arch, carry teeth bearing tubercles so placed as to fit alternately into each other when the gill-slit is closed. The upper pharyngeal teeth consist of one patch of elongated shape, attached to the end of the second epibranchial, and a roughly quadrilateral shaped plate, but really consisting of two pieces, on the ends of the third and fourth epibranchials on each side. The teeth on these are cardiform, those nearest the œsophageal opening being much stronger than the others. The teeth of the lower pharyngeals are more finely cardiform, but with stronger cardiform teeth on the inner margins, where the two plates of the lower pharyngeals meet in a broad V, although they do not touch each other in the median line. It would not be out of place here to consider the class of food that the pharyngeal teeth of the Cod has to deal with. In the southern part of the North Sea they feed mostly on crustaceans. These were found in 83 per cent. of stomachs examined, and consist of Crabs, including the Hermit-Crab, and Shrimps and Prawn-like animals. Fish were found in 35 per cent., the greater Sand Launce and the young of the Herring, the Sand Dab, and the Whiting, and other fish as well are brought into requisition. Polychæte

worms were found in 16 per cent., principally the Sea-Mouse (*Aphrodite aculeata*). Mollusca, chiefly Whelks.*

GADUS MERLANGUS. The Whiting.

The horny gill-rakers of the first branchial arch in this fish begin at the angle; there are none on the epibranchial, they number nineteen on the cerato- and hypo-branchial. The largest ones are nearly the same length as the depth of the gill below them; the gill-rakers are toothed on their inner face. The gill-rakers on the other arches are tuberculous, and they carry teeth. They fit into each other alternately, and form a close filter. The upper pharyngeal teeth appear as two circular patches of cardiform teeth, consisting actually of three pieces, but the joint of the lower piece hardly shows; those on each side nearer the middle line are more pronounced than the others. The lower pharyngeal teeth, also cardiform, are in a broad V-shaped patch, separated down the middle by a line of mucous membrane, and here, again, the teeth along the sides nearest the middle line are bigger than the others; there are two rows of such larger teeth on each side. The food of the Whiting consists of crustaceans, other fish, annelids, and star-fishes.

GADUS ÆGLIFINUS. The Haddock.

This fish has on the epibranchial two, and on the cerato-hypobranchial of the first branchial arch twenty-three horny gill-rakers, but they are not toothed. The remainder of the gill-rakers are elongated tubercles with minute teeth on them; they fit more nearly opposite to each other than alternately, thus leaving a large opening for water to pass through to the gills. The upper pharyngeal teeth are cardiform, with the more prominent ones along the tops of the three patches that contain them. The lower pharyngeal teeth are in two patches, forming a narrower V than in the last fish mentioned. The lower apex of the V is separated by a line of mucous membrane, and the larger cardiform teeth on the inner edges of the apex are arranged in clumps at the apex rather than in two rows as in the Whiting.

* The above percentage of food found in the stomachs of Cods is taken from the information posted up in the "Fisheries Investigations" Cabinet in the Central Hall of the British Museum of Natural History, where specimens of some of the food animals are also shown.

MERLUCCIUS VULGARIS. The Hake.

This fish is supplied with a formidable array of teeth along the jaws, and showing externally; it is likewise furnished with a liberal supply in the buccal cavity. The gill-rakers of the first cerato-branchial are short, stout, and horny, and carry teeth; there were seven on the left side and eight on the right in the specimen examined. The longest of them, the second of the series, is about two-thirds of the gill length immediately under it. Along the hypobranchial of the first arch the gill-rakers are turned into a number of flat plates bearing minute teeth, very close together, but not touching; thirteen of these were counted. Two gill-rakers, horny and toothed, grow on the first epibranchial, and above them two flat tubercles, also toothed. The inner edge of the first arch has upstanding gill-rakers studded with teeth. The inner and outer edges of the second and third arches and the outer side of the fourth arch have lumpy tubercles in the centre part, and up to the angle beyond that they merge into flat tubercles; all are tooth-bearing. The upper pharyngeal teeth consist of a patch of very fine cardiform teeth on the second epibranchial, with two patches of strongly built cardiform teeth on the third and fourth epibranchials. The difference of size and strength in the first and second and third of these patches is in strong contrast. The lower pharyngeal teeth are on two plates placed well forward in the gullet, and carry well-defined cardiform teeth with the usual very distinct rows on the inner margins of the plates. The ends of the plates nearer the œsophagus form two white flat surfaces devoid of teeth. The tubercles above mentioned and the pharyngeal teeth are white, and make a marked contrast to the black lining membrane of the buccal cavity.

BROSMIUS BROSMÆ. The Torsk. Fig. 1 (p. 135).

The outer margin of the first arch has nine flat tubercle gill-rakers on the cerato-hypobranchials, and only two very small ones on the epibranchial; the inner margin has seven smaller tubercle gill-rakers. All the above carry minute cardiform teeth which curve inwards. The inner and outer upper surfaces of the second, third, and the outer side of the fourth arch bear tubercle gill-rakers, and these all carry teeth similar to those of



Fig. 1.—*BROSMIUS BROSME*. The Torsk.

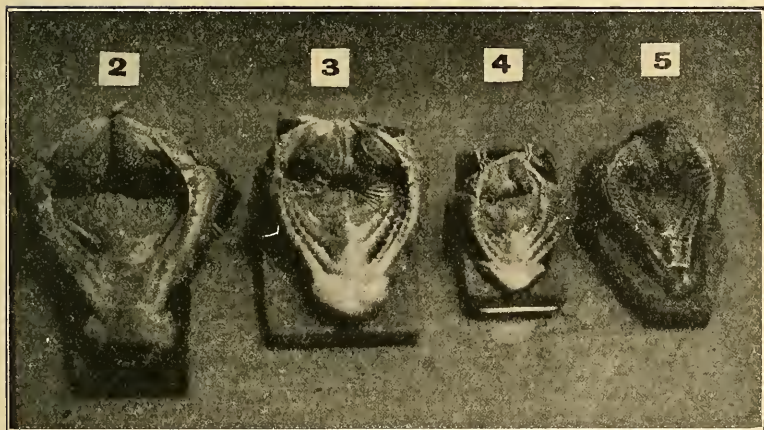


Fig. 2.—*MOLVA ELONGATA*.

Fig. 3.—*PHYCIS MEDITERRANEUS*.

Fig. 4.—*ONUS COMMUNIS*.

Fig. 5.—*GADUS POUTASSOU*.

the first arch. The upper pharyngeal teeth show as two patches. The second epibranchial terminates at its upper extremity behind a narrow bone carrying a patch of cardiform pharyngeal teeth; the third and fourth epibranchials similarly join on to a broadly oval-shaped pharyngeal bone that is covered with cardiform teeth, those on its lower portion being stronger, and with a more decided backward curve than those in the upper portion. The lower pharyngeal teeth are in two obtuse-angled triangular patches, studded, but not very thickly so, with cardiform teeth with the points directed backwards, the triangles lying across the mouth transversely, with a broad mucous division between them. The curve of the upper and lower pharyngeal teeth permits of the smooth passage of articles of food towards the œsophagus, but immediately checks any attempted retrograde movement, as can be tested by passing the finger along in either direction.

MOLVA ELONGATA. Fig. 2 (p. 135).

This fish, of the same family as *Molva vulgaris*, also called the Ling, has ten flat teeth bearing tubercles as gill-rakers on the cerato-hypobranchial of the first arch, with two on the epibranchial—these on its outer aspect; the inner aspect has a few very flat ones. On the second arch along the cerato-branchial the tubercles are confluent on the outer side; the hypobranchial is bare of tubercles. The third cerato-branchial has a few flat tubercles along its surface, both inside and outside. The fourth arch has a roughened skin along it. The upper pharyngeal teeth show as two segments studded with cardiform teeth. The upper one is attached to the second epibranchial, the lower to the third and fourth. The lower pharyngeal teeth are in two long triangular patches, the teeth on the marginal portions next the œsophagus being larger than the rest. The triangles are set with their length in the direction of the length of the mouth, and are distinctly separated by a mucous membrane division.

PHYCIS MEDITERRANEUS. Fig. 3 (p. 135).

A relative of *Phycis blennoides*, the Greater Forkbeard (Couch), found on the English coast. The Mediterranean species has eleven horny upstanding gill-rakers in the cerato-hypobranchial of the first arch, which diminish in size till the

last ones are very minute; they carry teeth on their inner margins. On the inner face of the first branchial arch there are tubercles, as also on the inner and outer faces of the second and third arches, and on the outer face of the fourth arch. The upper pharyngeal teeth show as two patches, the upper a small narrow patch with small cardiform teeth, the lower of the two as a circular patch with cardiform teeth specially strong at the lower portion of the patch. The lower pharyngeal teeth are in two triangular shaped patches, with a row of strong cardiform teeth along the margins on each side at the middle of the mouth, the other teeth being smaller. A narrow division runs up between the two patches of teeth.

ONUS COMMUNIS. Fig. 4 (p. 135).

This fish has seven tubercular gill-rakers on the first arch cerato-hypobranchials; these carry teeth. The inside of the first arch and the other arches have tubercles on them which are toothed. The upper pharyngeal teeth, which are cardiform, are in two patches, with a third small narrow piece on the inner edge of the third epibranchial, which has villiform teeth. The lower pharyngeals in two patches have minute cardiform teeth, which are more prominent along the middle portion of the mouth. The two patches meet across the middle of the mouth at the anterior ends.

ONUS TRICIRRATUS. The Three-bearded Rockling.

The upper and lower pharyngeals are as in the last mentioned, the junction of the two portions being more complete in this fish. The food of the Rocklings is mostly composed of crustaceans; they also eat annelids, starfish, and other smaller fishes than themselves.

GADUS POUTASSOU. Fig. 5 (p. 135).

This fish has twenty-three horny upstanding gill-rakers from the angle of the branchial arch to the end of the first hypobranchial arch, the one at the angle being the longest, and its length nearly one-fourth of the length from its base to the end of the hypobranchial of the same arch; these gill-rakers diminish in size fairly evenly till the last minute one is reached; there are six on the epibranchial. The inside of the

first, both sides of the second and third, and the outside of the fourth arch all carry small upstanding tubercles, which are toothed. When the arches are closed together the tubercles butt one against the other, and so do not form such a perfect filter as they would if they fitted alternately. The upper pharyngeal teeth show as three patches, and have strongly cardiform teeth in the lower portion. The lower pharyngeal teeth are in two triangular portions, with strong cardiform teeth along the middle portions of the triangles. The lining membrane of the mouth of this fish and its tongue are black.

URALEPTUS MARALDII.

This fish has minute cardiform teeth for the lower pharyngeals, with a stouter row towards the middle of the mouth, as recorded for the fish last mentioned. The upper pharyngeals have stout cardiform teeth at the lower portion.

CARANGIDÆ.

LICHIA AMIA. Fig. 1 (p. 139).

Along the cerato-branchial of the first arch there are, counting the one at the angle, seven hard bony gill-rakers, the inner sides of which are lined with villiform teeth; they decrease in size as they get more forward in the mouth; beyond the gill-rakers are two horny patches, hardly protruding above the level surface of the arch, covered with villiform teeth. There is one similar gill-raker on the epibranchial; this also has four horny patches covered with villiform teeth. On the outside of the angle formed by the cerato- and epi-branchials there are granular asperities. The outer and inner sides of the second cerato-branchial has a skin covered with fine villiform teeth. The outer side of the third cerato-branchial has the same kind of skin, but on the inner side it grows into flat tubercles, also covered with villiform teeth. The epibranchial of the second arch finishes up with an irregular shaped patch of villiform teeth, much longer than its breadth; this is the topmost one of the upper pharyngeal teeth. It shows clearly in the illustration. There are patches of skin with villiform teeth coming down along the epibranchial, stronger in its upper part, and diminishing in size as they approach the angle. These also can be seen in the illustration

CARANGIDÆ.



Fig. 1.—LICHIA AMIA.

2

3

4

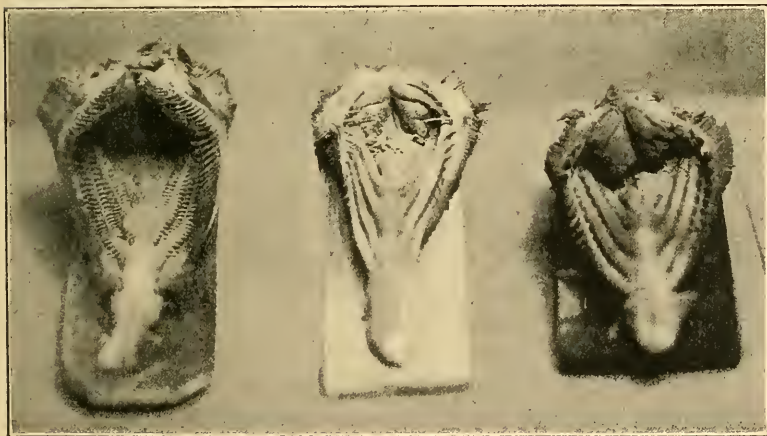


Fig. 2.—CARANX TRACHURUS. The Horse-Mackerel.

Fig. 3.—TEMNODON SALTATOR. The Skipjack.

Fig. 4.—SERIOLA DUMERILII. Yellow-tail.

on the left side of the gullet. The rest of the upper pharyngeal teeth are two patches on the ends of the third and fourth epibranchials, one a triangular patch with rounded angles; the second and lower one of these two is roughly ovoid in shape. The lower pharyngeal bones carry two elongated patches of villiform teeth. The proportion of the length to the breadth of these patches is nearly $3\frac{3}{4}$ to 1.

CARANX TRACHURUS. The Horse-Mackerel. Fig. 2 (p. 139).

The first branchial arch carries a number of fine horny gill-rakers, the one at the angle being the longest, and its length is contained about three times in the length from the angle to the junction of the hypo- with the basi-branchials. There are forty-five of these gill-rakers along the cerato- and hypo-branchials of the first arch, and sixteen on the epibranchial. They are smooth to the touch at their tips, but a little rough near the base. The inner side of the first, both sides of the second and third, and the outer aspect of the fourth arches carry short gill-rakers that fit into each other alternately and form a fairly close filtering process. They are covered with a rough surface, palpable on drawing the tip of the finger from the back forwards. The upper pharyngeal teeth show as two separate patches, with a number of small, sharp, cardiform teeth embedded in mucous membrane, each tooth fairly distinct from its neighbour. The ends of these teeth have a downward curve, and are very palpable if the finger is brought the reverse way to which food would pass in swallowing. The lower pharyngeal teeth are on two long narrow patches of an elongated triangular shape, with villiform teeth at the anterior part, but more cardiform in the posterior part; they are embedded in mucous membrane, with the points projecting. The food of this fish consists largely of small crustaceans.

TEMNODON SALTATOR. The Skipjack. Fig. 3 (p. 139).

This fish has but few horny gill-rakers on the outer-side of the first branchial arch. The one at the angle is the longest, and is contained about five times in the distance from the angle to the basi-branchial. Counting the one at the angle, there are nine gill-rakers along the cerato-branchial, the hypo-branchial

of the first arch is devoid of gill-rakers, and there are only two on the epibranchial. These gill-rakers are smooth to the touch. The other arches are wanting in gill-rakers. The upper pharyngeal teeth show as four distinct patches—one long narrow one at the summit of the second epibranchial, a larger one at the end of the third epibranchial, with a smaller patch along the same towards the angle, and a fourth attached to the fourth epibranchial. The lower pharyngeals are two long narrow patches. From the forward end of these along the basi-branchials there are a pair of patches of villiform teeth between the junctions of the basi-branchials with the second and third hypobranchials, the patches meeting close together in the median line. Another pair of patches, forward of the last two, starting from the junction of the second hypo- with the basi-branchial, are carried along to the junction of the hypo-hyal with the *os glossa*. These have a smooth portion in the middle line; they are covered with villiform teeth.

SERIOLA DUMERILII. Yellow-tail. Fig. 4 (p. 139).

This fish has twelve horny gill-rakers along the outside of the first cerato-hypobranchials; the longest one at the angle is contained some five times in the length of these two bones. There are three on the epibranchial. These gill-rakers have minute teeth on them. The inner side of the first arch has conspicuous tubercle gill-rakers on it, and there are very small inconspicuous ones on the inner sides of the second and third arches, with none at all on the outer sides. The surface of the skin of the arches is covered with a roughness that can be felt by the finger if passed over it in the direction against the swallow. The upper pharyngeal teeth show as three patches of teeth: sharp little teeth if the finger is drawn against them, smooth if the finger is passed in the direction of the swallow. The lower pharyngeals carry two long narrow patches of teeth; minute villiform teeth are found along the upper surface of the basi-branchials, and continue to the tip of the tongue.

NAUCRATES DUCTOR. The Pilot-fish.

The upper pharyngeal teeth are cardiform but minute, and so are the lower pharyngeal teeth.

THE DISTRIBUTION OF BRITISH ANNELIDS.

BY THE REV. HILDERIC FRIEND.

By Annelids, as understood in the series of notes which follows, we mean those earthworms and fresh-water worms which are usually known as Oligochæts, or worms with few bristles, to distinguish them from the Polychæts, which are usually marine worms. As I am preparing a Monograph of British Earth and Water Worms for the Ray Society, it seems desirable that we should take a survey of our present state of knowledge on the subject. As such a survey will require a considerable space, it is thought best to begin with the larger forms, which have been more fully studied than the aquatic annelids, and the whiteworms or Enchytræids. In the present paper I must be content to supply a list of those species of earthworms which are now known to occur in various parts of the British Isles. When Darwin published his work on 'Vegetable Mould,' it was assumed that about ten species were indigenous. By steady work during the past twenty years I have been able to quadruple that number, so that to-day we have a total of something like forty species, subspecies, or well-marked varieties.

As earthworms are most readily distinguished by the position of the girdle, I supply the numbers of the segments occupied thereby, counting from the head, and reckoning the peristomium (which has no setæ) as the first segment. As nearly all earthworms have special pores, tubercula, or bands on the under surface of the girdle, I give these also. When they extend over consecutive segments, as in all the known species of *Lumbricus*, the band is distinguished by the numbers joined with a hyphen. When, as in *Aporrectodea*, there is not a band, but pores on alternate segments, a colon is used. Thus $\frac{28-33}{29-32}$ indicates that the girdle begins on the 28th, and extends to the 33rd segment,

while the tubercula form a band on the four innermost of the girdle segments. On the other hand, the symbol $\frac{29-37}{31:33:35}$ would show that, while the girdle occupied the 29th to the 37th segments, the tubercula do not form a continuous band, but consist of pores on alternate segments.

Our earthworms were formerly arranged under three genera: *Lumbricus*, *Allolobophora*, and *Allurus*. When the internal structure came to be studied, however, it was found that the large genus *Allolobophora* included such a heterogeneous assemblage that further division was necessary. I shall be content with the briefest possible notes on these matters, as these papers are not intended for a systematic study of worms, but as a guide to the knowledge of their distribution.

I. LUMBRICUS.

Beginning with the oldest, best known, and most widely distributed group, we find that there are five true species of *Lumbricus* at present known in the British Isles. Judging from certain facts we ought to find three other species, but so far, if they exist, they have eluded our search. This group is known by the colour, which is more or less purple and iridescent, but, as this character is also found among the *Dendrobænas*, it is well to notice the fact that the head is inserted into the first segment (or peristomium) by means of a backward growth which extends to the intersegmental groove. In other words, the prostomium entirely divides the peristomium, while the setæ are always strictly paired. The male pores are on the 15th segment, with or without papillæ, the tail is usually flattened, and the girdle covers six segments (except in *L. papillosus*), while the tubercula form a band on the innermost four.

1. *Lumbricus terrestris*, L. $\frac{32-37}{33-36}$ The Common Earthworm.
2. *L. rubellus*, Hoff. $\frac{29-32}{28-31}$ The Redworm, smaller than the last.
3. *L. festivus*, Sav. (= *L. rubescens*, Friend). $\frac{34-39}{35-38}$ Almost exactly like the last, but with papillæ on segment 15.
4. *L. papillosus*, Friend (= *L. friendi*, Cognetti). $\frac{33-37(38)}{34-37}$
Closely resembles No. 1.

5. *L. castaneus*, Sav. (= *L. purpureus*, Eisen, &c.). $\frac{28-33}{29-32}$
 The smallest of all the true *Lumbrici*; often difficult to distinguish from such worms as *Dendrobæna mammalis* and its allies.

II. ALLOLOBOPHORA.

Colour variable, girdle and tubercula extending over a variable number of segments. Best known by the study of the head. The prostomium does not cut entirely through the first segment. The internal characters differ from those of *Lumbricus*.

6. *Allolobophora longa*, Ude. $\frac{28-35}{32-34}$ The Longworm; often confused with *L. terrestris*. The specific name *longa* is preferred to *terrestris* as being less confusing.

7. *A. trapezoides*, Dugès. $\frac{27-34}{31-33}$ Very similar to the next, both of which are sometimes included under the name *A. caliginosa*, Savigny.

8. *A. turgida*, Eisen. $\frac{28-34}{31:33}$

III. APORRECTODEA.

In this genus the tubercula are on alternate segments, and so it is linked on to the last genus by means of No. 8, which closely resembles the next.

9. *Aporrectodea georgii*, Mich. $\frac{29-35}{31:33}$

10. *A. chlorotica*, Savigny. $\frac{29-37}{31:33:35}$ The best known worm of the class, sluggish, dirty green, but very variable in colour.

11. *A. cambrica*, Friend. $\frac{29-37}{31:33:35}$ Related to No. 10 as No. 9 is to No. 8.

12. *A. similis*, Friend. $\frac{28-35}{30:32:34}$

IV. EISENIA.

Not easy to distinguish from the foregoing except by the study of internal characters.

13. *Eisenia fetida*, Sav. $\frac{26-32}{28-30}$ The well-known Brandling, with red and yellow bands, found in manure-heaps.

14. *E. veneta*, Rosa (= *E. hibernica*, Friend). $\frac{27-33}{30-31}$ Perhaps the most variable worm we have. Half a dozen well-marked varieties have been named by myself and others.

15. *E. rosea*, Sav. $\frac{25-32}{29-31}$ (= *A. mucosa*, Eisen). One or two well-marked varieties occur.

V. DENDROBÆNA.

An interesting group of worms, some of which are regularly found in rotten tree-stumps. They are usually a ruddy brown or purplish colour, similar to *Lumbricus castaneus*, but the head does not entirely bisect the first segment, and the setæ are wider apart.

16. *Dendrobæna mammalis*, Savigny (*D. celtica*, Rosa). $\frac{30-36}{33-34}$

17. *D. submontana*, Vejdovsky. $\frac{25-32}{28-30}$

18. *D. subrubicunda*, Eisen. $\frac{26-32}{28-30}$ Most frequently found with the Brandling.

19. *D. arborea*, Eisen. $\frac{26-32}{29-30}$ This is the true Tree-worm.

20. *D. octædra*, Sav. (= *D. bæckii*, Eisen). $\frac{29-33}{31-33}$

21. *D. alpina*, Rosa. $\frac{28-33}{30-32}$

VI. BIMASTUS.

The worms of this genus are best known by the absence of tubercula on the girdle-segments, and the absence of spermatheca.

22. *Bimastus eiseni*, Levinsen. Girdle-segments 25-32. Head like that of *Lumbricus castaneus*.

23. *B. constricta*, Rosa. Girdle, 26-31.

24. *B. beddardi*, Mich. Girdle (24). 25-31.

VII. OCTOLASIUM.

Rather large worms, similar to *Allolobophora*, but with the setæ in eight rows, and girdles resembling *Lumbricus*.

25. *Octolasion cyaneum*, Sav. (= *A. studiosa*, Rosa). $\frac{29-34}{30-33}$

26. *O. lacteum*, Oerley (= *A. profuga*, Rosa). $\frac{30-35}{31-34}$

27. *O. rubidum*, Oerley. $\frac{30-35}{30-35}$

28. *O. intermedium*, Friend. $\frac{28-35}{31-34}$

29. *O. gracile*, Oerley. $\frac{30-35}{30-35}$ Closely resembles No. 27, but seems to me to be a distinct species.

VIII. EOPHILA.

No definite external characters to distinguish it from some of the foregoing genera. I include here one species only, so far as Britain is concerned.

30. *Eophila icterica*, Savigny. $\frac{33-42}{35-41}$ It will be seen that the girdle and tubercula cover a larger number of segments than usual.

IX. HELODRILUS.

Worms which live in mud, and are at present little known.

31. *Helodrilus oculatus*, Hoff. So far it has never been found with a girdle, unless Michaelsen is correct in associating it with the next, which I am at present unable to do.

32. *H. hermanni*, Michaelsen. $\frac{22-32}{29-30}$ I place here also for the present

33. *H. elongatus*, Friend. Girdle extending from segment 15-24. It may prove to be a *Sparganophilus* or a near ally.

34. *H. relictus*, Southern. $\frac{50-59}{51-58}$

The whole of the worms placed here under *Helodrilus* and found in Great Britain are of peculiar interest, but need a great deal of further investigation.

X. ALLURUS.

The male pores are usually on segment 13, but may occur on the 12th or 15th. They are small worms found in mud, and have a square tail. Michaelsen has changed the name to *Eiseniella*.

35. *Allurus tetrædrus*, Savigny. $\frac{22-26}{23-26}$ A well-marked golden variety (*luteus*, Friend) is found, as well as the type.

36. *A. tetragonurus*, Friend. $\frac{18-22}{19-21}$

37. *A. macrurus*, Friend. $\frac{15-22}{20-21}$

38. *A. hercynius*, Mich. $\frac{23-27}{23-25}$ Male pores on segment 15.

Although this list still needs revision, it is the most complete available at the present time. Some of the species are still hardly known, and others are hard to define. We shall make it the basis on which to found the notes which are to follow on the distribution of Annelids as at present known in these islands.

(To be continued.)

NOTES AND QUERIES.

MAMMALIA.

Variety of the Badger.—Mr. Newstead's Badger, recently described (*ante*, p. 111), is not an uncommon erythristic variety of this animal, tending to albinism. I sent a description of a female of this variety, dug out of its "earth" near Longton, Staffordshire, to 'The Field' of August 19th, 1905. This animal is now in the London Zoological Gardens, with a male of the same variety from Oakham, Rutland. There is also a specimen in the Cromwell Road Museum; another is described in 'The Zoologist' for 1880, p. 252; another was in the Zoological Gardens in 1890; and another was reported from Oxfordshire by Mr. Aplin in 'The Zoologist' for September, 1907, p. 331. This animal seldom breeds in captivity, but it is possible that if the two animals in the London "Zoo" were provided with a more naturally formed "earth," instead of the present cage in which they were placed when I last saw them, success might result.—JOHN R. B. MASEFIELD (Rosehill, Cheadle, Staffordshire).

AVES.

Range of the Twite.—Mr. O. V. Aplin, in his notes on the Linnet (*ante*, p. 112), refers to the range of the Twite, and it may be of interest to state that the northern parts of the county of Staffordshire appear to be about the southern limit of its breeding range. As to the Twite in winter in this county, I cannot do better than quote from a letter recently written to me by Mr. B. Bryan, of Longton, who is a most accurate observer of wild bird-life. He says:—"I have met with the Twite singly and in small flocks. It usually occurs in company with the Linnet and Lesser Redpoll. Sometimes all three species associate. The Twite is often caught on the limed twigs and bents of grass used by birdcatchers, which are placed in the vicinity of a 'call-bird.' The Twite is not in much demand as a cage-bird locally, and consequently the birdcatchers, when they find Twites entangled in their bird-lime, often kill the birds rather than take the trouble to clean the bird-lime off the flight-feathers and release the birds. I once kept a Twite in captivity for about a fortnight, but the

bird was so wild that I released it. Last year I saw one in Longton that had been in a cage for about two years; it behaved much as the Linnet, and was continually uttering its call-note. The local name for the Twite is 'Dummock,' and any local birdcatcher knows that the Twite is meant by this name. I think the fact that this bird has obtained a local name goes far to show that this species is fairly common in winter with us." I may add that this local name "Dummock" must not be confused with "Dunnoch," a local name for the Hedge-Sparrow, but by which this bird is seldom if ever known in Staffordshire.—JOHN R. B. MASEFIELD (Rosehill, Cheadle, Staffordshire).

The Colour of the Kingfisher.—A perusal of the interesting article in December 'Zoologist' on the above subject (1910, p. 462) brings to my recollection an incident of many years ago. An artist, who in the summer spent much of his time sketching in this neighbourhood, on one occasion painted a large picture of a portion of the meadows, in which the winding river, with its sedges, alders, and willows, was a somewhat conspicuous feature; he thought the introduction of a flying Kingfisher would be a great improvement, if not an absolute necessity, as he had seen almost daily one or more of those winged jewels, and asked if amongst my few birds I had an uncased specimen to lend. I happened to have all his desire. The picture for the most part was painted in the meadows, but certain details—the figure of the Kingfisher amongst the number—were done in a large billiard-room where much of the light was obtained from the glass roof. On the return of my bird I was invited to see the finished canvas, and at once saw the well-outlined Kingfisher was incorrectly coloured. The gentleman was somewhat amazed at my criticism, and, having again brought the bird for comparison, he discovered that altering its position, say, from right to left, or *vice versa*, the colour of the back changed, and he afterwards told me that if the bird remained in the same position *in the room*, the colour of the back was not the same in the afternoon as it was in the morning, doubtless accounted for by the different position of the main source of daylight, but of this latter peculiarity I had no personal experience.—G. B. CORBIN (Ringwood, Hants).

Period of Incubation of the Sparrow-Hawk.—Referring to Mr. Jourdain's note on Mr. Selous's article on the domestic habits of the Sparrow-Hawk, it occurred to me also, on reading the passage (*ante*, p. 53), that Mr. Selous was quite unnecessarily suspecting the boy of

having robbed the birds of their first clutch of eggs. It so happens that many years ago (in 1887) I watched a Sparrow-Hawk's nest to ascertain the period of incubation, and, referring to my notes, I see the eggs took exactly five weeks to hatch. I remember being very much surprised at the time at finding the period of incubation so protracted, but some years ago I noticed in a paper or magazine that another observer had timed the Sparrow-Hawk to take five weeks to hatch its eggs.—E. W. H. BLAGG (Cheadle, Staffordshire).

Domestic Habits of the Sparrow-Hawk.—Whilst reading the very interesting notes on the nesting habits of the Sparrow-Hawk by Mr. Selous, it struck me that perhaps after all the boy (*ante*, p. 53) had not taken the eggs from the nest about the middle of May, as surmised by Mr. Selous. It is a popular belief with gamekeepers—at least in this neighbourhood—that the period of incubation of this species lasts six weeks, and some are very obstinate on this point; but I believe, however, that five weeks will be found much nearer the incubatory period, even its maximum period. I quite agree with Mr. Jourdain (*ante*, p. 113) that a Sparrow-Hawk commencing to set about the middle of May could not bring off its young and commence laying a second time much, if any, before the end of July. Whatever may be the habits of the Sparrow-Hawk elsewhere, it can be safely said that it is single-brooded here, and that the duty of incubation is confined to the female; also, that the male bird usually plucks his bird-victims before he transfers them to the safe custody of his mate. Much diversity exists, even among excellent ornithologists, as to whether this species usually or always builds its own nest, and I believe Professor Newton's statement that the Sparrow-Hawk always builds its own nest is much too absolute.—E. P. BUTTERFIELD (Wilsden, Bradford).

Breeding of the Honey-Buzzard in England.—Besides the counties mentioned by Mr. Aplin (*ante*, p. 113) there is fairly conclusive evidence that the Honey-Buzzard has bred on one occasion in West Staffordshire, close to the Shropshire boundary, in 1841 (*cf.* 'Zoologist' for 1856, p. 5096). The date of publication of Penant's 'British Zoology' renders it impossible for him to have referred to this occurrence, but it is quite likely that the bird figured by him was from the same district, and not from Shropshire. The same volume of 'The Zoologist' contains (p. 5058) a record of a nest "on the borders of Hampshire and Wiltshire" in 1852, and references to other instances of breeding in the British Isles. The latest record of nesting in England appears to be from Herefordshire

in 1895. "Mr. A. G. More ('Ibis,' 1865, p. 13) mentions nesting at Burnham Beeches, Berks (Charlesworth's 'Mag. of Nat. Hist.' i. p. 539), and Shropshire, on the authority of Mr. H. Shaw. He also adds that Mr. Heysham was informed that it bred in the woods at Lowther, Cumberland, but there seems to be no satisfactory evidence in this case." — F. C. R. JOURDAIN (Clifton Vicarage, Ashburne, Derbyshire).

Decrease of Corn-Crake, Wryneck, and Nuthatch. — The Corn-Crake has undoubtedly decreased in this district. Twenty years ago their harsh note was one of the characteristic sounds of the Thames Valley, now it is seldom heard. The decrease may be attributed to several different causes, first and foremost the fact that our meadows are now wetter than of old; either they have sunk (which is unlikely), or the head of water is kept at a higher level. Whatever the cause, it is a fact that, whereas the Corn-Crake was formerly a common breeder, it is now almost extinct, and that the Snipe, which seldom, if ever, nested with us, now breeds regularly. The Wryneck was never common in these parts, but about six years ago the numbers seemed to increase, and we had two or three nests in our boxes. During the last three seasons we have seen a few individuals on first arrival, though none remained to breed. Nuthatches, on the other hand, have very materially *increased*. When I was a boy they were uncommon, now distinctly numerous. Last season we had five nests in our boxes, and I knew of as many more in trees. This local increase is all the more remarkable, having regard to Mr. Aplin's note, as he resides certainly not more than forty miles from this property, "as the crow flies." — HEATLEY NOBLE (Temple Combe, Berks).

THAT all three of the birds named have much decreased in numbers in this part of Hants is a well recognized fact—the Corn-Crake in the meadows or the corn-fields, and the Wryneck in copse, orchard, or garden, both better known by their voice than their appearance; and how welcome those spring notes of "crake, crake" and "weet, weet" to a lover of nature, speaking of sunshine and hope! Last summer a single Corn-Crake was heard in this locality, where years ago it was comparatively common. A friend (now deceased), formerly living in Ireland (Westmeath), informed me of its gradual decrease from year to year; at one time it was so common near the house as to disturb the night's sleep, but it became so scarce that its voice was seldom heard. How often of old the Wryneck was heard by those to whom the bird was invisible in its

beautiful shadings of lichen-grey and brown, as it perched upon the tree-trunk close at hand! Many summers have passed since I last had the pleasure of hearing it; the woods and orchards are the same, but the birds are absent. It is true we have had unfavourable summers following each other; the mowing-machine (in the case of the Corn-Crake), telegraph- and telephone-wires, the builder's bricks and mortar, and in some cases unceasing persecution may be held responsible for the apparent decrease, but it seems as if other potent causes must be working destruction with many other species—the Swallow tribe, the Sky-Lark, the Linnet, and others; and the same law applies to fish and insects (Lepidoptera), as the angler and entomologist can testify. Let us hope that with more congenial summers an improvement in bird-life may be noted. As regards the Nuthatch, I do not think it is so scarce as newspaper and other reports assume it to be. Evidently it is not so common as it once was here, but I am told by those who provide a bird-table—and it is gratifying to know their number is increasing—that the Nuthatch is still much in evidence at times. With the uninitiated I believe it is sometimes overlooked, as it moves hither and thither, mouse-like, upon the branches, or ascending and descending the tree-trunk, unlike its companion, the Tree-Creeper, which seems unable to descend, and drops to a lower level to continue the examination. When I was able to ramble amongst the feathered tribes the Nuthatch was one of my many favourites amongst the small birds. Its comparatively large head and feet, its labour in contracting the Woodpecker's hole for its own requirements, its Tit-like attitudes and activity, its soft amorous whistle at nesting-time, are but a few points in the character of this shy but fearless species. I recollect once watching quite a battle near a nesting-hole in an old tree between one of these birds and a Great Tit. Everyone knows what an impudent and often courageous bird the latter is, but all his "pluck" and bluster were of no avail against the larger and stronger bill of the Nuthatch. It seems somewhat strange that the Nuthatch is seldom, if ever, found in the Isle of Wight.—G. B. CORBIN (Ringwood, Hants).

Decrease of the Corn-Crake.—If the Corn-Crake is becoming scarcer in some parts of England, it is a sad thought, but I can assure readers of 'The Zoologist' that most certainly such is not the case in the neighbourhood of Scarborough, where (to use the words of Mr. Steele Elliott in referring to its status in Staffordshire thirty years ago) "a pair at least of Corn-Crakes may be found nesting in

almost every large meadow," even within the borough boundaries. This bird is always so common here that when visiting some other parts of England in the summer months I have been surprised to notice the absence of its voice. Thus, when on a visit to the Norfolk Broad district, where I spent a week in May, 1901, thinking of and looking for nothing but birds, I neither saw nor heard it. On our north-east coast, where the hay and corn harvests are much later than elsewhere in England, the bird's nest and eggs are less likely to be destroyed by the reaping-machine, and this may account for its continued abundance.—W. GYNGELL (Scarborough).

THE observations in your recent issues prompt me to say that during the last seven years (1904 and onwards), in the course of many outings in Middlesex, Herts, and Bucks, I have only twice heard this bird, *viz.* near Great Missenden on June 5th, 1910. This experience is so greatly at variance with local ornithological writings that I cannot suppose it to indicate the actual prevalence of the species, but it may serve as a comment on the notes of your correspondents. Of earlier years in the above-named districts I can say nothing, but in the West of Scotland there was no more familiar sound in the fields, all over, than the calls of the Corn-Crake.—HUGH BOYD WATT (3, Willow Mansions, West Hampstead).

I notice that in the list of birds in the new edition of Mr. W. M. Webb's 'Brent Valley Bird Sanctuary' (Selborne Society, 1911), the Corn-Crake does not occur. The locality has now been carefully and continuously watched since 1905. Wryneck and Nuthatch: In the Sanctuary the Wryneck nested in 1910 (unsuccessfully), and the Nuthatch reared young in 1909 and 1910.—H. B. W.

Notes from South-Western Hants.—The damp and uncertain weather of last summer, followed by a no less damp and mild winter, seem to have upset the usual routine of bird-life, especially with the migrants visiting this particular locality. The two species of Martin, as well as the Swallow, were neither of them so common as formerly, although Swifts and Nightjars were in their usual numbers. The Nightingale was much more frequent than in the spring of 1909, but of the other warblers fewer were seen or heard, and in one or two localities where the Red-backed Shrike annually nested none were seen. In the winter, too, there appeared to be a comparative scarcity of both Fieldfares and Redwings; I heard of only one Bittern, and the northern breeding ducks were many of them altogether absent, or but scantily represented. The river being in flood most of the winter the usual "shoots" from "gazes" were comparatively few, but when

circumstances permitted plenty of the commoner kinds of wildfowl were found for the guns; on one occasion nearly five hundred head were killed, including a large number of Mallard, over one hundred Teal, one hundred and sixty-eight Coot, and many Wigeon; of the latter species a very large flock was seen upon the water, and good sport was anticipated, but on the first shot the whole community soared to a great height and made towards the sea, with their numbers somewhat thinned. Two or three immature Pintails and Shovelers—the latter no doubt bred in the locality—were met with, and one old well-marked Goosander was seen, as well as two or three “skeins” of Wild Geese—from five to fifteen—but none were killed. A very rare and interesting sight, for this neighbourhood, took place soon after the shooting began; upwards of forty Herons were on the wing at the same time, and an old sportsman, of long experience, told me he had never previously seen such a sight; it speaks well for the favour and preservation accorded to those much-persecuted but grand old fishers.

In August I saw an immature and rather prettily marked male of the Montagu Harrier, killed somewhere, I believe, near Fording-bridge. Its aspect was rather strange, as the “ruff” was well developed on one side of its head, but on the other was almost wanting, which gave the face a peculiar one-sided appearance. It had the remains of a sand-lizard in its stomach, but the body was thin and poorly nourished. About the same time I several times heard that a Honey-Buzzard had been killed in the Valley of the Avon, but I did not see it, neither could I trace its whereabouts, or be certain of its correct identification. The Peregrine Falcon has not put in an appearance so frequently as in previous years. I have the record of one being *seen*, but not molested; indeed, I am glad to say I have not heard of one being killed for a considerable time.

Jay and Wood-Pigeon.—This neighbourhood has been invaded by both species; the first intimation I had of the increase of Jays was at the end of August or beginning of September, when a game-keeper told me he had shot more within a few days than he had previously seen for twelve months. Eventually the same tale of slaughter came from various quarters, and if I may judge from the number of Jay’s wings I have seen in ladies’ hats, the birds must have been abundant. I know of one instance where three dozen wings were sent at one time to a lady. Whence does the Jay migrate? as it is by no means the first time the wanderers have come to us, and their visits seem somewhat irregular. The Wood-

Pigeons were and are unusually abundant; last summer in the meadows, before the hay-making, they were in large numbers foraging for the grass seeds, and since that time they have increased, but not in the neighbourhood of the Forest to such an enormous extent as they have in many other localities—as Essex and Isle of Wight. This may be owing to a comparative scarcity of both acorns and beech mast, for last season, I am told, was unfavourable for fruitage of both oak and beech, consequently the birds are taking toll of the farmer's greenstuff—clover, turnip-tops, &c.—and it seems almost incredible the quantity of this kind of food a single Pigeon can pack into its crop—it must be seen to be believed. Characteristically wary and from density of feathering hard to shoot, yet by means of a stuffed decoy very fair “bags” have been made in the open fields if the sportsman could secure enough shelter, but one man told me you have to be quick. The best time to shoot them is after sunset, when, having had their fill, they come to the woods to roost. A farmer told me that one evening he stood at the corner of a wood near a brook and shot thirty Pigeons in little more than half an hour. I have not heard of any disease of throat, beak, or feet amongst our present visitors, as was the case some few seasons ago, when I saw many specimens whose feet were quite deformed with the malady.

Otters.—The annual visit of the Otter hounds to this neighbourhood last season was not very successful, although from time to time I heard of Otters and their workings in different parts of the Valley of the Avon, where the river is too deep and broad for hunting. Situated near a residence is a rather large fish-pond, enclosed with wire-netting to prevent Foxes making too close acquaintance with the several species of “ornamental” ducks that find a home on the water; on two sides is a small wood with undergrowth of bushes. For some time it had been noticed that the fish were decreasing in numbers without any apparent cause; thieves and marauders of all kinds were repudiated, but eventually a burrow was discovered underneath the protecting wire, and a fine dog Otter, weighing 23 lb., was caught—no fish have since been missed. Another dog Otter of 20 lb. was shot by a party who were “cripple-hunting” after a day's shooting, and this fellow was disporting itself in the water, in the noontide sun, in a very lively and frolicsome fashion when it was killed, possibly it had a mate near which was unobserved. In another locality farther down the stream I understand a “holt” was discovered containing two cubs which were taken and are being

successfully reared. On March 23rd and 24th, Otters, weighing eleven and ten pounds respectively, were caught at a certain point in the river, possibly both of one litter, male and female; I saw the latter, which was the heavier of the two.

Salmon.—The flooded state of the river last autumn and winter was favourable to the ascent of spawning fish, and this season the “fresh run” examples are rewarding the patient anglers to some extent. I believe Salmon caught in the Avon, although much fewer in number than those taken in the rivers farther north, are, as a rule, heavier fish, and this season, thus far, has been no exception. Several good fish from 20 lb. to 30 lb. were taken, and two of 40 lb. weight yielded to the attraction of the fly; and I was informed of a curious incident happening at the capture of one of the latter, the *blade* of the gaff snapping asunder, but the expert angler played his quarry so long and dexterously that another gaff was secured from a considerable distance off, and the fish eventually brought to bank after much excitement and “language.”—G. B. CORBIN (Ringwood, Hants).

ANNE LIDA.

Dutrochet's Land Leech.—Two Leeches were found under a box of bulbs which was let six inches deep into the earth in a garden in Penge, rather less than one mile from Selhurst Road, and sent to Mr. W. A. Harding, of Histon Manor, Cambridgeshire, who identified them as *Trocheta subviridis* (Dutrochet, 1817). They were found in the beginning of February (or possibly end of January), 1911, by a gardener, who described them as of a very beautiful green colour, very firm and fat when first found, and one swallowed an earthworm whole.—F. NORGATE (20, Anerley Park, S.E.).

THE Leeches found by your correspondent at Penge are examples of Dutrochet's Land Leech, *Trocheta subviridis* (Dutrochet, 1817). This rare and curious form is met with from time to time, sometimes in considerable numbers; its occurrence, however, is always well worth recording, for we know little of its mode of life, or of the factors which determine its somewhat sporadic appearances. The fact that the first specimen noted in England was taken in Regent's Park (in 1850), and that more than one Leech found in the Zoological Gardens has been attributed, erroneously it has since appeared, to this species, not unnaturally suggested the idea that it had been accidentally introduced into the Zoological Gardens along with some tropical animal. It is, however, not a tropical species; its range as

at present known extends no further than Italy, France, and Algeria, and although rare, there is no reason for supposing that it is not indigenous in this country. Dutrochet's Leech is carnivorous, devoid of teeth, harmless to man, and far removed from the typical blood-sucking Land Leeches which are such a pest to the traveller in certain hot countries. The four pairs of eyes appear as a series of minute black spots fringing the anterior extremity. Its food consists of various species of earthworm, which are devoured piecemeal. Although spending much of its time in moist situations on land, it is really an amphibious form, and it appears to issue from its hiding-places for the most part at night in search of its prey. No doubt it has sometimes been overlooked on account of its nocturnal habits and superficial resemblance to an earthworm, and it is probably less uncommon than is generally supposed. It was last recorded in England in 1909, when it was discovered at the Withington Sewage Works, near Manchester, where it was found frequenting the effluent channels, and feeding upon the earthworms washed out of the filter-beds. I kept a number of specimens obtained from this source in an aquarium filled but a few inches deep with water, and having a quantity of moss banked up well above the water line. During the day the Leeches lay quiescent beneath the water, but at night they became active, frequently crawling forth amongst the moss, in which, during the early summer, their flattened, elliptical, horny egg-capsules were deposited. The occurrence of this Leech in England up to the year 1877 formed the subject of an interesting paper by Harting in the pages of this Journal ('Zoologist,' third series, vol. i. (1877), pp. 515-523), and a full description of the species, with its further history, has been given by the present writer in a recent paper on the British Leeches ('Parasitology,' vol. iii., pp. 183-186, plate xv., figs. 46 and 47).—W. A. HARDING (Cambridge).

NOTICES OF NEW BOOKS.

Atlas of Zoogeography ; a Series of Maps illustrating the Distribution of over Seven Hundred Families, Genera, and Species of Existing Animals. Prepared by J. G. BARTHOLOMEW, LL.D., &c., W. EAGLE CLARKE, F.R.S.E., &c., and PERCY H. GRIMSHAW, F.R.S.E., &c. John Bartholomew & Co.

SINCE Scater, Murray, and Wallace, the pioneers of our present knowledge of zoogeography, published their memorable volumes, the geographical delimitations of animal life have been much advanced by the increase of faunistic catalogues and the description of genera and species during the series of years that have now elapsed. The somewhat despised describer of species—and he should not be rated too highly—may be rewarded by seeing that he assists in enlarging the boundaries of our knowledge of animal distribution ; and the work is still far from being completed.

The divisions employed are the usual Palæarctic, Ethiopian, Oriental, Australian, Neotropical, and Nearctic Regions, and the animals studied comprise Mammalia, Aves, Reptilia and Amphibia, Pisces, Mollusca, and Insecta, the latter confined to Lepidoptera, Coleoptera, Hymenoptera, and, to a less extent, Diptera, Hemiptera (*Coccidæ* only), Neuroptera, Trichoptera, and Orthoptera.

An adequate introduction is given on general principles of distribution, its historical and geographical aspects, a zoological digest, and a very full bibliography indeed, one which will greatly assist any student of the subject. Of the large folio illustrations, which are split up into many smaller maps, the general excellence of Bartholomew's Physical Atlas is maintained, and gratefully we acknowledge a good general index. There can be no doubt about the value of this publication up to date.

It prompts, however, reflections as to the future treatment of the subject in the years to come. To exclude the distribution of *Homo* from that of other animals seems still a process that requires breaking, and one that at present unnecessarily ignores an important section of the Mammalia. Palæontology must

afford its full quota of facts ; the distribution of extinct animals can never be divorced from zoogeography. And now we come to a more debatable consideration in the question whether the principles of faunistic distribution can ever be completely founded without a study of, and full reference to, the flora and its distribution. A time must arrive, especially as we are even now all considered to be in some sense more or less evolutionists, when volumes described as devoted to the subject of "Natural History" will not deal with zoology alone, omitting *Homo*, and discarding the flora of the planet. Lastly, it is to be premised that in the future the geological floor on which animals are dispersed, and in which plants live, must receive the attention of students of zoogeography.

In relieving our minds from these cogitations we make no complaint against the preparation of this excellent publication, nor have we a right to expect it to deal with subjects before their time. The historian may arrive at some degree of finality, but the scientific philosopher—never. To think otherwise is the negation of the idea of an evolutionary progress in science.

As an item of bibliography, it may be mentioned that Dr. Selater's paper "On the Distribution of Marine Mammalia," read before the Zoological Society of London in 1897, was by a happy accident first published in 'The Zoologist' of that year (p. 217).

EDITORIAL GLEANINGS.

"ACCORDING to advices from the Caucasus, millions of singing birds, which used every winter to find a warm retreat on the southern slopes of the forest-clad mountains of the Caucasus, have suddenly been surprised by the intense cold and severe snowstorms, whilst they were on their way from the north. The sides of the mighty mountains, the highest in Europe, and the shores of the Black Sea, are now strewn with small corpses of singing birds, especially Bullfinches, Goldfinches, Redbreasts, Flycatchers, and other birds, which in the summer mostly visit these shores."—*Pall Mall Gazette*, Feb. 14th, 1911.

WE annex the following extracts from "Gareth's" well-known weekly contribution to the 'Referee' (April 9th, 1911):—

"It is curious how often we find the keenest observers contradicting

themselves about the habits of birds and beasts, the explanation being that the bipeds—the feathered ones, I mean—and the quadrupeds often differ so much in their proceedings. As a rule, for instance, the cock Pheasant is the lord of a harem with a number of attendant wives; but a great authority on this subject has stated that, though sometimes several hens with their families put themselves under the protection of one cock, there are other occasions when several cocks act as cavaliers to one hen and her family. She gets horribly conceited; at least, that is what one would be inclined to suppose. The recital of this fact only shows how careful we should be not to contradict each other, and to make assertions that things do not happen because we never chance to have seen them. Talking of the cock Pheasant in April, there is an authenticated instance of Pheasant chicks having been seen in Devon, eleven of them, as early as April 18th. A man might live in the country a great many years, become thoroughly well acquainted with the ways of the inhabitants of the countryside, and never see a Pheasant chick until well on in May. Indeed, the hen Pheasant generally begins to lay her eggs in the month—about the middle—of April, and having laid them it takes her about a month to introduce the fluffy contents to the world. There is an authenticated record of a Pheasant who was sitting on her nest, with twelve eggs in it, as late as Sept. 3rd, and that is the sort of story one would hesitate to believe unless it came from a very trustworthy quarter.

“If you asked the average countryman whether Pheasants nested in trees, having ascertained that you were not suggesting what is called a catch, he would inform you that they never did anything of the sort; that they roosted in trees, but conducted all their little family operations on the floor. This, again, would be wrong, and it is certainly not everyone who knows the rights of this particular case. Pheasants, it is quite true, do not *build* nests in trees; but one will occasionally lay eggs after having taken possession of the nest of some other bird, like a gorgeous Cuckoo. Some years ago I edited a book on the subject of the Pheasant, and that is how I chance to have gathered in out-of-the-way bits of knowledge. One of these bits was to the effect that in the year 1892 a credible witness bore testimony to the discovery of a Pheasant's nest with eleven eggs in it in a spruce fir fully twenty feet from the ground. The first thing one naturally thinks of is what is likely to happen to the chicks when they come into this troublous world; because they do not resemble the offspring of ordinary tree-building birds. The discoverer of this nest went to rob it, with the most kindly and benevolent intentions, his purpose being to put the eggs under a hen, so that when the chicks came out they might walk about in the ordinary course, instead of finding themselves in the air. The hen Pheasant, however, tried to frighten him away by flapping her wings and pecking at his hand. He left five of her eggs to console her, putting the others under the poultry hen, when they were duly hatched out; and going to the tree to ascertain how the others were getting on, he found a lately hatched Pheasant at the bottom of the

trunk calling out to his mother far above, while she was anxiously replying. The narrator of this interesting story goes on to state that he proceeded to relieve the other captives and bring them down to safety, the old bird, not having the wit to appreciate his intentions, constantly darting at and pecking him. Finally she chased him out of the wood, he declared, and went back to her young. That eminent authority the late Lord Lilford also published a story of a hen Pheasant who took possession of a Wood-Pigeon's nest, and laid nine eggs in it. Three of the chicks in this case were found dead at the foot of the tree, having broken their poor little necks or otherwise done for themselves in the fall, but the other half-dozen, it was believed, came off all right.

“What has been said about the different habits and dispositions of different birds is proved by another story of a cock Pheasant who sat on nine eggs and duly hatched them out. The cock Pheasant, as a rule, is not in the least commendable in the characters of husband and father. He is a very vain person, very haughty, and very greedy; struts about, does himself well, seeks admiration, and declines to be bothered in any way with family responsibilities. This one, who played at being a hen, was, of course, altogether an exception. Indeed, the hen Pheasant is not a model mother as the hen Partridge is; the hen Pheasant will often desert her nest if she finds anything to amuse her elsewhere, and is so deficient in maternal instinct that she will sometimes leave her unfortunate chicks to take care of themselves. In the valleys of the Caucasus ‘unsociable as a Pheasant’ is a familiar saying. There is no affability about our brilliant friend. I do not know anything more quaint and interesting about Pheasants than the fact that the hen will sometimes assume the plumage of the cock. How she manages to do it no one has been able to explain; nor, indeed, can one guess at the motives which induce so strange a transformation, but that there are hens who do this any amount of evidence unquestionably proves. For the matter of that, hen Pheasants are not the only hens of like proclivities. Another funny thing about Pheasants is the way in which they used to be sometimes caught in days of yore—very much yore, for the writer who first described the method, so far as is known, was the foster-brother of no less a personage than Richard Cœur de Lion. The would-be capturers—that is a clumsy expression, but one hardly knows whether to call them sportsmen or poachers—used to make a dummy cock Pheasant, coloured as nearly like the real bird as the paints of the period and such artistic skill as they happened to possess allowed. Having ascertained that there were Pheasants in the neighbourhood, the fowlers put out their dummy and took cover. Presently the cock Pheasant would see his supposed rival. The spirit of combat would take possession of him. He would advance to attack the intruder, as he supposed him to be, and while thus engaged would give the fowlers the opportunity of taking him in a net. I must not, however, occupy too much space with disquisitions on this pride of the woods.”

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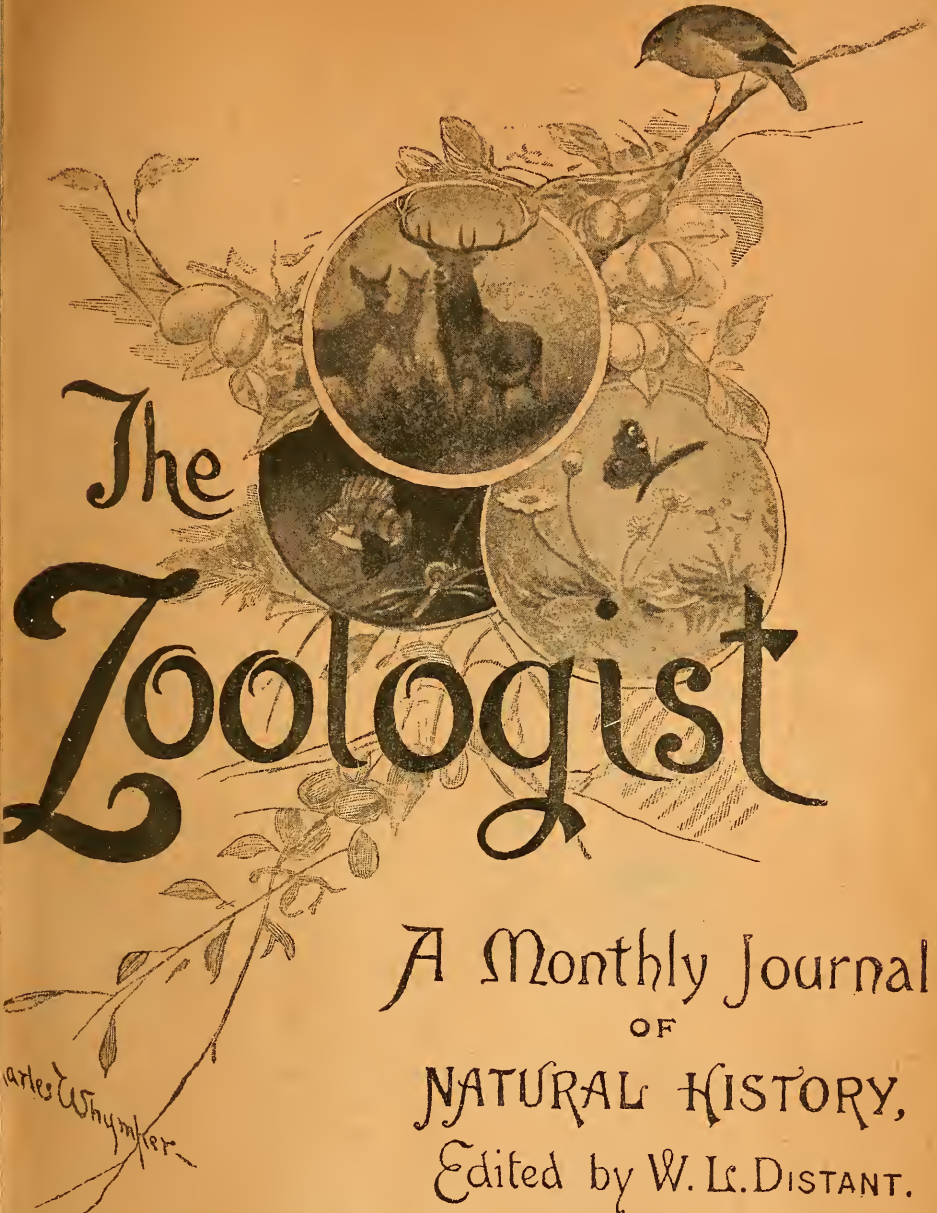
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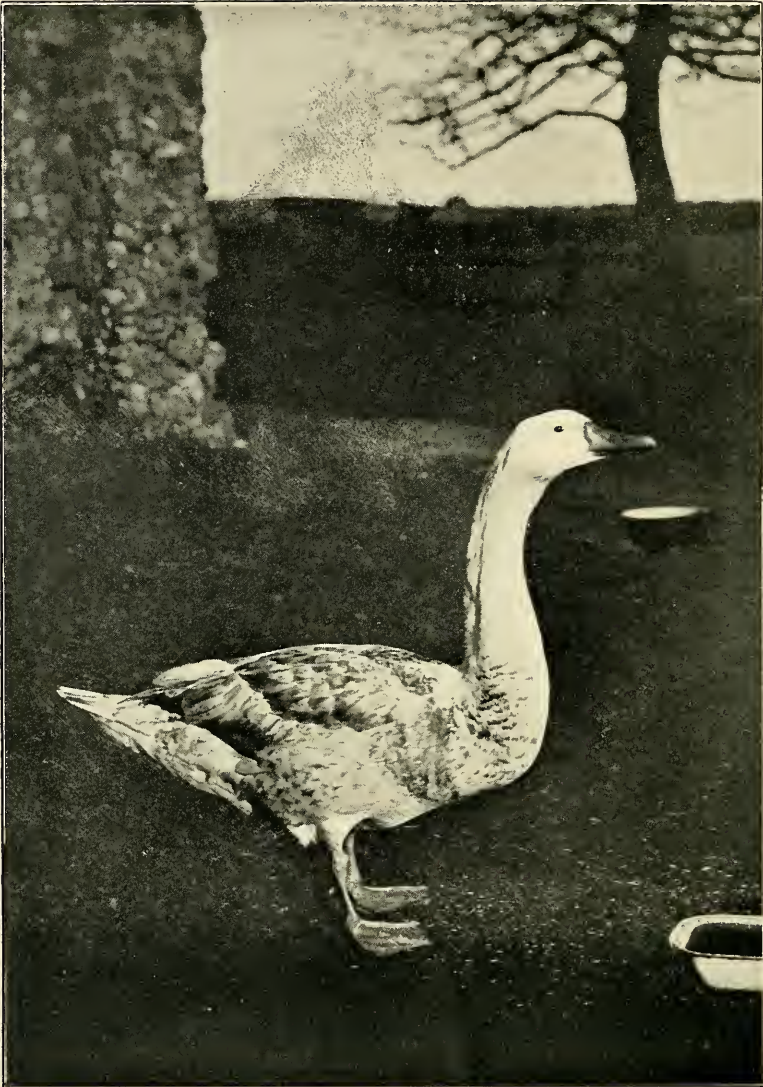
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THE ZOOLOGIST

No. 839.—May, 1911.

ORNITHOLOGICAL REPORT FOR NORFOLK (1910).

BY J. H. GURNEY, F.Z.S.

(Assisted by other Observers.)

(PLATE III.)

The Vernal Migration.—The unfailing March migration of Grey Crows, which has gone on from time immemorial—it was first noted in Norfolk as long ago as 1847 and 1848—again took place on March 6th, 7th, 11th, 12th, 15th, and 21st. The regularity with which they pass is very remarkable, and possibly in no other part of England is the exodus of Grey Crows larger. When this event was over, it was time to begin to watch for the spring migrants, of which the Pied Wagtail is the first. We had the Wryneck at Keswick on March 24th, and the Chiffchaff on the 30th, and after that the Swallow, Redstart, Blackcap, Greater Whitethroat, Ray's Wagtail, and Sedge-Warbler in pretty much their usual order, but the Cuckoo and Willow-Warbler were not so early as those noted at Brunstead by the Rev. M. C. Bird, who has furnished the following spring memoranda:—

January 6th, Snipe bleating.

February 11th, Blackbird singing; 12th, Kestrel's breeding cry heard; 18th, first Redshanks; 21st, Starlings paired; 25th, Chaffinches singing.

March 6th, Yellowhammers on clover-ley; 8th, Woodcocks
Zool. 4th ser. vol. XV., May, 1911.

on their return passage; 15th, Pied Wagtails and Stonechats seen; 17th, Thrush sitting on five eggs; 18th, Blackbird sitting; 21st, Hedge-Accentor frequenting high trees in their love-flights.

April 8th, first Swallow; 10th, first Cuckoo; 26th, Ring-Ouzel.

May 13th, Turtle-Doves; 21st, Spotted Flycatcher.

Golden Orioles are not, and never were, common birds in East Anglia, but I rather expected to have heard of some, as the Forest of Boulogne was ringing with their flute-like notes on May 28th. I have listened to a French gamekeeper imitating them very well, and in this way they may be drawn within shot.

Mr. Steele Elliott and others of your correspondents allude to the scarcity of the Corn-Crake, which is noticeable in Norfolk also. I cannot but think that it is attributable to their being shot in spring in the South of France, where anything which can be designated a *poule d'eau* (i.e. Spotted Crake, Baillon's Crake, Land-Rail, &c.) is in great request, the close-time being suspended for their benefit until the middle or end of April, the time varying in different Departments. That the decrease in the number of Spotted Crakes is due to that cause seems also probable, for the birds are reckoned delicacies of the first order, and, in fact, are made a special object of pursuit in spring, hundreds being sometimes killed in a single day on passage (see 'Richesses Orn. du Midi de la France,' p. 488).

The Autumnal Migration.—This is always a time for the ornithologist to be on the alert. Rough-legged Buzzards began to appear in October, and Water-Rails turned up in such odd places as the middle of Cromer town—on a fishing-boat (C. Ticehurst)—and in a bedroom (A. Patterson). Water-Rails are birds which, trusting more to their legs than to their wings, drop anywhere. Mealy Redpolls were very much in evidence, particularly near Yarmouth, but less so at Cley. Mr. E. Saunders writes of their being still about in gardens as late as November 14th, and Mr. Dye of many taken by birdcatchers. Whether there were any *S. linaria holboelli* among them was not ascertained. The chief arrival of Woodcocks evidently took place during the first week of December; on the 1st the Yarmouth wind register was E.N.E., force 6 (a gale); on the 2nd,

E.N.E., force 5; on the 3rd, E., force 6. Undoubtedly, it was these very high easterly winds which brought them over. In Norfolk the Woodcock has become more of a winter than an autumnal migrant, but one wonders whether these December flights across the North Sea are altogether voluntary ones, or whether these Woodcocks are not sometimes driven west against their will.

The Great Titmouse has long been a known migrant to Norfolk, a fact which I believe my late father was the first to recognize (*cf.* Zool. 1848, p. 2071). It has been taken on different occasions at our floating lightships, whence I have more than once received it. In the present instance the first Great Tits to arrive, or which came under the notice of the naturalist, were some seen on Lowestoft Denes by Mr. C. B. Ticehurst. On Oct. 1st he saw some, and on the 12th there were others in bushes near the sea, and on the 15th four were picked up at high-tide mark. At Yarmouth, Mr. Ticehurst was informed, about twenty were actually viewed as they came in from the sea, and a birdcatcher took several on Yarmouth North Denes. All examined by Mr. Ticehurst belonged, in his opinion, to the Continental race *Parus major major*, considered to be distinguishable by its brighter coloration and more slender bill (see Prazák, Orn. Jahrb. v. p. 239). This signal irruption of Titmice was equally marked on the coast of Yorkshire, and apparently in Lincolnshire, where my correspondent, Mr. Caton Haigh, writes of many being seen to the south of Humber-mouth on Oct. 17th, which was two days after I had met with them on the shore at Cley. Mr. Caton Haigh also speaks of a smaller flight on Oct. 24th.

The Visitation of Crossbills.—All through the spring of 1910 Crossbills were continually in evidence, those on the coast being, I presume, roaming parties, which kept giving way to new arrivals from inland. Their wanderings were traced in last year's narrative (Zool. pp. 121, 129) up to March 2nd, 1910, and continued by the writer in the Norwich Naturalists' 'Transactions' (ix. p. 71) up to May 14th—a record of the greatest Crossbill migration ever known. To take up the thread at that point can only be done locally. I should first mention that thirty-two were counted quite early in the morning by the

gardener at Northrepps, which considerable flock was joined later in the day by two smaller ones, so that altogether he estimated that there were no fewer than sixty-five Crossbills round the Hill House within a radius of four hundred yards. This parish is well wooded, with plenty of silver-fir, larch, and Scotch, in woods a mile or so from the sea. On June 22nd he counted about twenty-six, and on the 30th twenty-three. Again, after an interval, fourteen more were seen at the same place on Aug. 6th, and eight on Aug. 10th, and then, after a lapse of four weeks, three on Sept. 10th, while on Oct. 4th five were recognized at a point nearer to the sea. Whether the above observations all refer to European Crossbills, or any of them to the English race, from which they have been separated by Mr. Hartert, I must leave, as none were shot. The grounds on which Mr. Hartert distinguishes the English Crossbill from the Continental form are that the coloration is duller in both sexes, and that the bill is less elongated and less pointed, but it requires an expert to decide differentiations like these.

There is no doubt that most of the Crossbills have now taken their departure, but when they went is another matter, for it is so much easier to register the coming of birds than their departure. It did not seem that their numbers greatly lessened before July, 1910, but September probably saw many departures. On Sept. 5th a female, which may have been just going to leave, was obtained by Mr. F. Richards almost at the extremity of Blakeney Point, and I learn from Mr. E. C. Arnold of the presence of a small flock on Morston Marsh hedge about Sept. 10th, which is suggestive of immediate migration, as it is near the sea. Two were also reported by Mr. A. Napier from Holkam sand-hills on Oct. 23rd, close to the shore. But that all the Crossbills did not go is certain, for on Dec. 20th one was seen at Southacre by Mr. Daubenny, and about the same time the presence of some at Castle Rising was announced by Mr. Tracey, and others seen at Fritton by Mr. Buxton.

Particulars of their nesting in the Thetford and Brandon district (where Mr. Noble was the first to record nidification) have been elsewhere published, and need not be repeated. In quite another part of Norfolk a nest with four eggs was examined by Mr. N. Tracey on March 28th, 1910, *viz.* near King's Lynn.

Subsequently Mr. Tracey was told by the gamekeeper of his having seen broods of young Crossbills being fed by the parent birds in April at the same place where the nest was. A nest was also found at Swannington, near Attleborough, on April 16th, by Mr. W. G. Clarke, almost at the end of a Scotch-fir branch, some twenty-five feet from the ground.

Chief Rarities.—The principal rarities for the year were a Roller and a Bluethroat in May, a Black-headed Wagtail in June, a Common Crane and a Caspian Tern in August, and a Tawny Pipit and Yellow-browed Warbler in September. In February a Little Owl was caught at Costessey, in a rabbit-trap (E. Roberts), and during the autumn Mr. R. Clarke, of Snettisham, received no fewer than six Little Owls. It is a pity that people should be at the expense of turning out these engaging birds merely to have them killed by the irrepressible gamekeeper.

Rainfall, as registered by Mr. A. W. Preston: Total for 1910, 31·84 in., above the Norfolk average by 6·09 in. (four inches more than last year). Prevailing direction of wind, west.

JANUARY.

1st.—A raw day; nothing to remark upon except the unpleasant weather. My nearest neighbour's drake Teal died, aged nine years; as a rule pinioned wildfowl do not mind cold if they are well and frequently fed. On the same pond there is a Pochard drake more than fifteen years old.

22nd.—A heavy fall of snow, lying to the depth of five inches on the level.

23rd.—Yesterday's fall of snow had its expected effect on bird-life. Many Starlings were to be seen on the move, flocks of them hurrying somewhere, and frozen-out Otters lost no time in making their way down-stream. One result of this sharp weather was the very unusual advent of a flock of twenty-five Dunlin to Eaton Common, the largest company I have met with on an inland river. They were feeding greedily, with a score of very tame Snipe, at a place in the meadow which had been kept open by an overflow of the Yare. Next day there was a sudden drop in the barometer, and every Dunlin had gone.

24th.—Another consequence of this sharp weather was that

a Puffin got out of his reckoning, and was picked up to-day by a dog in West Lexham (S. Long).

30th.—Seven Bernacle Geese visited Breydon Broad, as I am informed by Mr. B. Dye, who handled two of them in the flesh.

31st.—Bridled Guillemot picked up on Yarmouth beach (B. Dye).

FEBRUARY.

12th.—A Common Buzzard,† which settled on a dead Wood-Pigeon used as a decoy, not far from Norwich, promptly fell a victim to its temerity.

MARCH.

21st.—Greater Spotted Woodpecker constantly “jarring.” A Dabchick† picked up on the beach at Overstrand.

APRIL.

22nd.—Spotted Crake “telegraphed” near Aylsham (E. Roberts). Carrion-Crow at Keswick.

23rd.—A Garganey Teal sitting closely on ten eggs, and on May 3rd she was still on the nest (J. M. Goodall).

24th.—Eighty-six Herons' nests counted in Reedham heronry by Mr. S. K. Long.

MAY.

1st.—A Hoopoe at Cringleford Hall; seen close to the house (Keppel).

5th.—Under this date Sir Digby Pigott writes of a Tawny Owl's nest at Sheringham, in a hole in the ground in a wood, but clear of trees. The hole was what is here called a “blind” (*i. e.* unfinished) rabbit's-hole, only three feet deep, and contained four young Owls.

8th.—Sleet, but no wind. Mr. J. E. Knights writes of having seen to-day four Spoonbills flying over Yarmouth North Denes, at about 1 p.m., at no greater height than twenty yards. About half an hour later he saw them again passing over the outskirts of the town, and scarcely higher than the level of the chimneys, the interval having no doubt been spent on the beach. The populace was too unobservant to be aroused to any interest by their appearance, although it might have been attracted, as Mr. Knights' attention was, by the noise they made when on the

wing—like somebody rattling a can—a sound no doubt proceeding from the contact of their pinions with the air. Presently they were seen to wheel round and go off in the direction of Breydon Broad. On the 15th a Spoonbill put in an appearance on Breydon Broad, where it was watched and protected until the 25th. On the 27th a second appeared.

13th.—E.S.E., 4. A bird which, from the description, was possibly a Blue-cheeked Bee-eater (*Merops persicus*) (cf. 'British Birds,' iv. p. 126), was seen by Capt. S. E. Holland and others in an osier-bed at Mundesley-by-the-Sea. Within a few days of its occurrence a Roller was also seen at Garboldisham by Mr. A. R. Dunell. A rather high easterly wind had prevailed for some days, which may have had to do with the Bee-eater's advent, if it was one.

15th.—I am informed, on good authority, of a Curlew's nest with four eggs, found by a gamekeeper at Royden Fen. In 1889 and 1890 this species was believed to have nested at Wolferton (Zool. 1889, p. 336), but complete proof was lacking.

JUNE.

17th. — Thirteen young Sheld-Ducks on Breydon Broad (G. Jary), perhaps bred on Caister Denes.

19th. — A Black-headed Wagtail (*Motacilla flava melanocephala*), identified near the sea at Cley by Mr. J. R. Harding ('Field,' July 2nd).

20th.—Another Spoonbill appeared on Breydon (G. Jary), but left on the 24th.

30th.—E., squally. A clutch of three incubated Ringed Plover's eggs found on Eccles beach by Mr. Bird. A mysterious black bird like a Goose alighted on Breydon Broad during a heavy tempest, but went away without Jary being able to identify it.

JULY.

No notes worth recording, except a Quail seen at Eccles on the 11th (M. Bird), and three Green Sandpipers at Sustead on the 29th (G. Davey).

AUGUST.

5th.—Mr. Hamon Lestrange informs me of a female Crane, shot at Thornham, which had been seen about the neighbourhood for a week or so before meeting its fate.

7th.—A Red-legged Partridge's nest containing fifteen eggs discovered in a hole in a straw-stack at Long Stratton (P. B. Fickling), and another nest in a similar situation, with the same number of eggs, at Pulham (F. Adcock).

9th.—N.E., 4. A Caspian Tern settled on Mr. Jary's punt, which was moored about fifteen yards off his houseboat in which he was, remaining half an hour, after which it caught some whitebait and flew away; he says its bill was very red. It appeared to be tired, and was not seen again on Breydon Broad. This tidal water has been known as an occasional resort of the Caspian Tern since 1825; it was visited by one in July, 1901, and again by another in July, 1902.

30th.—A Hoopoe seen on the Bure Marsh, Yarmouth (Dye).

SEPTEMBER.

1st.—Red-necked Phalarope at Sidestrand (S. Cummings).

3rd.—W.N.W., 3. Yellow-browed Warbler at Southwold in Suffolk (J. G. Tuck).

12th.—Three Black-tailed Godwits on Breydon (Dye).

13th.—Spotted Crake at Ruston (Bird).

14th.—E. Influx of various small birds observed by Mr. Borrer (see 'British Birds,' iv. p. 182).

15th.—N.E., 3. A Tawny Pipit shot on the coast (Bull. Brit. Orn. Club, xxvii. p. 16).

16th.—N.E., 5. Mr. F. Richards identified a Yellow-browed Warbler, and an Ortolan Bunting on the coast.

20th.—N.E., 3, at Blakeney; N., 4, at Yarmouth. Mr. E. C. Arnold saw a Barred Warbler, perhaps the same which was shot on the 27th, and subsequently exhibited at the British Ornithologists' Club.

OCTOBER.

1st.—A young Gannet close in shore at Mundesley (B. Riviere).

3rd.—W.N.W., 3. About forty Linnets flying parallel with the coast. Yellow-browed Warbler in Lincolnshire (Caton Haigh).

8th.—No wind. A few small flocks of Finches going north at 6 a.m., too dark for identification.

12th.—Misty. A Coot† picked up at Swardeston.

13th.—N.E., 7. Very heavy sea and high wind; about

12.30 p.m. a large steamer went down within sight of Sheringham, with the loss of many lives. Many flocks of Gulls, unable to remain stationary, were to be seen passing Cromer, and thousands, I understand, were visible on Hickling Broad (A. Nudd). This Broad is about three miles from the sea, and here they could obtain temporary shelter from its violence.

14th.—E., 6. Wind still very high; a few Gulls were to be seen hugging the cliff rather than face the wind, but the major part of them had long since passed on, and were by this time possibly hundreds of miles away.

15th.—S.E., 3. In the course of a walk along the shore my son and I met with a Snow-Bunting and a Purple Sandpiper, and further inland a Rough-legged Buzzard; we also heard of another Buzzard, a Grey Shrike, and a Peregrine Falcon. During the night there had been an arrival of Golden-crested Wrens, some of which had dropped into the first cover they met with—grass among the shingle.

16th.—No wind. At 8 a.m. a flock of Starlings, estimated at nearly a thousand, passed over Northrepps, going north-west; also a few Rooks and Jackdaws (W. Burdett). More Goldcrests at Yarmouth (Dye).

17th.—A considerable incursion of Rough-legged Buzzards marked the autumn, but I will not guarantee that the following dates of Buzzards seen or shot all refer to different individuals. This fine bird is now much persecuted in Norway, whence our supply probably comes, and consequently is a good deal rarer in England than it used to be:—Oct. 15th. Cley, Felbrige,† and Holt. 17th. Cley and Yarmouth. 21st. Thorpe Market (H. Cole), and Salthouse (?). 24th. Hickling (Nudd). 25. Rough-ton (Gunn). Nov. 2nd. Cromer. 6th. Benacre (C. Ticehurst). 19th. Beccles† (contained the remains of a hen Pheasant), Weybourn, and Hillington (R. Clarke). During December, one at Wheatacre (or two), one at Aldeby (R. Tilney), one at Raveningham (Tilney), and one at Wrentham, in Suffolk. In January, 1911, one at Gayford (Clarke).

18th.—Young Gannet at Cromer.

28th.—A solitary Snipe seen at Hoveton by Mr. Barclay.

30th.—A Long-eared Owl on the beach at Yarmouth (Dye).

NOVEMBER.

1st.—About this date an orange-coloured Goose, which Mr. A. Napier failed to identify, joined the herd of Pink-footed Geese at Holkam (*cf.* Zool. 1910, p. 134).

2nd.—Wheatear at Eccles-by-the-Sea (Bird).

3rd.—Grey Phalarope at Yarmouth (Gunn).

14th.—Land-Rail at Yarmouth (E. Saunders).

18th.—W.S.W., 3. About midday a gale sprang up, with intervals of sleet and much rain; it was not higher than force 3 to 4 in Norfolk (sixteen to twenty-five miles per hour), but at Spurn Point it got up to force 8. I marked about eighty Teal† get out of a pond in a large wood near the coast.

19th.—N. Wind north and still high, reaching to force 7 at Spurn Point. At 8.30 a.m. Rooks and Gulls were just topping the houses next the sea at Sheringham as they endeavoured to face it. Large flocks of Wild Swans were seen at Holkam, and flights of Wild Geese at Brunstead and Bacton (M. Bird). I think this gale showed its effects on the Little Auk more than on any species. Many were reported at sea on the coast of Yorkshire, no doubt pressing southwards, and almost simultaneously they appeared off Blakeney and Cley, also at Cromer and Lowestoft, at which latter place seven or eight came under Mr. Ticehurst's notice. But the migration did not reach anything like the dimensions of that of 1895. Several unfortunates were picked up inland at Hickling, Holt, Hellesdon, Eye, Rockland, and Buckenham.

22nd.—Under this date Mr. A. Napier writes of a Glaucous Gull on the Holkam Lake, where it had been for some time:—“The Ducks and Coots, especially the latter, seem to be terrified of it. There was one here in the spring, and I think it played havoc with the nests of the Canadian Geese; at any rate, we found the eggs in many of the nests broken, and I watched the bird making a thorough search of the island.”

25th.—Waxwing at Cromer (F. Barclay), and Mr. Roberts had another.†

26th.—Thirty-two Wild Swans passed over Hickling water (Nudd).

29th.—The destructiveness of the Wood-Pigeon is becoming more and more apparent. At a meeting of the Norwich Natura-

lists' Society to-day, Mr. E. Roberts exhibited 1188 grains of barley† taken out of the crop of one Pigeon. It is true that this was grain which had probably been strewn for Pheasants, but I doubt if the same can be said of 1371 grains of barley, 94 blades of young clover, and a bean, which Mr. Bird informs me were found in a Wood-Pigeon the other day by Nudd.

30th.—A Fork-tail Petrel, which had been taken alive near the Cockle Lightship, Cromer, two miles from the shore, received by Mr. Dye, who also mentions a Stormy Petrel, caught alive in the harbour.

DECEMBER.

2nd.—A Pintail drake,† shot by Mr. Buxton on the river at Colney. Six Bernacle Geese seen at Cley by Mr. Ramm; none shot.

8th.—Mr. Roberts showed me a full-sized Mole† which he had taken almost uninjured out of a Heron, in the gizzard of which he also found the remains of another, together with one small fish. Both moles and rats have been very numerous this year in Norfolk.

9th.—Two pinioned Brent Geeset† killed, presumably by a Fox, their heads neatly bitten off about the middle of the neck; afterwards two Egyptian Geeset† shared the same fate.

10th.—Two Green Sandpipers† at Intwood Sluice, and another on the 18th.

VARIETIES OF PLUMAGE.

February 28th.—A white Hawfinch was seen by Mr. Hamond at Twyford, where it continued to haunt the same three thorn-trees up to March 20th. Although very conspicuous, it was not an albino, as there was some colour on the head. In March it paired with one of the normal colour, but the nest, if they made one, was not found.

April 16th.—A white Wood-Pigeon† received at the Museum from Great Snoring; eyes of the usual colour. Another† was shot at Holkam in September (Gunn).

August 20th.—A fawn-coloured House-Martin on Sidestrand cliffs (S. Cummings). In August, Mr. B. Riviere caught a white Hedge-Accentor at Norwich, and kept it alive for some weeks; possibly it was a progeny of the same parents as the one recorded last year (Zool. 1910, p. 135).

September.—At the close of September, Mr. T. E. Gunn had in another of the singular red Partridges (*Perdix montana*) from Lenwade, and was told that a second was seen. It is remarkable how persistent the race has been in this particular district, where it was first recognized in December, 1896, and where no protection has been given to it. It is not known to have been shot in other parts of Norfolk that I am aware of. The first recognition of *P. montana* in England appears to have been in Northumberland in 1863. Whether these sprang from imported eggs cannot now be ascertained, but that the Norfolk birds have done so there can be little doubt. The number of Partridge's eggs sent over from Hungary, South Austria, and other parts of the Continent in the last thirty years have been very large, and a great many have found their way to Norfolk and Suffolk. Twenty-two of these red birds have now been recorded in Norfolk alone, and no doubt others have been shot; there seems no reason why, if sportsmen would stay their hands for a few seasons, a breed should not be established. Their colour is always the same when they are adult—that is, yellow heads and dark red bodies—offering a handsome contrast to the common type of Partridge. I have seen no intermediate phases of plumage, allowing for difference of age.

October 15th.—A Redwing† with a bleached tail and some white on the wings shot by Mr. Catley. Another,† nearly white but showing a little of the chestnut flanks, was received by Mr. Gunn in December.

November 12th.—A pure white Gull, seen by Mr. R. Pinchin with some Common and Lesser Black-backed Gulls at Blakeney, may have been only a Glaucous Gull or an Icelander in the white stage which these Gulls pass through.

FOOD OF THE STARLING.

As usual, when the weather happens to be mild at Christmas, Lapwings and Starlings were to be seen on the young wheat. There is considerable discrepancy of opinion among agriculturists as to whether the Starling does more good or harm. In their anxiety to peck out grubs they displace a great many blades of wheat, most of which turn yellow and dry up, and the kernels die, which naturally causes some annoyance to the farmer; but

besides that, they often eat the kernels, probably when they begin to sprout and are milky.

Ten Starlings, recently shot at Suffield (on April 6th, 1911) by Mr. J. H. Bugden whilst feeding on a field of spring wheat, were found, when cut open, to contain whole kernels of wheat, and kernels of oats, which they had evidently just dug up. Some, Mr. Bugden informs me, had nothing in their crops at all but corn; others had corn and wireworms. Four more Starlings, shot by Mr. Bugden the following week, had also been eating corn. These were submitted to Mr. John Hamond, of Bramp-

Bird.	INJURIES.		BENEFITS.		Neutral and Undetermined (as yet).
	Vegetable Matter, &c.	Insects, &c.	Vegetable Matter, &c.	Insects, &c.	
(1) Male ..	20 grains of wheat, some sound, some germinating, and some little more than husk, 1 grain of oats	2 centipedes	2 daisy heads	About 23 wireworms of all sizes — some whole & some in segments, 3 small snails, segments of the millipede, 1 click beetle, 2 fly pupæ (probably Anthomyid)	2 spiders, 4 fly grubs (what sort not yet determined)
(2) Male ..	6 grains of wheat, with a large amount of wheat husk and some germs	1 Staphylinid beetle, 1 Staphylinid beetle grub, 1 Carabid beetle, 1 centipede, 1 Syrphid fly grub (eats green fly)	.....	2 weevils, 2 click beetles, 1 wireworm	A few small pieces of beetles
(3) Female	10 grains of wheat as in (1), with a moderate amount of wheat husk, and germ with young roots	2 centipedes	3 daisy heads, 1 seed of iron-grass (<i>Polygonum aviculare</i>)	15 wireworms, some whole and some in segments, 7 click beetles, 1 small snail	1 fly grub as in (1), and few beetle remains
(4) Female	7 grains of wheat as in (1), with a moderate amount of husk (wheat)	2 Staphylinid beetle grubs, 1 small Staphylinid beetle, remains of 10 Carabid beetles	.....	16 wireworms, some whole and some in segments, 6 small snails, 4 click beetles (<i>Elater</i>), remains of 11 weevils	2 spiders, beetle remains as yet unidentified

ton, for critical examination, and the results printed in our local paper ('The Eastern Daily Press,' April 15th), which are so interesting that I shall make no apology for quoting them (see Table, p. 173):—

Judging from these facts, and from those which have already been recorded by Mr. Kelso (Zool. 1910, p. 144), I am afraid it must be recognized that Starlings are not the harmless birds which they are usually considered to be. On the other hand, one is reluctant to give so handsome a bird a bad name, and it cannot be denied that their utility as destroyers of insects is great.

Mr. Hamond's dissections of his four Starlings show a diet of forty-two grains of corn as against sixty-nine wireworms and click-beetles (the former being the grub of the latter); the balance therefore, in this case, was in favour of the Starlings.

SWAN × GOOSE HYBRID.

There is at present living, at a farmhouse near Cromer, a hybrid Swan. This anomalous bird, which is the produce of a male Mute Swan and a female domestic Goose, both of them the property of Mrs. A. T. Reynolds, of Beeston Priory, was hatched in April, 1910. Another was hatched with it, which unfortunately was subsequently killed; there being no gander on the place their parentage is apparently beyond dispute. As will be seen from one of the photographs which Mrs. Reynolds has had taken of it, this hybrid is more like a Swan than a Goose in shape, and its long neck, which at times it doubles up in Swan fashion, contributes to the similarity. In colouring it rather more resembles the Goose (*cf.* Plate III.).

BLAKENEY TERN SETTLEMENT.

The following memoranda on the prosperity of the Tern Settlement at Biakeney have been supplied to Mr. Q. E. Gurney by the watcher in charge, who considers 1910 to have been the best season he ever had, as there was an extra quantity of Terns of both sorts, and they did exceedingly well. He was fortunately able to trap several rats and stoats:—

April 26th.—Lesser Terns arrived.

28th.—Common Terns arrived.

May 16th.—Lesser Tern's nest with eggs.

19th.—Common Tern's nest with eggs.

24th.—Plenty of nests of Common and Lesser Terns.

31st.—Fresh nests of Common Terns.

June 6th.—First Lesser Terns hatched.

10th.—First Common Terns hatched.

19th.—Common and Lesser Terns hatching all over the place.

24th.—Young Terns feathered.

29th.—Several young Lesser Terns flying.

July 9th.—A few young Terns killed by the tide.

August.—In this month there were several nests with eggs.

AN OBSERVATIONAL DIARY ON THE DOMESTIC HABITS OF THE SPARROW-HAWK (*ACCIPITER NISUS*).

BY EDMUND SELOUS.

(Concluded from p. 110.)

At 6.20 p.m., whilst I am watching the female on the nest there comes the accustomed cry of the male, and in a moment or two she rises and flies straight towards it. I can see the final sweep up to the branch on which the male sits, and almost immediately he strikes away to one side, having evidently delivered his charge. The female, for some little while, stays away from the nest, flying, at intervals, from one tree to another, and crying from time to time, as I have heard her, when feeding. I can just see, once, when she flies, that she carries something, but no more. At 6.38 she flies up on to the nest, utters the cry there (which is unusual), and then begins to tear up what is perhaps—or was when she received it—a whole or only decapitated bird, for now, at 6.55 she is still doing so, though the male has for several minutes been back and crying in the plantation. Now, at 6.58, the meal at last seems over, having lasted just twenty minutes. Yet on this as on every other occasion, with one perhaps partial exception, I have not observed any “pluming.”

I again note that the tearing up of the booty always takes place now on the side of the nest’s rim opposite to where it used to, and this independent of the direction from which the bird comes in. The side at first used was indeed that which the bird first comes to on flying in with its booty, for the male hawk almost always enters the plantation on that side of the nest, yet this can hardly have been the reason for, at the *very* first, just after the hatching, the side now in use was selected. Moreover, in each half of the circumference of the nest there are various points at which the bird might stand to tear up the booty, whereas it has throughout only done so at one in each, the

two being opposite one another, as far as I am able to judge, along the line of the greatest diameter. It is at these two points also, and these only, that I can recall having seen the bird standing on the rim of the nest. It looks, therefore, as if there were two special places, and two only, where the female hawk, who is alone the distributor, stands either to perform this office, or to rest and digest.

I now mention that when the male had this last time delivered the booty brought in by him to his partner, he made a dive down amongst the foliage in the near proximity of the nest where the dead Redstart was once placed, but not, I believe, on to it. I had, however, in consequence, intended to examine this nest before leaving (as I have done daily, or almost daily, without finding anything stored there), but forgot it. This is the more to be regretted because the action certainly seemed the outcome of some special object on the part of the bird making it, and, on account of the great quickness, and, as one might say, lightness of motion characteristic of the species on such occasions—for the passing of the booty, which I could never actually see, would be a very similar one—it is quite possible that something really was a second time placed in the nest. Why otherwise such a bird as the Sparrow-Hawk should suddenly have flown thus in towards the trunk of this tree, at so slight a height above the ground, it is not easy to imagine. In regard to the long exeat (some forty-five minutes) of the female hawk, and her return at the end of it without anything, she may possibly either have been foraging for herself or stretching her wings merely—supposing that she did not sit all or most of the time in the plantation.

July 2nd.—In plantation about 3.30 a.m., and take up a new position commanding both that part of it where the male hawk usually makes his entry and also the nest. At 4.5, when first able to make use of the glasses, I can only distinguish the nest, but at 4.25 I see the female hawk standing on the rim of it. She has been there all the time, but in the gloom I had mistaken her for one of the branches amongst which it is lodged. All is now quiet, the hawk so motionless, she might well be asleep, and it is not till nearly 5 that I hear the cry of the male in the plantation. Then in a moment or two she rouses herself, and

flies directly to him. I catch a glimpse of the two together in the air, and then of a pair of claws stretched down and grasping something that looks larger than has hitherto been the case. They are those of the female, as afterwards appears, for I follow her thus laden into and from one tree to another, then into a third, and from this to the nest. But though the booty certainly looks larger, and from the hawk's way of picking at it seems to stand further out from her feet than it has before—for she bends her head less inwards—yet the duration of the banquet does not bear this out, since it is over in five minutes. It is all, or nearly all, given to the chicks. This, and my last observation of yesterday, assure me that no change has been initiated in the domestic economy of the birds, and that the female is supplied, both for herself and young, entirely by the male, not only, as I believe, from the time of the hatching of the eggs, but during the incubation as well, for there were the same cries of the male as he entered the plantation, and the female flew to him in just the same way.

About 5.35 the male re-enters the plantation, but he cries for some time before the female goes to him. He does not desist or go away, and here again it is evident that the one bird is as interested in delivering the food as the other is in receiving it from him. As has been seen, if kept too long waiting he will even deposit it, himself, in the nest. At last, in perhaps some ten minutes, the female hawk flies to her mate, there is the usual meeting, and afterwards I see her standing on a bough with something that might be a quite small dead bird held in one cruel-looking claw, and uttering her plaintive-sounding cry. Soon she flies to the nest with it, eats ravenously herself, for a little, then feeds the chicks, and stands statuesquely. The joint meal takes some five or ten minutes.

July 4th.—This last morning of my observations—for I leave by the afternoon steamer—tallies with my previous ones. I entered the plantation at 4.20 a.m., finding the hawk on the nest, and about 5 the voice of the male was heard, she flew to him very shortly, and at 5.10 returned and fed the chicks—which did not take quite five minutes. More than this I was unable to see, but there is no need of further repetition. As always, the voice of the female hawk was heard on this tree or that several

times between her flying to the male and returning to the nest. The female, when I came, was covering the chicks, as from the beginning. The latter are now very conspicuous during the feeding, and, as I have never been able to distinguish more than two, I have no doubt that this is the brood.

A short *résumé* of the principal facts contained in the above observations may here be added. It is clear that there is a marked differentiation of the domestic habits, as between the male and female Sparrow-Hawk. The female alone incubates, and, from a reperusal of my notes, I am inclined to think that, even during this period, she is to some extent, at any rate, supplied with food by the male. Possibly she may be so entirely, or almost entirely, and it would seem that the booty is not always delivered to her personally, but may be deposited by the male in some place that they both know of, from which she can take it at her pleasure. That it once was so deposited, and that she did so take it, are facts, nor can they be supposed to stand alone. On one other occasion, also, there was an appearance of the female having taken something that had been so deposited on the branch of a tree—as the other had been in, or rather on, an old Jay's nest—but the question is whether the female herself, or the male bird, had made these deposits. The former would seem the more likely, for those who hide can find, and since such booty might conceivably have been received by the female from the male in the first instance, the question of the bird's habits in this respect would be unaffected. In the Jay's nest thus used, however, we seem to have something in the nature of a special known place of deposit, and the fact that the male hawk did, on one occasion, make what looked very like a special descent upon it—its situation being such as to render an accidental or chance visit very unlikely—suggests that it may have been he who placed the dead Redstart there to supply the future needs of his partner—possibly also his own.

To whatever extent the female Sparrow-Hawk, whilst incubating, may be supplied with viviers by the male, the latter's duty in this respect becomes extremely rigorous from the time that the eggs are hatched; yet it is to be noted that both birds were seen by me flying together, apparently on the look-out for

prey, at a time when, in all probability, the young were out, though, as their arrival must have been, at most, a very recent event, this may have related rather to the incubatory period than the one succeeding it.

The male only brings the booty procured by him to the near neighbourhood of the nest (showing a choice of locality in this respect), where it is received by the female, the delivery taking place either on the branch of a tree or in the air. If, however, she is slow in coming, he grows impatient, and may then fly to the nest, and there alight and deposit his offering. This is a very rare occurrence, but it would, not improbably, always take place were the arrival of the female to be inordinately delayed.

Having, only in one instance, seen the female hawk pluck the bird that was delivered to her, and that, as it appeared to me, to but a modified extent, it would appear that this office is performed by the male. Such plucking may be an instinctive or accustomed act following close upon the striking of the prey, in which case we need not associate it with any conscious idea, in the male hawk's mind, of doing a service to his partner. A question, however, is raised by the condition of the dead Redstart that had been deposited in a Jay's nest. Not a feather of this bird appeared to have been so much as ruffled, so that unless it was afterwards plucked by either of the birds, and left there (probably partially devoured), it must have been eaten, feathers and all, by the female, for assuredly she did not, at that time, pluck it, or I must have observed her doing so. There were no feathers on the ground underneath the branch where she sat feasting, nor did any fly out on the air. Possibly, however, some other plucked bird had been left in the place of this earlier deposit after I left the plantation at 7 a.m. on the day that I made the discovery—for I did not return till the following morning. In any case, we have the fact of the storing and subsequent seizure, though only—demonstrably—in this one instance.

Besides plucking or "pluming" the bird brought in by him, the male, it seems likely, frequently makes his own meal on it, so that the final presentation to the female is of a morsel and not a whole dish. I know not how else to account for the

appearance of what I have sometimes seen the male and also the female hawk carrying, or for its smallness.

When on the nest the female Sparrow-Hawk takes no trouble to eject her pellets, or castings, outside of it. I could not find any under the home-tree, and upon two occasions I saw one extruded into the cup of the nest. It is the same with the dejecta both of the young and, presumably, her own. There is no projection of them over or on to the nest's rim, and no subsequent cleaning of the nest, in this respect, by the mother bird. I have never seen anything of any sort or kind carried away from the nest.

The female hawk receives the supplies of the male, both for herself and the chicks. She often makes her meal upon the nest, and does not always share it with the latter. Her habits in this respect may vary with the age of the chicks.

The prey is torn up upon the rim of the nest, and two special parts of it, opposite one another across the greatest diameter, are made use of for this purpose.

In covering the chicks the mother hawk invariably steps from one of these places, where the dissection has taken place, to the other, thus crossing the nest, and, turning round, settles herself down with her head towards the place thus left. This seems an odd performance, for it would surely be as easy for her to cover from where she is and has, all the while, been standing and distributing. The fixity of so trivial a habit is therefore to be noted. It shows the force of routine—a factor that may be of considerable importance in the philosophy of bird antics, especially some stereotyped and apparently useless ones, appertaining to combat. It would seem to be part of the duties of the male Sparrow-Hawk, whilst in the neighbourhood of the nest, to keep intruders away from it.

So far as I am aware, the specialisation of the parental duties in the Sparrow-Hawk is not shared by other raptorial species, nor is the disparity of size between the male and female, characteristic of the family, in their case so great. Possibly these two facts may be inter-related. If, as would seem to be the case, the Sparrow-Hawk is accustomed to pursue its quarry into covert, and there seize it, the male, as the smaller, would probably have an advantage over the female, and be the quicker

taker of the two. He might, therefore, often have met the female as she was leaving or preparing to leave the home-wood, with fresh quarry, and if this was sometimes taken by her, as being the more eager of the two in the actual feeding of the chicks, the present system might have gradually grown out of these elements. It is common, moreover, for the hen bird to brood her chicks longer and oftener than the male, and this would also have helped in the formation of the habit.

In an article entitled "My Eyas-Musket," which appeared in 'Country Life' of November 6th, 1909, and in which the domestic habits of a pair of Sparrow-Hawks are recorded, it is stated that, during two days, the prey brought in to the nest by the female was already plucked and decapitated, that the young were fed on the entrails only, and that the remains were carried away by the mother bird. My observations of June 23rd and 27th tend to corroborate, taken together, the first two of these statements, but my position on the ground, and at some distance, did not allow me to see more positively, or to confirm the impressions then gained. What is said in regard to the plucking justifies my inference that this is done by the male, since I was able to conclude with certainty that the female did not pluck what she received from him before flying with it to the nest; yet, as now appears, it is plucked when she reaches it. Only "to some extent," however, and therefore, as I never saw the female pluck it even then, I conclude that a good many feathers are swallowed by her. The final statement that the remains of the birds brought to the nest are removed from it by the female is at variance with what I observed, and although, owing to my not very advantageous position in regard to the nest itself, such removal might have been missed by me, on this or that occasion, yet owing to the sudden and unpremeditated manner in which many of these exits were made, and the special purpose of others, I am certain that in the great majority of cases the bird did not remove anything, though her feeding, once, shortly after leaving the nest, and without having joined the male, is susceptible of this interpretation, as well as the one I have suggested—a previous deposit, namely. The 'Country Life' chicks were, however, a fortnight old, and the observations in connection with their feeding extended over two days only. The chicks in

the nest watched by me had been hatched only ten days, as far as I could judge, when I left, and during the whole of this time it was the habit of the female to take her meals on the nest, as well as in trees, before coming to it. This would affect the habit of removing the remains if, as seems likely, the hawk removes them, when she does so, only in order to devour them elsewhere. In the account referred to it is mentioned that "a clatter arose in the wood, and mobbed by a troop of small birds, especially Blackbirds, the female hawk came flying down to the nest with the body of a victim clutched in her claws." Only on one occasion did I see anything at all resembling this, and that was when the two Orioles followed the male, who was carrying booty, into the plantation, though at a considerable distance. Otherwise there was never any mobbing whatever. This small sombre plantation was not, indeed, much frequented by small birds. Still, there were some in it and many round it—as witness the constant supply—which makes this difference somewhat remarkable. The male hawk, too, must generally have flown up, with his booty, over low trees and undergrowth—the coverts which he seemed regularly to beat for game. It has often occurred to me that the Cuckoo is much more frequently followed by small birds than the Sparrow-Hawk, for which it is supposed to be mistaken; and when sitting perched it is sometimes so persecuted as to be driven from tree to tree, or right out of any small plantation or coppice. This I have seen, and I have seen small birds fly right at its head and peck it severely, when thus at rest. On the deception theory, the Sparrow-Hawk should be treated in the same way; but is it? I have also seen the Turtle-Dove pursued by a small bird. Was it mistaken for a Cuckoo, or could it have been for a hawk?

THE DISTRIBUTION OF BRITISH ANNELIDS.

BY THE REV. HILDERIC FRIEND.

(Continued from p. 146.)

BIBLIOGRAPHY.

1.—‘A Catalogue of the British Non-parasitical Worms in the British Museum.’ By George Johnston, M.D. London, 1865.

2.—‘A Monograph of the Order Oligochæta.’ By Frank E. Beddard, M.A., F.R.S. Oxford, 1895.

3.—“Contributions towards a Monograph of the British and Irish Oligochæta.” By Rowland Southern, B.Sc. Proc. Roy. Irish Acad. vol. xxvii. 1909.

4.—“The Oligochæta (Earthworms and their Allies) of the Forth Area.” By William Evans, F.R.S.E. Proc. Roy. Phys. Soc. Edin. vol. xviii. 1910.

5.—“British Tree and Earthworms.” By Rev. Hilderic Friend, F.L.S. Journ. Linn. Soc. vol. xxiv. 1892; and other papers alluded to by Beddard and Southern.

Let us now inquire into our authorities. It is a striking fact that, while almost every Natural History Society carefully records finds among flowering plants, lichens, mosses, micro-fungi, butterflies, beetles, and all other classes of plants and animals, none has ever given attention to our marvellous range of Annelids.* With the exception of the papers contributed by myself during the past twenty years to a vast number of local magazines, journals, and newspapers, I do not know of anything having been done in England to further our knowledge of their distribution; while Mr. Evans of Edinburgh and Mr. Southern of Dublin are the only other systematic workers in the whole of the British Isles.

* An exception must be made in the case of Devonshire, while Sussex and some others have published lists.

The first attempt to give information on the subject, if we omit minor references in general books, was made by Dr. Johnston (1). In his Catalogue we find eleven earthworms recorded, together with three or four other Oligochæts. The greater part of the volume, however, deals with marine worms, or Polychæts, and the few land forms which are mentioned need much revision to bring them into line with present-day nomenclature. The records are limited to some half-dozen localities, including Berwick, Kelso, Hammersmith, and Devon. In the year 1890, when I took up the study, there were three authorities in England: Professor (now Sir) E. Ray Lankester was known for his anatomical work, Beddard was preparing for the production of his splendid Monograph (2), and Benham was investigating the waterworms. The latter would doubtless long ago have produced a volume dealing with British Annelids, but for his removal from our shores. Lankester's work was only incidentally connected with distribution, while Beddard's was on a world-wide scale, and consequently mentions regions or countries only. His Monograph is of value, from our point of view, chiefly because it enables us to form an opinion on the probability or otherwise of finding any given genus or species of worm in the British Isles. The same applies also to his valuable article on the "Classification and Distribution of Earthworms" in the 'Proceedings' of the Royal Society (vol. x. p. 235 *et seq.*).

It is to Southern that we owe the first attempt (3) to supply a list of British Oligochæts, including alike the earthworms and the microscopic forms. His list, though it omitted many species of Enchytræids and other worms with which I had long been familiar, contains one hundred and thirty-five British species and subspecies, and must ever be regarded as the foundation upon which any future superstructure shall be raised. Naturally it gives us special help in relation to Ireland.

Next in order comes the valuable article by Evans (4) dealing with the Forth Area. Mr. Evans is a diligent collector, and has not confined his researches to the neighbourhood of Edinburgh, as we shall gather from later records.

To the foregoing I may add allusion to the "Check List of British Earthworms," published by myself, and revised from

time to time in 'The Zoologist,' 'Naturalist,' and other journals; the account of "Earthworms and Treeworms" (5), published in the 'Journal' of the Linnean Society; and the many papers in 'Science Gossip,' 'Essex Naturalist,' 'Gardeners' Chronicle,' and elsewhere, which have during the past twenty years issued from my pen. The results will all be found embodied in the following lists.

We come now to the question: What plan is best adapted for securing an accurate idea of the distribution of British Earthworms as at present known? I propose, first of all, to name the English counties alphabetically, so that a collector in any part may see at a glance what has already been recorded for any particular district. Scotland, Ireland, and Wales will then be taken, and when the county records have been tabulated, a second list will be supplied, showing the known distribution of each species. The smaller worms will afterwards be treated in the same fashion. For details respecting species the reader is referred to the List (*ante*, p. 143), while information relating to their peculiar habits and tastes will be supplied when we come to specific distribution. The Isle of Wight, Isle of Man, Scilly Isles, and Channel Islands will each be taken separately, and in like manner special records may be made for Kew Gardens and Chelsea. There are no fewer than ten counties for which at present there is no authentic record known to me. May I appeal to naturalists in Bedford, Berks, Cheshire, Durham, Rutland, and elsewhere to help me in my attempts to obtain information respecting their Annelid fauna? A beginning may be made with the commonest kinds found in every garden, field, and wayside. The worms should be sent, alive, in tins padded loosely with moss. Tins should not have holes punctured in them, as the worms crawl out and perish in the wrappings. The lids should fit loosely, so as to allow of sufficient ventilation, and the boxes addressed: 110, Wilmot Road, Swadlincote, Burton-on-Trent.

COUNTY RECORDS.

1. BEDFORD.—No records.
2. BERKSHIRE.—No records.
3. BUCKINGHAMSHIRE.—April 25th, 1892, Mr. Henry Blaby,

of Brackley, on the borders of Northants, Oxford, and Bucks, collected a series of worms for me on the Buckingham border. It contained (1) *Lumbricus terrestris*, L.; (2) *L. castaneus*, Sav.; (3) *Allolobophora longa*, Ude; (4) *Aporrectodea chlorotica*, Sav.; (5) *Allolobophora caliginosa*, Sav. (form *turgida*, Eisen); (6) *Eisenia fœtida*, Sav., known as the Brandling; (7) *Dendrobæna subrubicunda*, Eisen; (8) *Allurus tetrædrus*, Sav., and possibly an immature specimen of *Bimastus eiseni*, Levinsen.

July 26th, 1901: Mr. Mark Webb (now editor of 'Knowledge') sent me 2, 5, 6, and 7 from Langley St. Mary's; (9) *Lumbricus rubellus*, Hoffm.; (10) *Eisenia rosea*, Savigny, together with *Aporrectodea chlorotica*, from Burnham Beeches; and (11) *Dendrobæna mammalis*, from Langley and Eton. I have the latter also from High Wycombe and Cressicks, where I have also personally collected all the foregoing. Total, 11.

4. CAMBRIDGESHIRE.—In 'Life Lore,' vol. i. p. 68, I find (1) *Allurus tetrædrus*, Sav., reported for Cambridge. My own researches were limited to the Botanic Gardens, Sept. 27th, 1905. (2) *Lumbricus terrestris*, L.; (3) *L. rubellus*, Hoffm.; (4) *L. castaneus*, Sav.; (5) *Allolobophora caliginosa*, Sav. (form *turgida* prevails); (6) *Eophila icterica*, Sav., was recorded, I believe, for the first time for Britain; (7) *Allolobophora longa*, Ude; (8) *Eisenia fœtida*, Sav.; (9) *E. rosea*, Sav.; (10) *Aporrectodea chlorotica*, Sav.; (11) *A. cambrica*, Friend; and (12) *Dendrobæna subrubicunda*, Eisen, were also found, and reported in the 'Gardeners' Chronicle' later on. I added shortly after: (13) *Octolasion cyaneum*, Sav. (= *Allolobophora studiosa*, Rosa); (14) *A. trapezoides*, Dugès (typical form); confirmed the record for *Allurus tetrædrus*; and on July 26th, 1907, had the pleasure of placing (15) *Allolobophora hermanni*, Michaelsen, on the British List (see 'Report of the Botanic Garden Syndicate,' June 6th, 1908). Oerley records the finding of another worm at Cambridge, known as *Allolobophora platyura*, and by many other synonyms (Rosa, 'Revisione de Lumbricidi,' p. 43); but so far I have failed to identify it. Sept. 30th, 1909, I examined a further supply, kindly sent by Mr. Lynch, and found (16) *Dendrobæna arborea*, Eisen, besides confirming several of the foregoing species. Total, 16.

5. CHANNEL ISLANDS.—On June 18th, 1892, I received from my sister, Nurse Hetty Friend, a consignment of earthworms

which she had collected for me in Sark. It contained five species, besides an Enchytræid, leech, and other things. These were: (1) *Lumbricus rubellus*, Hoffm.; (2) *Aporrectodea chlorotica*, Sav.; (3) *Eisenia fætida*, Sav.; (4) *Dendrobæna subrubicunda*, Eisen; and (5) *Allurus tetrædrus*, Sav.

In November, 1909, Mr. Church, of Jersey, sent me eleven species from that island, collected by his daughters. These included the foregoing, except *Allurus*, and added: (6) *Lumbricus terrestris*, L.; (7) *L. castaneus*, Sav.; (8) *Allolobophora longa*, Ude; (9) *A. turgida*, Eisen; (10) *A. trapezoides*, Dugès (these two being distinct forms in Jersey); (11) *Eisenia rosea*, Sav.; and (12) *Octolasion cyaneum*, Sav. Total, 12 for Sark and Jersey.

6. CHELSEA BOTANIC OR PHYSIC GARDEN.—The Annelids of the Physic Garden are of peculiar interest, but the list is doubtless still very imperfect. While I have personally visited the Garden, I am specially indebted to the Curator (Mr. William Hales) for his great courtesy and frequent attentions. In the 'Gardeners' Chronicle,' Oct. 23rd, 1909, will be found a special report on *E. icterica*, Sav., which I had already recorded for Cambridge.

August 11th, 1909, I found: (1) *Lumbricus terrestris*, L.; (2) *Allolobophora longa*, Ude; (3) *Eisenia rosea*, Sav.; and (4) *Octolasion gracile*, Oerley. I gave an account of the latter in the 'Gardeners' Chronicle,' June 11th, 1910, but now find that my Chelsea record was overlooked.

October 23rd, 1909, in addition to the foregoing, I received (5) *Eophila icterica*, Sav.; (6) *Allolobophora caliginosa*, Sav.; and (7) *Octolasion cyaneum*, Sav. The list was revised and extended in April and May, 1910, when, in addition to some interesting species of *Perionyx* and *Perichæta*, which breed freely in the greenhouse, I found again *O. cyaneum*, *O. gracile*, *E. rosea*, *E. icterica*, and added (8) *Octolasion lacteum*, Oerley (= *Allolobophora profuga*, Rosa); (9) *Allolobophora turgida*, Eisen; two interesting varieties of *Eisenia rosea*, Sav.; and (10) *E. fætida*, Sav. On May 3rd I added two further species, viz. (11) *Lumbricus rubellus*, Hoffm., and (12) *L. castaneus*, Sav., besides confirming several former records.

It will be seen that the features of this collection are some-

what foreign and full of instruction. Twelve species, besides aliens, so far recorded.

7. CHESHIRE.—No records.

8. CORNWALL.—So far as I have been able to ascertain, there were no records for this county previous to 1910. I am indebted to Mr. A. C. Bartlett, formerly of Pencarrow, Washaway, for very valuable help in my researches, and for the addition of what is probably a new worm to our British Lists.

February 11th, 1910, received from Mr. Bartlett (1) *Lumbricus terrestris*, L.; (2) *Allolobophora longa*, Ude; (3) *A. turgida*, Eisen; (4) *Aporrectodea chlorotica*, Sav.; (5) *Eisenia rosea*, Sav.; and (6) *Octolasion cyaneum*, Sav.

February 21st, along with the foregoing (7) *Eisenia fœtida*, Sav.; (8) *Lumbricus rubellus*, Hoffm.; (9) *L. castaneus*, Sav.; (10) *Dendrobæna subrubicunda*, Eisen; and (11) *Eisenia veneta*, Rosa. I have named the variety of this polymorphic species *carnea*, but have not yet published the description.

April 29th, 1910, I received a further set of worms, which included a new worm, which I provisionally record as (12) *Helodrilus elongatus*, Friend, along with (13) *H. oculatus*, Hoffm. Unfortunately Mr. Bartlett was leaving Pencarrow at this time, and I have been unable to get fresh material for my work. It may be, therefore, that (12) *Helodrilus* will prove to be a *Sparganophilus*, or allied form, and that what exactly resembles the immature *H. oculatus* (13) will prove to be something else. An article entitled "Worms in a Cornish Garden," published May 7th, 1910, in the 'Gardeners' Chronicle,' was based on the material supplied me by my valued correspondent. Eleven species already identified, with one or two still *sub judice*.

9. CUMBERLAND.—In 1890 I commenced the study of Annelids by collecting around Carlisle. My earliest gleanings were submitted to Dr. Benham, and are recorded from his lists. The first list contains (1) *Lumbricus terrestris*, L.; (2) *Allolobophora longa*, Ude; (3) *Aporrectodea chlorotica*, Sav.; (4) *Eisenia fœtida*, Sav.; (5) *Allolobophora turgida*, Eisen; (6) *Allurus tetrædrus*, Sav., the whole having been got near the Eden or at Monkhill. In June of the same year I added (7) *Lumbricus rubellus*, Hoffm., and (8) *L. castaneus*, Sav., by gleaning at Dalston, and (9) *Dendrobæna arborea*, Eisen, was found in the decayed stump of

a tree. August was also a busy month, and resulted in (10) *Bimastus eiseni*, Levinsen, which Benham reported as being new to Britain. I found *L. castaneus* and *A. chlorotica* on Cross Fell, and several of the foregoing in other localities (see "Earthworms of the North of England" in the 'Naturalist,' January, 1891). Though I left Carlisle in 1891, I have collected in Cumberland at frequent intervals since, and in April, 1899, recorded *A. longa*, *A. caliginosa*, *A. chlorotica*, *L. rubellus*, and *Allurus tetrædrus* from the Cockermouth and Keswick district. I added (11) *Dendrobæna subrubicunda*, Eisen, and (12) *D. mammalis*, Sav. (= *A. celtica*, Rosa), which I had found at Langholm in 1890. I found near the Art School and station at Keswick (13) *Octolasion lacteum*, Oerley, and several of the foregoing on Latrigg, Catbells, and elsewhere, besides discovering many interesting Enchytræids and waterworms, which will be reported later.

In February and March, 1911, I visited Cumberland again, and made careful investigations for both the terrestrial and fresh-water forms. At Brougham I found (14) *Octolasion cyaneum*, Sav., as well as *A. chlorotica*, *A. longa*, *L. terrestris*, *L. rubellus*, *L. castaneus*, *A. turgida*, *D. mammalis*, and *D. arborea*. On the way to Newton Moss I discovered (15) *Lumbricus festivus*, Sav. (= *L. rubescens*, Friend), as well as *A. chlorotica*, *A. longa*, *L. terrestris*, *L. rubellus*, *L. castaneus*, *Allurus tetrædrus*, and *D. mammalis*, while I added (16) *Eisenia rosea*, Sav., to the list. I had the further pleasure of finding (17) *Octolasion gracile*, Oerley, at Caldewlees, not far from Carlisle.

It is interesting to note that *D. subrubicunda* was found at 2800 ft. on Skiddaw, that a peculiar variety of *A. chlorotica* occurs on the shores of Bassenthwaite Lake (perhaps = *L. anatomicus* of old authors), and that a golden form of *Allurus (luteus)*, Friend occurs in the Caldew at Cummersdale. *L. rubellus* is found at sea-level at Silloth, and on the top of Penrith Beacon. The district, owing to its mountains and lakes, streams and estuaries, is peculiarly rich in the lesser forms, and, though I have done a good deal of research among these, much remains to be done. Total number of earthworms thus far recorded, 17.

10. DERBYSHIRE.—In September, 1902, I spent a few days in the Peak District, and recorded in the 'Naturalist' of January,

1903, eleven species of earthworms and two or three Enchytræids. These included (1) *Lumbricus terrestris*, L.; (2) *L. rubellus*, Hoffm.; (3) *Octolasion cyaneum*, Sav. (or *O. lacteum*, Oerley); (4) *Eisenia fetida*, Sav.; (5) *Dendrobæna subrubicunda*, Eisen; (6) *Aporrectodea chlorotica*, Sav.; (7) *Allolobophora caliginosa*, Sav.; (8) *A. longa*, Ude; (9) *Eisenia rosea*, Sav.; (10) *Dendrobæna bæckii*, Eisen (= *L. octædra*, Sav.), a rare worm in most parts of England; and (11) *Allurus tetrædrus*, Sav.

September 17th, 1910, digging in my garden at Swadlincote, in South Derbyshire, I found *A. longa*, Ude, very common, *O. cyaneum*, Sav., a little less so; *L. terrestris*, L., more rare, and *L. rubellus*, Hoffm., but seldom. October 29th, when going into the country, I found (12) *Lumbricus castaneus*, Sav., and (13) *Dendrobæna mammalis*, Sav. (= *celtica*, Rosa), while I further found the latter at Smisby in April, 1911, plentifully, and provided with spermatophores. Nearly all the worms found in the Peak District I found also in this neighbourhood, while (14) *Dendrobæna arborea*, Eisen, is found wherever one meets with decaying tree-stumps. *Allurus* and *A. chlorotica* are common everywhere. On April 14th I found a worm at Swain's Park Crossing, which I at first took to be *Bimastus eiseni*, Levinsen. It proves, however, to be a new British worm, and, as it seems to be also new to science, I have named it (15) *Dendrobæna merciensis*. As my present district lies at the boundary of three or four counties, it is difficult at times to say exactly to which a specimen is to be referred. Hence the Leicestershire list may be compared with the one from Derbyshire, and those of Stafford and Warwick. Present record, 15 species.

(To be continued.)

A NEW EARTHWORM.

BY THE REV. HILDERIC FRIEND.

AIDED by a Government grant, I have recently been enabled to give special attention to the Annelids of Great Britain, and to add considerably to our knowledge of their numbers and distribution. In this paper I propose to place on record a new discovery. So far as I can at present learn, the worm which I am to describe is not only new to Britain but also to science. As I first found it in Derbyshire, not far from the ancient capital of Mercia, I propose to call it

DENDROBÆNA MERCIENSIS, Fr.

When first discovered it was mistaken for *Bimastus eiseni*, Levinsen, but a little fuller examination showed that it differed from that species in important details, just as it resembled it in others. *B. eiseni* has the head arrangement of *Lumbricus*, so has *D. merciensis*, i. e. the prostomium makes a perfect mortise and tenon with the peristomium, or constitutes what Michaelsen terms the "tanylobisch" type. It is, however, not so pronounced as in *Lumbricus*. In *B. eiseni* the girdle begins on segment 25, but sometimes as early as 24, in *D. merciensis* it begins on 24, but eventually includes two other segments, and extends from 22 to 31. We have no other worm, except *Allurus*, in which the girdle assumes such a forward position. In *D. merciensis* the setæ are not strictly paired, nor is the colour of the purple *Lumbricus* type, which characterises *B. eiseni*.

The new worm is a denizen of the leaf-mould, and may possibly in the past have been mistaken for *D. constricta* or *D. subrubicunda*, which it closely resembles. But it may at once be distinguished from these by the shape of the head, the position of the girdle, the absence of tubercula pubertatis, and the nature of the male pores. These latter organs are found on segment 15, but whereas in *D. subrubicunda* they are on prominent papillæ, which often affect the adjoining segments, in the new worm they are somewhat sunk, though clearly visible. The worm is of the warm brown or chestnut colour which is characteristic of this group of worms, with a ventral surface free from pigment, and an absence of iridescence dorsally.

D. merciensis has about one hundred segments, and is some two to three inches in length. I have noticed two or three peculiarities which seem to deserve mention. All our earthworms have their own special modes of progression. Some are sluggish, others active, some always follow their head, others prefer to go backwards. But in the new worm I notice a peculiarity which has not been met with before in our purely native worms, except in a species found in Kew

Gardens, though it is common among exotics. All who have studied certain Perichæts know that they have a habit of doubling themselves like a fish about to leap, then with a sudden rebound flinging themselves to a considerable distance. This is the habit of *D. merciensis*, and I have also observed it in certain species of white worms (Enchytræids), but at present we know too little of the past and present life-history of worms to be able to suggest the reason for this peculiarity.

In one specimen which I captured the tail consisted of only twenty segments instead of sixty or eighty, but the length was only a little short of the normal. The extension had been secured by triannulation of the segments, so that each one was nearly three times as broad as the type. This curious fact, which I have constantly seen confirmed in other species, is very suggestive. We know too little about the life processes among the lower animals to dogmatize as to the meaning of this, but it would seem that a certain average length of tail is necessary for each kind of worm to enable it properly to work up the material which passes through its body. In most British Earthworms there is a gizzard occupying two segments in front of the girdle. Behind these segments (usually about the 17th or 18th) the intestine runs right through the body to the posterior extremity. It contains a curious invagination known as the "typhlosole," and a certain amount of research has been carried out by one or two physiologists with a view to ascertaining what changes the food undergoes in passing along the intestine. I do not, however, know that anything has been done to show why a certain length of tail is necessary. This is only one of the many problems which the study of earthworms suggests, and it has an important bearing on agricultural and other questions.

I am waiting for an opportunity to dissect the new worm, and give details of its internal anatomy. This is necessary before one can finally settle the genus, but there can be little doubt on that point when all the external evidence has been weighed. Meanwhile I may conclude with a brief summary:—

D. MERCIENSIS, Friend. — Length, two or three inches; warm brown or chestnut coloured dorsally, the ventral surface without pigment. Head entirely cutting the first segment, as in *Lumbricus*, though not so deeply. Girdle from the 22nd to 31st segment (a total of ten); without tubercula; fused on the back when fully mature, segments 22 and 23 being the last to be affected. Male pores on segment 15 clearly seen, but not attended by swellings or papillæ. Dorsal pores large, beginning in intersegment $\frac{4}{5}$, but not seen on the girdle (as they are, for example, in *Eisenia rosea*, Sav.) when fused. Moves, when irritated, by powerful jerks. Habitat: Leaf-mould by woods and in gardens, near Repton, the old capital of Mercia.

ON THE INTERBREEDING OF THE SONG-THRUSH AND BLACKBIRD IN MIDDLESEX.

BY GILBERT E. ADAMSON.

(Sec. Middlesex Zoological Society; Soc. d'Orn. Eur.).

IN March, 1910, I found a nest of the Song-Thrush (*Turdus musicus*) in a lane leading from Edgware to Elstree, about three-quarters of a mile south of Edgwarebury. It contained three eggs, which bore a very strong resemblance to those of the Redwing (*T. iliacus*). As the winter had not been particularly severe, I conjectured that a straggling pair might possibly have remained in England to breed. Richard Jeffries has recorded this from Surrey ('Wild Life in a Southern County,' chap. xvi.). I, accordingly, awaited the return of the parent birds. In a few minutes the mother bird returned, and I was rather surprised to find that she was not a Redwing, but a mature and healthy Song-Thrush. Shortly afterwards she was joined by her mate, a male Blackbird (*T. merula*). Upon my approaching the nest the two birds flew to an adjacent hedge. The nest was a typical nest of the Song-Thrush, lined with the usual layer of mud. I took one of the three eggs, and noted the following points of difference:—

	Normal <i>T. musicus</i> .	Normal <i>T. merula</i> .	Hybrid.
Ground colour:—	Light greenish blue ..	Light greenish	Whitish green
Markings:—	Deep brown; not clustered	Deep brown; clustered	Light brown; clustered
Size:—	28 × 20 mm.	28 × 22 mm.	29 × 21 mm.
Shape:—	Polycinic*	Polycinic	Chenistic*

This occurred on March 30th. On the following Tuesday another egg resembling the former three in size and appearance was laid, after which the nest was abandoned. I am inclined to think that the egg last laid was never incubated, but the first three undoubtedly were. In all these cases of interbreeding I

* Polycinic: The usual "egg-shape" (*Turdidæ*, &c.). Aesthetic: Shape of the eggs of the Gull tribe. Rotund: Round (*Strigidæ*). Isoplatiæ: Of equal width (*Alcedinidæ*). Chenistic: Shape of eggs of the Goose tribe (*Anseridæ*). Pyriform: Pear-shaped (*Charadriidæ*, &c.).

have always found that the male bird has the influence over the external appearance of the shell of the egg.

As I was again visiting the district this year, I found two identical eggs in a last season's nest. I am unable to say whether or not the nest was the same used by the pair in 1910. The eggs were quite cold, and no bird visited the nest. The next day it was blown into the roadway, as the rain and wind had loosened the foundations of the old nest. The eggs were, of course, smashed, and their contents were in a perfectly liquid state.

The question naturally arises: "Do these hybrid eggs ever hatch out, and, if so, whom do the nestlings resemble?" Mr. Berry recorded in the 'Glasgow Naturalist' (vol. ii.) that no difference could be seen between the young hybrids and young Blackbirds. This, however, though not uncommon, is not always the case.

The birds produced from these hybrid eggs are almost always ugly in appearance. They seem to be pre-eminently Thrushes, but are sometimes uniformly darker, or darker in patches. Very often they possess a Blackbird tail or beak, more often the former. Although young Song-Thrushes are normally darker than their parents, they are in no way so dark as are these hybrids.

The reason for this union, in nature, can hardly be the absence of birds of the same species. In captivity, Thrushes and Blackbirds will invariably mate and interbreed. Again, the district in which the birds are seems to affect interbreeding. I have noticed this in Middlesex and Buckinghamshire, and in both cases more than one pair of birds were interbreeding. In the Edgware and Barnet district it is, I think, very noticeable, and in both these districts the Song-Thrushes far outnumber the Blackbirds. An account appeared in the 'Country Side' (vol. i. p. 51) of a nest of hybrids at Stanmore, a village near Edgware. The writer, finding Blackbird's eggs in a Thrush's nest, was persuaded that the eggs were laid by stress of circumstances in a Song-Thrush's nest. This, of course, occasionally occurs, but I am rather inclined to think that this was another case of interbreeding in North Middlesex.

The explanation often given that the female bird, being

deprived of her own mate, had been forced to mate with one of an allied species, seems discredited when we find so many cases of interbreeding as early as March.

The simplest explanation seems to be that *in certain districts* the female birds are totally indifferent as to whether they mate with one of their own species or with one of an allied species. Although this seems so opposed to natural direction, I do not think that in practice it would be so difficult.

We may, then, safely conclude that Blackbirds of both sexes *do* mate and interbreed with Song-Thrushes, and the eggs are externally influenced, *to a certain extent, by the male bird*, and that the young resemble the mother bird, with some of their father's characteristics. By far the most usual form of Thrush-interbreeding is the male *T. merula* with the female *T. musicus*. But it must not be forgotten that in nine cases out of ten the eggs are unfertile, and are never incubated by the female.

NOTES AND QUERIES.

MAMMALIA.

Water-Shrew in Surrey.—I happened, on April 11th, to observe a Water-Shrew (*Crossopus fodiens*) on the bank of a small stream which flows into the Tillingbourne at Abinger. Although seldom seen, there is no reason to suppose that this very interesting small mammal is not generally distributed throughout Surrey. A collector tells me that he has discovered and trapped numbers near Oxshott and near Milford. I was able to watch the one I have mentioned for some minutes at two yards' distance. Its powers of vision did not seem great, though when I moved it took refuge for a moment under the bank. I was struck with the extraordinary strength with which it swam against the clear, rapid stream of the narrow brook. It remained about ten or fifteen seconds under water, always heading against the stream, and I could see it nosing the bottom and poking under the stones like a trout grubbing for food. Its movements were exceedingly rapid, and when it came ashore and shook itself, as it did at frequent intervals, its fur seemed as dry and soft as a mole's. Since most Shrews are nocturnal, I must add that this one was active in brilliant sunshine at four p.m.—HAROLD RUSSELL (Shere, Surrey).

AVES.

White Wagtail (*Motacilla alba*), on Migration, visiting Bartragh Island, Killala Bay.—An interesting fact in the history of *Motacilla alba* is that, on the spring migration to their northern breeding haunts, the line of flight of part of the migratory host appears to be across Ireland, and in their course pass over the island of Bartragh, apparently going due north over Killala Bay, as if to Iceland and Norway. I first met this interesting species on April 25th, 1851, on the island of Bartragh, when observing a solitary bird feeding, after the harrows, in a field where barley was being sown. My attention was attracted by its very light grey-coloured back, and the large amount of white on forehead and cheeks, and also by its quiet movements while feeding. It at once occurred to me that it was *Motacilla alba*, a bird I had never seen before, so, changing the charge in

my gun to No. 8 shot, I secured the first recorded specimen of that bird ever obtained in Ireland. However, in order to be certain of my identification, I sent the bird by post to my old and valued friend, the late Dr. J. R. Harvey, of Cork, for his fine collection of native birds, but unfortunately the specimen was delayed too long in the post-office, and when it reached my old friend it was in a state quite unfit for preservation; but fortunately he was able to determine that it was a specimen of the true *M. alba*. From that time until April 29th, 1893, nothing more was seen or heard of visits of this species to Bartragh, but on that day, with a couple of young friends whom I took in my boat to Bartragh, we came across a pair of these birds feeding on a marshy flat pasture that extended from the base of the sandhills to the shore of the estuary. This flat was the usual resting and feeding place of any birds visiting Bartragh, and where, if any birds were on the island, they were always to be met with. After watching these birds for some time, I managed to secure one—a fine male—but the other, after the shot, rose and flew right away. At that time I had no idea that this species visited Bartragh regularly, merely looking on them as uncertain stragglers; but in order to find out if such was the case, I asked my young friend, the late Mr. A. K. Kirkwood, to keep a good look-out for any visitors to the island, for, as he resided in Bartragh House, he had the best opportunities for observing any strange visitors. However, it was not until April 29th, 1898, that this species was again met with, and since then, through his kind assistance while he lived, and, after his lamented death, through that of his father, Capt. Kirkwood, I have been enabled up to the present date to keep a record of the yearly dates of arrival, and of the number of birds seen on each visit. The number of birds visiting the island and the duration of their stay depend nearly altogether on the state of the weather. If northerly or north-easterly winds prevail at the time of passage, some birds are sure to be met with, but if the weather is calm, their stay may be only a few hours before they resume their northern flight; but if the wind rises to a gale, they may remain on the island for several days. I now append list of dates and numbers of birds seen or met with:—

1898.—April 29th. Five birds, only remained a few hours. May 10th. A flock of fifteen, only remained that night. 19th. Three birds seen. 26th. Two birds obtained.

1899.—April 21st. One bird seen. May 4th. Two birds in farm-yard.

1900.—April 27th. One bird in farmyard.

1901.—May 12th. Two feeding on the flat. 20th. One bird on lawn.

1902.—May 8th, 9th, 10th, and 11th. Several birds seen.

1903.—May 17th. Ten birds feeding on marshy flat. 18th. Five seen in garden.

1904.—May 10th. Six birds, but only stayed a few hours. 13th. One solitary bird seen.

1905.—April 29th. Five birds, remained till May 4th. May 3rd. Eight birds seen, but went next morning.

1906.—May 1st. Two birds seen, but left shortly after. 5th. Six appeared, but did not remain. 9th. Four birds arrived. 10th. Five seen.

1907.—None were seen this season, but some may have arrived and departed unseen.

1908.—May 6th. Eight birds seen. 7th. Ten observed near garden.

1909.—April 25th. One bird seen. 26th. A flock of ten arrived, and remained for a week.—ROBERT WARREN (Ardnaree, Monkstown, Co. Cork).

Breeding of the Honey-Buzzard in England.—"I found the Honey-Buzzard's egg on June 8th, 1867, in Penyard Wood, Weston-under-Penyard, Herefordshire. The birds had taken possession of an old nest of Common Buzzard in an oak about forty feet from the ground, and had re-lined it with green oak-leaves. About eight days after finding the nest I climbed to within about a yard of it before the bird flew from it; thinking it was empty, I was on the point of leaving it when I caught sight between the oak-leaves of a small piece of the blood-red egg, about the size of a sixpence. The bird had evidently plucked off a sprig of oak-leaves to cover the egg with before leaving the nest. As the nest-tree was within about forty yards of a road, and the next day was Sunday when the wood was much frequented by town boys, I hastened home and painted a hen's egg, which I substituted for the Honey-Buzzard's egg. . . . On Monday morning I . . . found the broken hen's egg and the inside of the nest at the foot of the nest-tree. . . . The egg is creamy, marked with red and blotched heavily at both ends with very dark red, almost black. The same year, in August, the Honey-Buzzards re-lined an old nest of Buzzard, about a mile from the first nest in the same wood. But though I climbed to it many times, I never found any eggs in it. The next year (1868) I was unfortunate in disturbing the Honey-Buzzard from an old nest of Buzzard which

it had re-lined with green oak-leaves, in Nacker's Hole Wood, a small wood opposite, and about half a mile distant from Penyard Wood. . . . I afterwards heard the Honey-Buzzards in the Forest of Dean, but looked in vain for the nest."—W. C. PALMER ("The Admirals," Hingham, Attleborough, Norfolk).

[The above account is extracted from a letter dated April 1st, 1911, written to Mr. F. Norgate, who has kindly forwarded it to us for publication.—ED.]

IN a note under the above heading (*ante*, p. 150), Mr. Jourdain calls attention to a nest at Burnham Beeches, *Berks*. I would like to point out that Burnham Beeches is not in *Berks*, but *Bucks*.—HEATLEY NOBLE (Temple Combe, Henley-on-Thames).

Spring Arrivals of Sandwich Terns in Killala Bay and the Moy Estuary.—While residing at Moy View, Co. Sligo, from 1851 up to 1909, I kept a record of dates of the spring arrivals of Sandwich Terns to Killala Bay and the Moy Estuary. The list of dates is rather imperfect, owing to occasional absences from home and other unavoidable circumstances. The exceptional omissions were 1856–1863, 1864–1866, 1870–1872, 1872–1874. However, all the other dates were noted down regularly. It will be interesting to compare these dates with those of arrival at the English breeding haunts. The irregularity of dates of arrival is hard to account for, because some arrivals of the birds took place in very cold weather in March. On one occasion there were six inches of snow on the ground, and for some days the thermometer indicated six degrees of frost, and yet the Terns were as lively and noisy as if in warm May weather:—1851, April 7th; 1852, March 23rd; 1853, April 7th; 1854, March 21st; 1855, April 1st; 1856, March 20th; 1863, April 2nd; 1864, April 16th; 1866, April 11th; 1867, April 15th; 1868, April 18th; 1869, April 26th; 1870, April 15th; 1872, April 30th; 1874, April 30th; 1875, April 15th; 1876, April 4th; 1877, March 29th; 1878, April 2nd; 1879, April 5th; 1880, March 24th; 1881, March 31st; 1882, March 30th; 1883, April 1st; 1884, April 3rd; 1885, March 30th; 1886, March 25th; 1887, March 28th; 1888, April 5th; 1889, March 28th; 1890, March 15th; 1891, March 28th; 1892, March 28th; 1893, March 23rd; 1894, March 27th; 1895, March 30th; 1896, April 3rd; 1897, March 22nd; 1898, April 3rd; 1899, March 26th; 1900, April 6th; 1901, April 1st; 1902, April 6th; 1903, April 11th; 1904, April 10th; 1905, April 4th; 1906, April 1st; 1907, April 4th; 1908, April 10th; 1909, April 10th.—ROBERT WARREN (Ardnaree, Monkstown, Co. Cork).

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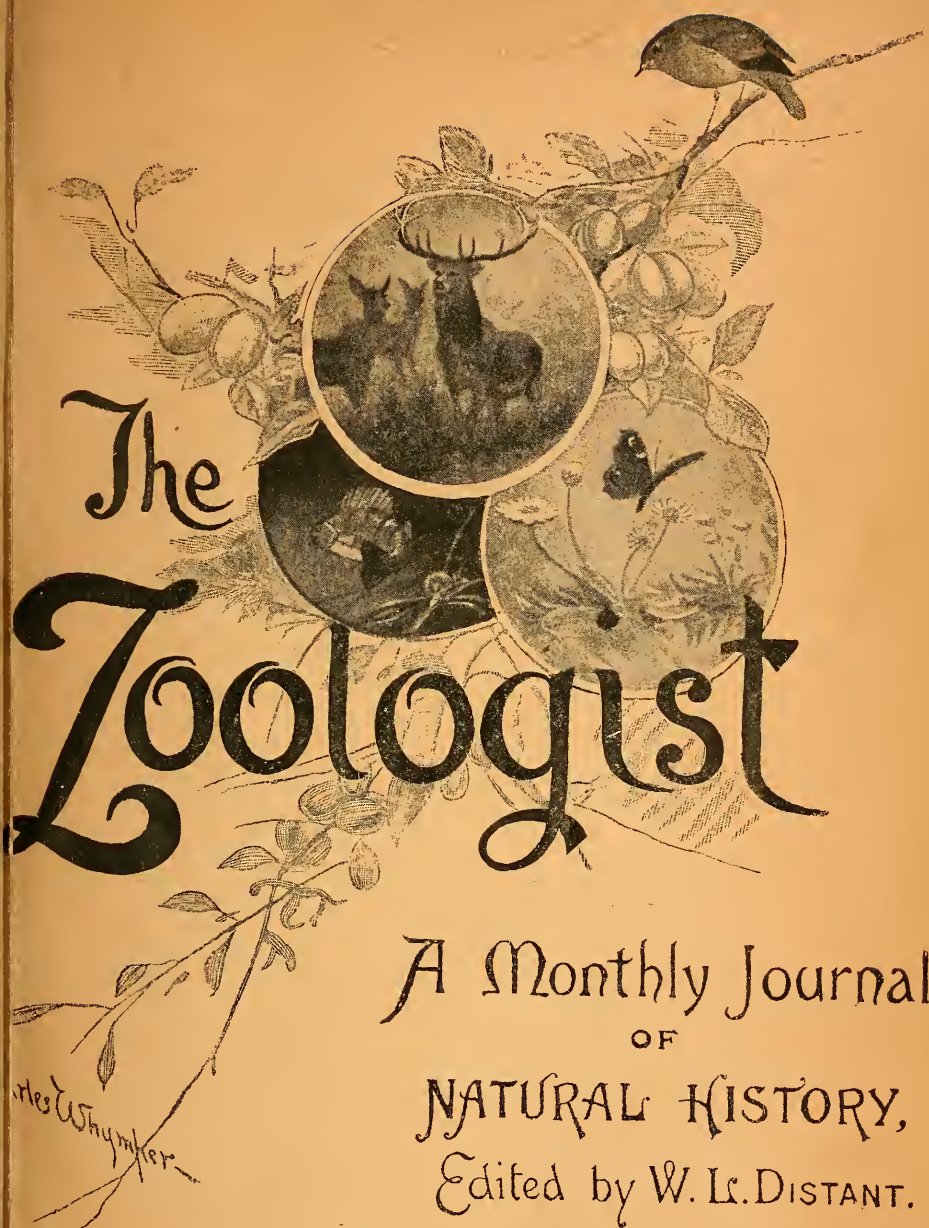
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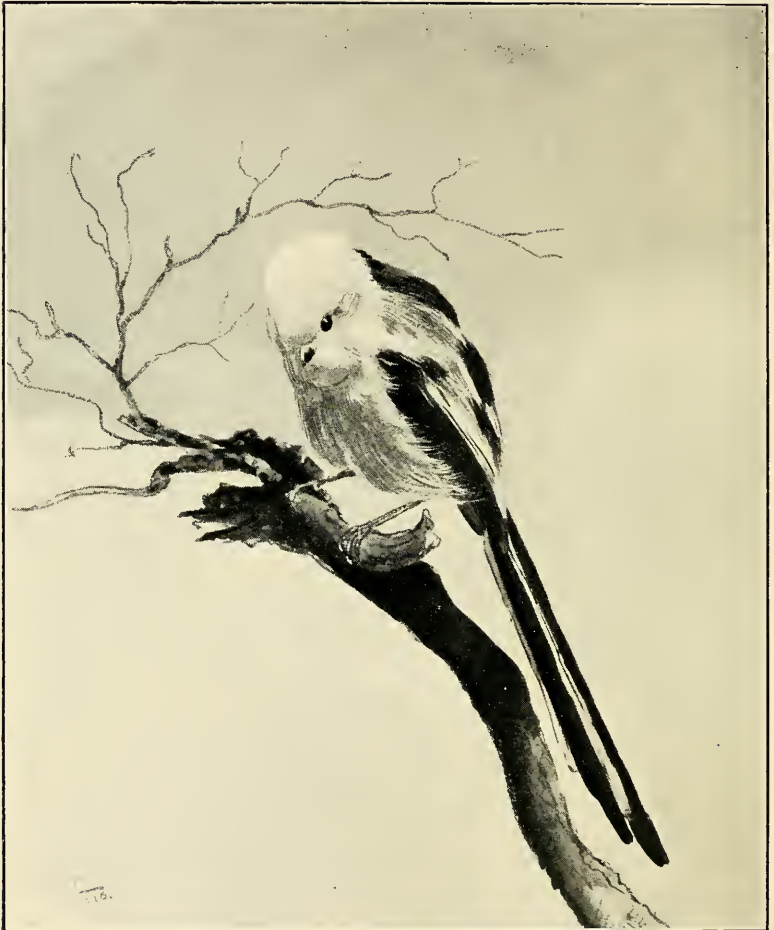
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WHITE-HEADED LONG-TAILED TITMOUSE
(*Acredula caudata*).

THE ZOOLOGIST

No. 840.—June. 1911.

THE SOUTH KENSINGTON SITE.*

(A DANGER TO THE FUTURE GROWTH AND EFFICIENCY OF THE
NATIONAL NATURAL HISTORY MUSEUM.)

WE learn that a Memorial signed by Sir Henry Roscoe and others referring to the site on which it is proposed to place an extension of the buildings of the Science Museum was recently presented to the Cabinet by Mr. Runciman, President of the Board of Education. We have heard with grave concern that the Government have come to a conclusion which apparently agrees with the views formulated by the Memorialists. In the belief that the imposing display of opinion indicated by the signatures of many leading men of Science may not have been without effect upon the deliberations of the Government, we venture respectfully to call your attention to the fact that a number of others who are interested in the progress of Science in this country take a view which is widely different from that which has been represented in the above-mentioned Memorial.

In taking this step we wish to make it clear that we are actuated by no feelings of hostility to the Science Museum. We should, on the contrary, welcome the fulfilment of the wish expressed by so many of our colleagues and friends that a worthy home may be found for the Science Museum. We can-

* This protest, signed by the leading naturalists in the country, and due to the initiation and energy of Dr. A. E. Shipley, F.R.S., Master of Christ's College and Reader in Zoology in the University of Cambridge, has been addressed to the Right Hon. H. H. Asquith, M.P., Prime Minister.

not, however, avoid the suspicion that some of those who have signed Sir Henry Roscoe's Memorial have done so in ignorance of the irreparable nature of the injury which would be done to the Natural History Museum by the curtailment of its present site. This conclusion appears to be supported by the words of the Memorialists, who say :

“ We, the undersigned, interested in the practice and progress of British Science and Industry, beg, therefore, to express our emphatic opinion that, whilst nothing should be done to interfere with the development of the Natural History Museum, any action which prevents the erection of a Science Museum on an adequate scale on the proposed site would be a national disaster, and we cannot but believe that the two competing claims can be reconciled without the sacrifice of essentials on either side.”

It becomes incumbent on us to show, therefore, that the proposed allocation of the site would interfere with the development of the Natural History Museum to such an extent as to affect vitally the continued efficiency of that Museum, and to render nugatory the provision which had been made for its normal growth in the future.

The Natural History Museum is about thirty years old, but during the short time in which it has been in existence the collections have increased to an extent which can hardly have been anticipated by those who were responsible for drawing out the original plans. It cannot be too strongly emphasized that the growth which must continue to go on, if the Museum is to hold its position among the great Museums of the world, is very far from having reached its limit. The number of species of animals and plants, recent and extinct, which are not at present represented in the Museum is enormous. The importance of the Biological Sciences in matters which affect the practical concerns of mankind is becoming increasingly obvious. Not only has the study of these Sciences, in their relation to the theory of Evolution, profoundly affected every department of Human thought, but it has also been proved to have the most important bearing on Economic questions. We may merely allude, in this connexion, to the discovery of the part played

by blood-sucking Insects in the dissemination of Sleeping Sickness, Malaria, Plague, Yellow Fever, and other diseases which affect Man and Domestic animals, and to the immense practical importance of an accurate knowledge of the Insect and other pests which attack cultivated crops. In some of the studies connected with these Insects the Museum has taken an important share. In order that it may continue to do so it is essential that room should be left for expansion of the collection of Insects ; and large additions to the Insect-Room are urgently required even now.

Throughout the Museum the need of additional accommodation is already acutely felt. The public Galleries are overcrowded, the space available for the study-collections which are indispensable for comparison when the opinion of the Museum is asked on any question is quite inadequate, and in some parts of the Institution it is already impossible to find proper accommodation for the members of the permanent staff and for students who come to consult the collections. It is impossible to foresee the future needs of Palæontology, but the Museum would even now have great difficulty in finding room for the reception of any considerable collection of the more gigantic species, such as some of the extinct Reptiles, new forms of which are being discovered by expeditions at present in the field.

We think that the full effect of the proposal to remove the Spirit-Building from its present position can hardly have been apparent to some of those who signed Sir Henry Roscoe's Memorial. We pass over the waste of public money which is involved in the destruction of a building which, with its fittings, has cost £30,000. The alienation of the strip of land, to the North of the main Museum, which it is proposed to hand over to the Science Museum, would leave an area to the North of the former building which would be so small as hardly to provide sufficient accommodation for any extension of the numerous outbuildings which are essential for the work of the Museum. But the most fatal objection to the present proposal is that, by placing the Spirit-Building anywhere between the main Museum and the public roads, space would be occupied which is of vital importance to reserve for the future growth of the main Museum itself.

The experience of the last thirty years proves beyond the shadow of a doubt, in our opinion, that the whole of the unoccupied part of the site which has hitherto been reserved for the Natural History Museum is barely sufficient for the extensions which will be required in a future, which is by no means remote.

We, the undersigned, beg therefore to express our emphatic opinion that the maintenance in its integrity of the site which was secured to the Natural History Museum by the delimitation of its Northern boundary by the Treasury and the Office of Works in 1899 is of vital importance to the future efficiency of that Museum ; and we beg most respectfully that you will cause such steps to be taken as will secure a consideration of our views before the question is finally decided.

THE DEVELOPMENT OF THE SNIPE.

BY F. J. STUBBS.

THE informed ornithologist rarely finds himself pleased with a mounted Snipe, or with the picture of one. Even such masters of ornithological art as Wolf or Keulemans have failed with the Jack-Snipe, and one searches in vain through the ornate literature of birds for a faithful portrait. It is now many years since naturalists first began to notice the orderly arrangement of the roots of a bird's feathers, but apparently few appreciate the value of the order prevailing in the disposition of their distal ends. Several modern artists since Wolf have seen their models intelligently, yet the work of the average taxidermist is still a disappointment, although better results might have been expected from the general example set by such men as Pickhardt and Ward.

This is not the place to demonstrate the errors appearing in stuffed birds, but one or two examples will be noted as having a bearing on my further remarks. For instance, the spots on the breast of the Common Flycatcher are, in life, arranged to form distinct streaks. This is so with many other birds, but after passing through the hands of the stuffer the pattern is an inextricable tangle. The streaks have vanished, and the outward pattern or *feather mosaic* of the bird is distorted beyond recognition. Now, I hasten to add that this result is not invariably the fault of the taxidermist, for rearrangement of the feathers is always very difficult and is often impossible.

In the living, healthy bird the feathers are as definitely arranged as are the scales on a reptile. In some of the smaller perching birds this is not always evident, particularly on the back; but in such as the Grouse or the Pheasant, and in hundreds of other birds, the markings of the feather-tips follow in regular succession to form a special design that is unquestionably of importance to the wearer. Each feather stands in a settled relation to its neighbours, and the general pattern depends on the proper arrangement of these elements of colour. Spots, as I remark, collect in ranks to form stripes, and such marks as the eyes on a Peacock's train, instead of being scat-

tered without law (as many artists have depicted them), are marshalled in geometrically accurate, intersecting arcs of circles.

In portraits of the Jack-Snipe the feathers are not properly drawn, nor have they been accurately described in any work I have yet consulted. The long golden scapulars are said to be "yellow on the outer webs." This is only partially true, for the anterior feathers are alternately yellow on the outer and on the inner webs. In the living bird, except on rare occasions, these important feathers are so arranged that the yellow parts exactly overlap and produce two brilliant golden streaks down the sides of the back. The edges are cleanly defined, and when we tamper with the arrangement, upsetting the order of the colours (*i. e.* causing the dark web to fall below the yellow web of the preceding feather), the loss in brilliancy becomes at once evident. The brightness is attained by each yellow web being backed by a second yellow web with the barbs crossing at right angles, and this arrangement is of the utmost importance to the bird.

When a Jack-Snipe is flushed at short range, and flies down wind, the scapulars may sometimes be seen fluttering like tiny pennons; yet when the same bird is detected a few seconds later lying prone and motionless, the feathers are clearly arranged with instinctive care. In a drawing these feathers are rarely, if ever, properly figured; yet I have seen one excellent photograph (in Mr. R. Kearton's 'Wild Nature's Ways,' p. 266) that gives a refreshingly accurate portrait of a Jack-Snipe—one of the rare instances in which the camera rises superior both to the man of science and to the trained draughtsman. It is seldom, indeed, that this bird leaves the taxidermist's hands anything else except a bedraggled caricature. In a freshly killed bird, by a little patience, it is possible to replace the feathers in their proper order, but the task is far easier with a "green" skin, for the slightest scratching with the finger-nail along the inside, following the pterylae, is sufficient to throw the feathers into their natural ranks. With care this order can be preserved in the mounted bird.

In spite of its wide distribution, the Jack-Snipe is not a well-known bird to the field naturalist who is not also a sportsman. It is rarely observed except on the wing. Even the gunner seldom sees the bird until it is flushed by his dog or by

his own footsteps. It has been written (vaguely and without details) that the Jack-Snipe skulks in the dense vegetation like a Rail, and runs like that bird through the miniature jungle of the marsh. On the contrary, the bird is rarely encountered except in a clear space, small though this may sometimes be. Frequently I have seen them on perfectly bare mud, or on beds of *Sphagnum* away from more conspicuous vegetation.

In such a setting the Jack-Snipe forms the most perfect example of elaborate protective coloration with which I am acquainted. The fact that I have often seen them does not directly affect the question, for I have succeeded not by looking for a bird, but by searching for *two curved blades of faded grass* of a colour rather more brilliant than that of any plant native to the locality where most of my observations were made. Perhaps I might offer a quotation from one of my note-books (October 8th, 1901) describing my first appreciation—I had been before acquainted with the matter in a careless degree—of the coloration of the bird:—"The dog had been twice round the pond [a miniature spongy marsh perhaps thirty yards square] . . . when two yellow streaks caught my eye, and I saw a Jack, prone, with head and bill stretched straight out in front; the grey feathers of the bird almost invisible, and the bright yellow feathers on the back looking marvellously like two withered blades of sedge. . . . I had to make a few seconds' examination at a distance of four or five feet before I could convince myself that I had not made some mistake. For about five minutes I walked around it, looking at it from different points of view, and the bird never moved in the least."

Since that date I have observed many such cases, and have experimented with the birds, both living and dead, at home and in the field. Sometimes it has happened that the Snipe has been surprised on a patch of green turf, or some other in-harmonious background, and (not caring to fly) has run to squat down on the mud near a patch of herbage in the adjacent pond. The prone position is worth noticing. The feet and legs are entirely hidden, the tail is depressed until the tip just touches the ground, and the bill is laid flat. Differing from my first note on this point, the neck is usually bent until the head is close in to the shoulders. In transverse section the bird

would be not circular but triangular: a crouching bird (of any species) habitually spreads out the flank feathers on each side, with the effect—whether intentional or not, I cannot say—of destroying the tell-tale shadows. The importance of this action can only be appreciated by those prepared to make actual experiments.

The streaks on the head of the bird are vaguely in line with the dorsal stripes, which are very conspicuous, and curved and tapered like the faded leaves of the surrounding *Carex curta* or similar marsh plant. The remainder of the bird has disappeared; not actually hidden behind any material screen, but obscured by the glaring rivalry of the yellow plumes. There is also a further aid to obliteration. In nine cases out of ten the bird is crouching near a pool of water. This, of course, reflects the light of the sky, and is almost or quite white against the surrounding earth. While experimenting with dead birds, playing a sort of hide-and-seek, I found that the simple act of placing the Snipe at the edge of a tiny pool, or even close to my handkerchief dropped (apparently casually) on the ground, served to mislead my companion to a most gratifying extent.

The explanation is, of course, that the gaze is attracted by the patch of white and (if I may be allowed the useful exaggeration) blinded by its glare to such an extent that adjacent inconspicuous objects pass unnoticed, and the eye roves on to another part of the field. In a similar manner do we explain the value and meaning of the dorsal stripes. The enemy (whatever form this may take) is looking for birds, and not for a couple of dead leaves of sedge, and the more noticeable these leaves can be, the more will they monopolize the gaze of eyes that would otherwise hardly fail to detect the delicate differences between the rest of the bird and the bare ground on which it crouches. The metallic purples and greens of the mantle, and the elaborately designed colours of the rest of the plumage, all take definite parts in the general scheme, either by matching the colours of the damp ground, by simulating the fragments of dead stems and grasses, or (by the action of the law of simultaneous contrast) enhancing the brilliancy of the stripes on the back.

Excellent as the livery is, it would be almost useless without two important ancillary features. The Jack-Snipe has a perfect (instinctive) confidence in its invisibility that places it in a

position apart from other British birds. Although one of the shy and wary race of waders, it will on occasion wait until actually trodden on. I once saw a pointer place his paw upon a Jack-Snipe, holding the bird until I picked it up, and I can remember at least one case of a bird being caught in a cloth cap.

Such occurrences are unusual, for, although lying apparently paralyzed, the bird is really perfectly alert, and when capture seems imminent it springs—a living Jack-in-the-box—far into the air, and is well on the wing before the startled intruder can gather his wits. A winged Grouse or Plover, if unable to hide, will seek safety in running. The wounded Snipe progresses in a series of huge hops, a gait that is the response to the instinct telling that the first move out of danger is to spring into the air.

Many sportsmen believe that the Snipe uses its bill as a third leg in leaping from the ground, and that occasionally it will strike downwards with such force on soft ground that the bill becomes embedded, and cannot be withdrawn quickly enough to avoid capture. I once had a Common Snipe brought to me by a man who had caught it in this manner. He was, however, mistaken, as I shall explain later. Neither the Common Snipe nor the Jack use the bill in this way. I have frequently watched them rise, sometimes from a distance of a few inches (in observing both wild and captive birds), and always found the bill to be kept parallel with the ground. The birds spring entirely from the legs, which are in both species extraordinarily large and muscular.

In the Jack-Snipe the muscles of the toes are particularly powerful, and the leg of the bird is bigger than that of a Knot, which far exceeds it in size and weight (two and a quarter ounces against five ounces). The muscles of the thigh are also unusually large, but direct observation suggests that the toes are chiefly used in the work of lifting the bird from the ground.

The necessity for this powerful apparatus is obvious, for protective colours on a bare marsh would be of little use in the event of their owner being unable to get a good start when movement became imperative. Perhaps this suggests a use for the long inner secondaries, which keep the primaries dry and prepared for flight, although the rest of the plumage may be

damp from brushing against wet herbage. I have noted this feature in many other birds addicted to running or creeping about amongst plants that may often be rain-soaked.

The true home of the Jack-Snipe is in permanent marsh with preferably a peaty humus. Thousands of small ponds throughout the country supply the necessary conditions, and in these the bird lives unsuspected by most men, and free from enemies or rival species—with one striking exception, which I shall discuss later. So far as a barrier to human beings is concerned, five feet of peaty mud of unknown depth is as good as fifty yards when no reason for crossing it is evident. The bird has little to fear from Stoat or Kestrel, or even, after considering the local conditions, from the Heron. Such creatures as Harriers and Bitterns, once abundant in Europe, were perhaps the factors stimulating the Jack-Snipe* to adopt its present livery and habits; and to-day the bird is left with hardly any enemy except the combination of a man with a gun and a dog. As a consequence it is firmly established as a common British bird, and one that can only be attacked by the destruction of its haunts.

It is a common joke that the novice can return again and again to the same corner of marsh to flush, shoot at, and miss the same Jack-Snipe. Yet this still holds good if the bird be killed each morning! Some tiny pond may never hold more than one, or perhaps two birds. If one be flushed by a dog and shot, the place will hold another the next day, if not the same day at a later hour. This process can be repeated far into the winter: I am speaking now in general terms, and of districts where the conditions are suited to the peculiar requirements of the bird. Thus it will be seen that it is the race and not the individual that is constant to the favourite habitat. The Jack-Snipe is as faithful—if this be the proper term—to its marsh as the Sand-Martin is to its particular river-bank, or the Bittern to its reed-bed. Like them, it is fitted to these particular surroundings, and is uncomfortable and unsafe anywhere else.

I recollect the case of a man actually killing from a single small pond a Snipe a day for eighteen consecutive days. I forget how many of these were Jacks, but I see no reason to doubt that the same process could be gone through by one who

* As a species, acting upon it by eliminating the least protected individuals.

devoted himself to procuring the smaller bird, from a spot that was suited to the species. The ponds I write about are really fragments of true marsh-land, with a distinct florula—*Sphagnum* spp., *Marchantia polymorpha*, *Eriophorum angustifolium*, *Carex curta*, *C. levigata*, *Comarum palustre*, and plants of a similar character. At one time many parts of England, now drained, were clothed with these peat-loving plants. To-day, when a "made" pond stands long enough, a deposit of peat forms an island in the middle, and in time it becomes covered with the plants I name above, and in winter forms a safe home for the Jack-Snipe. It appears to me that there are more birds than we have room for, and if we kill the individual occupying a desirable pond, the spot is at once occupied by the first-comer from what one may term the floating population. It is hardly necessary to add that the Jack-Snipe does not crowd in these localities; if this were so, my explanation would not hold good.

The sexes of the Jack-Snipe are alike at all seasons, and the antiquity of the livery is suggested by the nestling bird, in which the dorsal plumes are brilliant and well-defined, and the bill precociously lengthy. That the plumage has passed the plastic stage is proved by the rarity of variations. I have only been able to learn of two abnormal Jack-Snipes. Mr. Bond had a very dark (melanistic) specimen in his collection, and some years ago the 'Countryside' published a photograph of one with white feathers in the wings. As we all know, varieties amongst Common Snipe are remarkably frequent—more so, perhaps, than in any other British bird except the Ruff.

The Jack-Snipe rises superior to a frost hard enough to clear a district of all other marsh-birds, and I have known it to remain long after every drop of water had been bound up as ice; under these conditions they live well. The plumpness of a Jack in frosty weather is proverbial, while under the same conditions the Common Snipe may be reduced to a pitiful bunch of feathers. Many of the above details form part of the common knowledge of observers, but their application is important.

Every ornithologist knows that the Jack-Snipe is exclusively a winter visitor to this country; the many accounts of its nesting with us are not worth a moment's attention. Differing from

most winter *Limicolæ* (*Arenaria*, *Strepsilas*, *Limosa*, &c.), individuals are very rarely noticed in England during summer. The first records generally mention the middle or end of September. My earliest personal record is the remarkable date of Sept. 9th (1905), when I picked one up beneath the telegraph-wires in the Conway Valley; yet I have seen many in the third week of September, and have had odd ones brought to me in the second week of that month. The range of the Jack-Snipe is very great, but I have failed to discover what grounds Seebohm had for stating (in his 'Distribution of the Charadriidæ') that the species originated in Ceylon. Little good can come of taking this fanciful speculation seriously, for in accepting it we must allow that, while the summer range has wandered far to the north, the winter range has radiated in all directions!

In England the Jack-Snipe is a silent bird. I have two records, both made in Yorkshire (by Atkinson and by Boyes), of cases in which a bird was heard to utter a thin bat-like note. Dubois ('Faun. Ill. Vert. Belg., Oiseaux,' ii. 233) describes it as quite a noisy creature in Belgium; but I am inclined to think that perhaps he is quoting some author who has written of the Jack-Snipe in other parts of Europe. In the far northern breeding grounds it is said to be a noisy bird, but we are not told whether its "hollow notes" are vocal or instrumental. A fine day in late winter will sometimes prompt the Common Snipe to flutter and "chip," if not to drum, but I have never known its sedate little neighbour to act so under the same emotions in England.

Linnaeus, when he prepared the Tenth Edition of his 'Systema Naturæ,' did not know the Jack-Snipe. Earlier writers in this country failed to separate it from the Common Snipe; Francis Willughby confessed that, until corrected by Mr. Lister, he believed it to be the "Cock Snipe," and this is still the opinion of ignorant sportsmen. Even to-day many students of birds hold the two species to belong to the same genus, but some writers, aware of the striking differences displayed in the sternum and the tail, have placed the birds apart, using the genus *Lymnocyptes* of Kaup for the smaller bird, and that of *Gallinago* for the other.

(To be continued.)

THE BIRDS OF THAT PORTION OF THE NORTH-EAST COAST BETWEEN TYNEMOUTH AND SEATON SLUICE, NORTHUMBERLAND.

BY J. M. CHARLTON.

(Continued from p. 131.)

(PLATE IV.)

MISTLE-THRUSH (*Turdus viscivorus*).—A fairly common resident. A few pairs breed annually in Holywell and Whitley Denes. I have no records of any migratory movements.

SONG-THRUSH (*T. musicus*).—Numerous both as a resident and migrant. Large numbers of the latter go by, passing south in autumn and north in spring. Many frequently pass inland also in autumn from the north-east, and at the same time other birds are leaving the coast and *vice versa* in spring. These migratory movements occur so closely upon one another that it is only with the greatest care that they can be distinguished. I have seen during these migrations many hundreds of weary travellers hopping disconsolately about among the numbers of fishing cobbles lying on the top of the banks at George's Point, Cullercoats, and doubtless these boats form an adequate shelter for such as they when waylaid during stormy weather. Mr. W. G. Monk informs me that, while he was on the lighthouse on St. Mary's Island, in the autumn, during the prevalence of hazy weather, numbers of these birds, together with Blackbirds and Starlings, frequently hovered around the lantern. Mr. H. S. Wallace, writing in the 'Newcastle Weekly Chronicle,' March, 1910, mentions a large stone on Seaton Links used by Thrushes as a means of breaking snail-shells. He identified the following species of snails from the shells cast around:—*Helix nemoralis*, *H. hortensis*, *H. hortensis minor*, *H. hortensis* var. *lilacina*, *H. arbustorum*. I have not come across many of these breaking stones in the district. The local name for this species is "Grey bird."

REDWING (*T. iliacus*).—A fairly common winter visitant, commonest during the time of arrival in autumn and departure in spring. As a rule they arrive at the beginning of October, but sometimes later.

FIELDFARE (*T. pilaris*).—A fairly common winter visitant, and more so than the last species. The times of its most frequent occurrence are the same as those of the Redwing. The average date of the first arrival is Oct. 2nd. The local name is "Feltie."

BLACKBIRD (*T. merula*).—A common resident and migrant. In April, 1910, a pair built a nest of string and clematis-stalks in an old aviary in our garden. A pied bird was shot at Seaton Delaval in about 1900, another at Whitley somewhat later, and one with white markings on the head at Holywell in 1909.

RING-OUZEL (*T. torquatus*).—This species is rare here, and the two specimens obtained were spring migrants which had just arrived and were halting on the coast before passing inland. An adult was shot at Cullercoats on May 1st, 1834, and is now in the Hancock Museum. Another bird of this species was shot at St. Mary's Island in April, 1904.

WHEATEAR (*Saxicola oenanthe*).—A regular resident during spring and summer, and more numerous in spring and autumn when numbers of migrants arrive and depart respectively. Breeds along the sea-banks at Whitley. Usual dates of first arrival—March 30th or April 1st; the earliest record I have is March 20th, which was in 1905. Young fully fledged are usually seen by June 22nd. I several times observed a male uttering its short and somewhat mixed song, hovering some six feet above the grass on George's Point, Cullercoats, during June, 1903, while his mate sat on her nest under the bank. Mr. Hodgson informs me that several years ago he found a nest of this species containing eggs in a hole in a stump in Briar Dene. There were two entrances which had been formed for a rope to pass through, and the bird retreated by the exit opposite to the approaching observer. Unfortunately, as is the same in many places, when he returned a day or so later, some urchins had harried the nest. The latest record of the departure of this species is October 2nd, in 1909. The local name is "Whiterump."

WHINCHAT (*Pratincola rubetra*).—Now only seen in spring

and autumn when on migration, but formerly it used to breed regularly on Whitley Links. A young bird in the first plumage, which was shot there on July 26th, 1877, is in the Museum.

STONECHAT (*P. rubicola*).—An uncommon spring and summer resident. A favourite haunt is on the furze along the sea-banks at Whitley, now fast disappearing. The first record I have is of one, now in the Museum, shot at Whitley in 1835. It seldom occurs in winter, and then only on migration.

REDSTART (*Ruticilla phoenicurus*).—It is only seen on migration, in spring and autumn, although formerly it probably bred in the district. The first record I know of is one shot at St. Mary's on Sept. 3rd, 1899, and which is in the Museum. The usual date of the first arrival is April 14th. The local name is "Nanny Redtail."

BLACK REDSTART (*R. titys*).—A rare winter visitant. A male, which is in the Hancock Museum, was shot at Cullercoats in 1856; and in March, 1857, a female was shot at the same place. These two are mentioned in J. Hancock's catalogue. I saw a male on Nov. 23rd, 1903, at the rifle range near St. Mary's Island; it had only just arrived and was very exhausted, allowing me to approach very close to it.

BLUE-THROATED WARBLER (*Cyanecula suecica*).—There are two records of the occurrence of this species in the district. The first I found among some notes of John Hancock's, written after the publication of his Catalogue. He writes as follows:—"A specimen of this interesting bird was shot at Cullercoats on Wed., 8th Oct., 1879. I saw the bird at a birdstuffer's in Percy Street a few days after it was shot. The specimen belongs to a Mr. Richardson." The birdstuffer would be R. Charlton, of Newcastle-on-Tyne. The second bird was taken on St. Mary's Island by Mr. J. Ewen, on Sept. 18th, 1883. It was stuffed by Mr. Bates, of Newcastle, and examined by J. Hancock, who considered it to be a female of the northern form in winter plumage, just having completed the moult. Mr. Ewen informs me that he watched it in his garden on the island for several hours before he shot it. This was the time of the large immigration of this species on the east coast. The first example was also of the northern or red-spotted form, which is usually the form obtained in Britain.

REDBREAST (*Erithacus rubecula*).—A common resident.

WHITETHROAT (*Sylvia cinerea*).—Rare as a spring and summer resident; more numerous on the coast at the time of its arrival in spring and departure in autumn, but never occurs in large numbers.

GOLDEN-CRESTED WREN (*Regulus cristatus*).—An autumn migrant; quantities arrive on the coast generally in October, and I have found them in the streets of Cullercoats so exhausted that I could easily catch them with my hands. J. Hancock mentions in his Catalogue that they may be seen every autumn as they arrive at St. Mary's Island in large numbers, and Mr. W. G. Monk tells me that he occasionally caught them during storms on the lighthouse there. The year 1906 was remarkable for a large influx of these birds.

YELLOW-BROWED WARBLER (*Phylloscopus superciliosus*).—The first specimen obtained in Britain was shot on the sea-banks opposite Bates' (St. Mary's) Island by John Hancock on Sept. 26th, 1838. In his Catalogue, Hancock says:—"It was catching insects on the tops of the taller herbage; and its actions were so like those of the Golden-crested Wren that I mistook it at first for one of that species. Its movements were very graceful as it flitted from plant to plant." This specimen, which is an adult male, is now in the Hancock Museum, and is figured by Hancock in his Catalogue. This specimen was supposed to be a Pallas's Willow-Warbler (*P. proregulus*) ["Dalmatian Regulus," Gould] until 1863, when Swinhoe pointed out the error, and Hancock rectified his identification ('Ibis,' 1867, p. 252) [H. Saunders, Man. pp. 61, 63].

CHIFFCHAFF (*P. rufus*).—Arrives in small numbers in spring. An adult male was shot by my brother, H. V. Charlton, while it was creeping about in a hedgerow behind Cullercoats on Dec. 20th, 1905. The weather at the time was very stormy, and it must have been on migration south from some sheltered spot in the south of Scotland, where it had remained to tempt fortune too long. This specimen is now in the Hancock Museum (Zool. 1906).

WILLOW-WREN (*P. trochilus*).—Numerous as a migrant, but only a few breed in the district, and those chiefly in Briar and Holywell Denes. The average date for its arrival is April 21st.

SEDGE-WARBLER (*Acrocephalus phragmitis*).—Although this bird probably was, and is, a regular spring and autumn migrant, yet, owing to its arriving at night, as do most migrants, and quickly departing inland, I have no record of it, excepting three which I myself saw in Briar Dene in 1905, just after they had arrived.

HEDGE-SPARROW (*Accentor modularis*).—Common. The local name is "Blueie," on account of the colour of its eggs.

DIPPER (*Cinclus aquaticus*).—An irregular visitor in autumn. Occasionally a bird is observed on the stream at Holywell.

LONG-TAILED TITMOUSE (*Acredula caudata*).—A rare migrant, arriving on the coast in autumn. The first record I can find is one which was found dead at Tynemouth in November, 1852, and was presented to J. Hancock by W. J. Forster, Esq. Hancock says of it:—"It was in a very good state of preservation, and, when picked up, could not have been dead more than a day or two. It had probably just arrived from the north of Europe." This bird was a specimen of the northern form of this species, the true *A. caudata*; that is, the White-headed Long-tailed Tit of some authors, owing to its having an entirely white head (Plate IV.). This is the only pure specimen of this form which has been obtained in England. It is figured in Hancock's Catalogue from a drawing by the author from the bird stuffed by him now in the Hancock Museum. (Howard Saunders, 'Man. British Birds,' p. 101.) Of the British form of the Long-tailed Tit (*A. rosea*), several examples have been obtained within the district. The first was shot by Mr. Ewen at St. Mary's Island on Nov. 11th, 1892, and is in his possession. It was stuffed by Mr. R. Duncan. The second was shot at Spittle Dene, near Tynemouth, in about 1890, by Mr. J. Douglas, now of Cullercoats; and another, a mature female, was shot in Holywell Dene, in about 1898, by Mr. Richardson, of Holywell. The figure is from the first-mentioned specimen in the Newcastle Museum.

GREAT TITMOUSE (*Parus major*).—A visitant by no means common.

MARSH-TIT (*P. palustris*).—A very rare visitor. I have only one record, which is of one shot at Holywell Dene in 1905.

BLUE TIT (*P. cæruleus*).—A fairly common resident, frequenting Holywell Dene chiefly.

WREN (*Troglodytes parvulus*).—A common resident.

TREE-CREEPER (*Certhia familiaris*).—A very rare visitor. The only occurrence was one shot in Holywell Dene in 1900 by Mr. Richardson.

WHITE WAGTAIL (*Motacilla alba*).—On Aug. 20th, 1854, Mr. Duncan shot a bird of this species near St. Mary's Island, which was identified at the time, and was obtained by a collector living in Shropshire. Mr. Duncan has a drawing of it in his possession, and it undoubtedly belongs to this species. Although this specimen was shot prior to the publication of Hancock's Catalogue, owing to an oversight it is not mentioned by him. Up to 1885 there had been no published record of its occurrence in Northumberland, in which year Howard Saunders observed one near Langley Castle ('Man. British Birds,' p. 123). This is, therefore, the first authentic occurrence of this species in Northumberland.

PIED WAGTAIL (*M. lugubris*).—Seldom seen in winter, but in spring it is more numerous, when birds that have spent the winter in the south return and pass inland to breed.

GREY WAGTAIL (*M. melanope*).—Only seen on the coast in winter, returning inland for the summer months. It is never numerous, and I have seldom seen more than three or four on the coast at the same time.

YELLOW WAGTAIL (*M. raii*).—A spring visitant, very uncommon. It never remains more than a day or two after its arrival in spring, but passes inland, up Briar Dene generally. From my notes, I see that the usual date of arrival is April 15th and the following week.

TREE-PIPIT (*Anthus trivialis*).—Only seen on migration, arriving in fair numbers during April. The earliest record I have is March 30th, which was in 1904.

MEADOW-PIPIT (*A. pratensis*).—Numerous; large numbers arrive in spring from further south. I once (March 30th, 1904) saw great numbers arrive at 7 a.m., and halt in the fields to rest. A local name for this bird is "Cheepy."

ROCK-PIPIT (*A. obscurus*).—A not uncommon partial migrant on the coast. The first record is of a male shot at Whitley in 1832 by John Hancock, which is now in the Hancock Museum.

(To be continued.)

SOME ODD NOTES ON YARMOUTH FISHES.

BY ARTHUR H. PATTERSON.

DURING the past thirty years the fishes of this district have afforded me much interest—in adding species hitherto unrecorded as local, and in noting the changes which have taken place as to numbers and movements. Some that were marked as rare on the Pagets' list ('Sketch of the Natural History of Yarmouth,' 1834) I have found to be exceedingly common, and others that were numerous in the earlier half of last century have become otherwise. I have been led to believe that most species are migratorial in habit—that some are fairly regular in coming and going, in their proper season, and that, like birds, which under certain conditions are spasmodic in their movements, many fishes fluctuate in numbers from year to year: they may be scarce one year, abundant another, or may come regularly for a time, and then absent themselves for long periods. What accounts for such capricious movements is not always discoverable, and it is certainly less easy to suggest reasons, as one may do sometimes in cases of bird fluctuations.

In our own immediate neighbourhood the Mackerel presents a striking instance. When I was a lad the Mackerel fishery was, and had been for years, an institution; May and June saw remunerative catches landed on the beach, the then market for their landing and dispersal. Then for years the spring fishery was practically a failure; and still later on they appeared in the autumn in company with the Herrings, so much so on occasion as to tempt owners to change the Herring-nets for the larger meshed Mackerel-nets. In recent years they have come again in some numbers in spring. No reason, so far as I can gather, is assigned for this, save mere caprice, which must certainly be a most unsatisfactory one; personally, I believe the movements of Herring-syle have to do with this phenomenon.

During the past fifty years considerable changes have taken place on Breydon; parts of it that, when I was a lad, were under water at low tide are now bare at half-ebb—indeed, for hours at a time the flats are dry: where the *Zostera* was flourishing, the mud is now hard, and those on the lowest level—bare of

“grass” then—are becoming solidified by a dense growth which will not be permanent. Over these flats, up till the seventies, Grey Mullet still largely fed in shoals, but in lessening numbers; they swarmed there in the earlier half of last century. Among the vegetation they found plenty of Crustacea and Mollusca, and varied their provender by partaking freely of the *Ulva lactuca*. Up till the same period Flounders were abundant, nets for these, as well as the Grey Mullet, being specially constructed and worked. Mullet were a payable catch, and Flounders were saleable as bait for Cromer fishermen. No one fishes especially for them to-day. The sewage pollution, which did not obtain until latter years, is undoubtedly detrimental in its effects; the sewage that runs freely into the rivers on the ebb-tide is not altogether got rid of ere the tide turns, and much of it goes upstream again.

For these reasons—pollution and the hardening of the flats—Eels have also become scarcer. Probably instinct has taught these various species to keep off the flats where they would be left stranded. The dainty Smelt, however, still persists in facing the altered waters, and, notwithstanding a reported scarcity in the Wash, local smelters complain more loudly on account of successive days of bad weather, which prevents them netting, than about a shortage of fish. These keep much to the three principal “drains” that are constantly widening and deepening, and also to the Channel. The numbers taken occasionally are astonishing, whilst good hauls are taken by the draw-netters in the Ham at Gorleston, and up the Bure.

I am of opinion that a much stronger current runs along the Yarmouth seaboard than when I first knew it, owing no doubt to the licking away of the sandhills farther north; these undoubtedly fended off the current. Much less seaweed and sea *débris* come ashore north of Yarmouth, and fish no doubt resort more to bay-like curvatures, as at the Ham, and again in the neighbourhood of Lowestoft, where great catches of Cods and Whitings are at times notorious; these come close inshore. That many fish “miss” our harbour that might otherwise ascend I have no doubt, since the lengthening of the North Pier and the deepening of the harbour-mouth automatically, as it were, combined with a stronger ebb-tide, all tend to keep them out and drive them southward.

The decay of the local trawling industry, and our dependence on Lowestoft vessels for even what little "offal" is used in our fish-shops, has led to a falling-off of many interesting species which, although not really local fish, albeit many of these boats trawl as near home as Cromer Knowle, at one time spiced one's interest by a sight of an occasional curiosity or sea-monster. A similar remark might apply to the Herring fishing, with its present-day rush and unrest—nothing that is unsaleable is bothered about, and so without a doubt many strange species are thrown back into the sea that in years gone by—in the leisurely old days—would have been brought ashore, to find one of the hands a small equivalent in tobacco, or the skipper a few shillings some showman might proffer him. Twenty years ago, when the fishing-luggers were mostly, if not all, sailing-boats—the Scotch boats, at any rate—the Scotch fishermen, thrifty and speculative, used to take to sea with them long hand-lines, for the purpose of catching Cods while the boats were lying to the net-warp drifting. Scores of excellent and large Codfish were brought by them to the fish-wharf, their sale making a nice little addition to the crews' earnings on occasion.

Since the deepening of the harbour-mouth and the constant dredging of the rivers have let up so much more water, the "salts" continually go higher up the rivers, and high tides are more frequent. One effect of this incursion of salt water may be seen in the deterioration of the common reed; localities that in my younger days were bright in summer-time with stretches of waving reeds are now bare of them. Old Breydoners have reminded me of reeds that grew halfway down beside Breydon north walls, and twenty years ago there grew a goodly patch near where my houseboat is moored. The Roach now never visit Breydon but by an accident of tide, whereas fifty years ago they were commonly caught there with Flounders in nets.

The Perch was in Lubbock's time still a regular visitor to St. Olave's. He writes: "St. Olave's bridge . . . has long been celebrated as a station for anglers; . . . if Shrimps are up as high as the bridge, it is generally found that Perch are there also." Sir Thomas Browne mentions their capture on Breydon "in mixed water." It was usual to take large Perch in the trammel-nets set for Flounders. I have not seen a Perch of any size taken at St. Olave's for a very long time; a few Roach and

occasionally a tolerable-sized Bream are taken on the neaps. The falling-off of large Perch in Norfolk waters has been noticed for some years; its decrease was laid at one time to the invasion of the *Anacharis* weed into its breeding haunts. Probably the unrest and turmoil of the waters caused by the great increase of steam, and now motor, vessels have had something to do with destroying the ova of this and other fishes, the swell from their screws beating the reeds with constant commotion: add to this the petrol which floats upon the surface.

The Bass, known locally as the "Sea-Perch," has become much less frequent in its visits, and is now seldom netted, notwithstanding considerable numbers appear to be found off Aldeburgh, and even up the Alde estuary.

The Bualis, added to my Yarmouth list in 1891, and then believed to be rare, is not by any means so, numbers being taken in the shrimp-nets.

The Grey Gurnard inshores spasmodically. In a hot summer quite a host may put into the shallows, and even take the baits of anglers; then for years it is conspicuously absent. Last summer a home-coming fisherman saw, and reported to me, an unusual number in the roadstead; "the sea around the vessel," he assured me, "being alive with them."

The Lesser Weever is much more plentiful off Gorleston (where it runs to a large size) than on the Yarmouth side of the harbour. The quieter waters immediately south of the break-water apparently suit their habits.

The Scribbled Mackerel (said to be only a variety of the Common Mackerel) would seem to be met with annually. I generally manage to see three or four. It is curious to relate that this fish seldom or never occurs of a greater length than fifteen inches.

I have reason to believe that a migration of the John Dory takes place late in January and early in February, when they are about the size of one's hand. For some three weeks great numbers were taken in the neighbourhood of Cromer Knowle in the trawl-nets. Then followed them, during February, hordes of Greater Weevers, running to about ten inches in length.

The Scad, or Horse-Mackerel, generally occurs simultaneously with the Mackerel and Herring shoals, and are then of a goodly size—quite as large as the Mackerel themselves. Singularly

enough, although plentiful during the 1910 autumnal fishing, they invariably corresponded in size with the Herrings; this was much remarked on by fisher-folk. And now that cranning has superseded "telling" (counting) the Herrings, everything goes into the "swills" promiscuously, and the number of Scads discovered by the gutters when working at the troughs has given rise to much complaint, this fish being worthless, like the small Whittings and broken Herrings also measured in with the bulk.

The White Goby, which I added to the Norfolk list in 1890, when it was taken numerously, has ever since that year been seldom seen. It is stated by Günther to be a fish that is born, matures, and dies in one year.

The Pagets described the Skulpin or Dragonet—local, "Fox-fish"—as very rare; on the other hand, I find it on occasion abundantly taken by the local shrimpers.

There existed at one time a decidedly general prejudice against the ugly-headed Wolf-fish, locally known as "Cat-fish," as food. It was formerly brought into Yarmouth by the deep-sea trawlers, and seldom disposed of, except on the quiet, to fish-fryers, who sold it in savoury-smelling pieces after an experience in boiling fat. Latterly this species has been much in evidence at Norwich, Yarmouth, and elsewhere, filleted, smoked, and dyed to a bright yellow, and sold under the name of "Grimsby Haddock." Some persons profess to esteem this fish, but to me it eats very like coarse Skate.

The Viviparous Blenny does not nowadays seem nearly so plentiful as it did thirty years ago, when it was captured in some numbers in small trawls on Breydon and at the entrance of the rivers to cut up for bait for eel-lines, and as bait for the "pots," being covered with a very tough skin. It is exceedingly good eating, the flesh when fried being white and firm, and is as palatable as Sole; the backbone left on the plate is of a rich emerald-green colour.

In the October of 1890 immense shoals of small Codlings came up Breydon, and were taken on the hook as fast as the lines could be hauled out. One afternoon I filled the bottom of my boat with them. Since then only one or two such incursions have been noted there. I think it likely that they will not face the dirty river; maybe the piers set them off, for,

although great numbers may be taken at Lowestoft and off our piers, none seem to find their way to Breydon. Codlings were extremely numerous during the winter of 1910-11, fine examples being numerous taken outside the five-fathom limit.

In looking over the 'Guide to the International Fisheries Exhibition' (1883), I came across the following note:—"Many people will be surprised to hear that hardly more than thirty years ago, when trawling used to be systematically carried on in the North Sea, Haddocks were caught in such vast numbers that there was hardly any market for them, and the fishermen were ordered to bring only a certain number ashore. Tons of them were then thrown overboard again." The species in the southern part of the North Sea is now no longer common; off our own coast it is even of rare occurrence, and the capture of a small specimen on an angler's line is an event to be chronicled. I have noticed of late many Codlings smoked to pass muster with the Haddocks, and sold as such to the unwary; few, however, notice any perceptible difference in flavour.

The Whiting still comes late each autumn inshore in smaller or greater numbers, but seems to give the deeper waters off Lowestoft a greater preference than Yarmouth. The five-fathom limit is much closer inshore at Lowestoft. When Codlings are exceptionally numerous, Whitings are noticeably scarce.

Young Pollack the size of Mackerel, known at Yarmouth as "Pinnikin Coles," are irregular visitants. Occasionally in May they are numerous, even in the river. This fish occurred abundantly in the September of 1910. Adult examples are more commonly taken, I believe, off Wells.

Brill and Turbot of any size are not often met with in local waters; chance-time the wolders, fishing off Palling and beyond, and shrimpers take a few small Brill. The same may be said with regard to Plaice. Curiously enough, an occasional small Plaice strays up-river, one being taken on a hook near the entrance of one of the Broads a few months since, and was identified by a well-known local fish-merchant.

Whilst Flounders are not nearly so numerous on Breydon to-day, either in summer or winter, when large spawning examples used to congregate at the confluence of the Yare, Bure, and Breydon, considerable quantities of large fish draw

into the harbour during the Herring-fishing, and are caught in hoop-nets baited with broken Herrings. Numerous Eels are taken at the same time in the same fashion.

Several pairs of fine Soles are frequently taken in a day by those shrimpers who use small trawls in addition to their dredge-nets. I believe that large spawning Soles come numerous inshore near Palling in April; that process is soon over, and the spent fish at once betake themselves to deeper waters. I know one shrimper who appears to know where to drop across Soles, and who frequently in the summer displays several pairs in his little shop-window.

In my earlier rambling days it was not a rare thing to find variously sized Congers helplessly cast ashore during severe easterly frosts. I have seen old men carrying a sack for any such that they might find. The reason for their inshoring was due to their getting into shoal waters, and being nipped by frost, when their bladders, distending, placed them helplessly at the mercy of the breakers. It is a very rare circumstance nowadays to meet with the species off Yarmouth.

The various Sharks that get entangled in the nets when pursuing the Herring are now seldom brought ashore, there being no sale at all for them. At one time a few shillings might be made of them for some purpose or another. The Porbeagle, large Topes, and Nursehounds, at one time, were not infrequently landed; to-day they would only be thrown upon the refuse-heap, and, being useless, would be an inconvenience in these days of feverish bustle and haste. Piked or Common Dogs are washed ashore with dead Herrings when an easterly wind obtains. Spotted Dog-fishes would seem to have greatly decreased since the Pagets' time, when they were stated to be our commonest species.

The Lamprey and the River Lampern are in no request locally, and, although not rarely taken in the rivers, are seldom eaten. The Lampern, or Silver Lamprey, is by far the commoner species, and ascends our rivers for purposes of spawning. Mr. W. S. Everett assured me last year that "some thirty years ago a man named Bessey took from his eel-set in the Waveney, after one night's fishing, no less than 5 cwt. of Lampreys. He despatched them in boxes to London."

NATURAL HISTORY RECORD BUREAU (1910): THE
MUSEUM, CARLISLE.

By D. LOSH THORPE & LINNÆUS E. HOPE, Keepers of the Records.

THE year 1910, though not altogether unproductive of ornithological incident, has perhaps been less so than most seasons, at least as regards rare occurrences on the Solway, or in Cumberland generally.

This was no doubt greatly owing to the mildness of the spring months, there being little or no frost or snow after the end of January in this district, and the absence of storm during the period of migration, which apparently pursued its normal course without any noticeable break.

The mild weather conditions during this season had also the effect of producing early nuptial arrangements amongst our resident birds, Thrushes were singing in January, Chaffinches in February, and Lapwings were investigating suitable nesting quarters high up on the moors by the end of February. Mr. Eric B. Dunlop, who has exceptional opportunities, and uses them, of observing the birds in his district, gives some early instances, and his notes on the birds in the Windermere district give a very good idea of the sequence of arrival of our summer visitors in the Lake District. On several dates in the spring of 1910 he heard and recorded the singing of the Redwing (*Turdus iliacus*); it is not the good fortune of every English ornithologist to hear the low plaintive song of this species of migratory Thrush in this country.

A considerable amount of controversy in the Press was occasioned by the extraordinary behaviour of a Common Buzzard (*Buteo vulgaris*), which has contracted the somewhat offensive habit of swooping at persons who trespass on the hillside which it considers its special domain. Let it be clearly understood that it is a single bird which has contracted this habit; the bird

is well-known to several Westmorland and Cumberland ornithologists, and this habit is not characteristic of the species. This bird has been variously described as a "Buzzard," "Bustard," and "Golden Eagle," but the reports of it attacking people are somewhat exaggerated, although it is a little disconcerting to have a large bird like a Buzzard swoop down near enough to knock off one's hat. It frequently swoops at and "strikes" sheep on the hillside when annoyed by the presence of man. We saw it do this when irritated.

Mr. W. Nichol, of Skinburness, Silloth, relates an instance of the persistence with which a Stoat will attack and pursue so large a bird as a Pheasant. On November 3rd he noticed a Pheasant running, followed closely by a Stoat; the Stoat tried to take the bird in the rear, but the Pheasant showed a bold front and kept his assailant at bay. After some time a Blackbird, which had been a spectator of the whole proceeding, attracted the Stoat's attention for a moment, when the Pheasant made off and hid in a clump of grass, but the Stoat, not yet defeated, again gave chase, and its tactics in again reaching his desired prey were most interesting; sitting up on its haunches, it spied out the ground frequently, but finally detected its quarry by scent, and after another tussle gave up in disgust and left the Pheasant master of the situation.

Mr. Nichol also contributed an interesting note on a Peregrine which frequented the shores of the Solway, near Silloth. On December 27th he noticed the Falcon chasing a Curlew which three times took to the water to escape its pursuer; the Falcon did not attempt to lift its prey from the surface, as it is said to do in the case of ducks which it has chased until exhausted, but finally left it on the water. Shortly after this incident the Falcon brought down a Barnacle Goose which Mr. Nichol had wounded by a shot.

The most interesting ornithological event of the year is one which is close home to us in connection with the wild Whooper Swan which has visited the Eden for six successive winters. Last year, as we recorded in these notes, the Whooper returned to the Eden on December 24th, accompanied by a mate and two other Swans of the same species, adult birds. On Nov. 16th she again returned, this time also accompanied by her mate,

but also by one young bird, evidently her offspring, and by two adult birds, presumably the two birds which spent last winter on the Eden, the latter being accompanied by two young birds, apparently their offspring. These seven Swans did not stay over-night on the river, and six of them *only* returned the following day, one of the adults of the pair with the two young being missing—evidently some accident to which wild birds are too frequently subject had overtaken one of the parents—and the two young Swans have continued to be attended by one adult only, the surviving parent. Two days later two more adult Whoopers made their appearance, perhaps the remainder of the herd to which our bird had become attached. These eight wild Swans have remained on the river during the whole winter, and at the time of writing are still with us.

The Puffin (*Fratercula arctica*), although a breeding bird all round our coasts, and especially numerous on some parts of the west coast, is not a common visitor to the Solway. Still it occasionally occurs, generally as a derelict on the shore, but sometimes as an exhausted bird picked up inland. We have twice known it picked up alive in the Solway district, the last being one in the early months of 1910, which was placed in our aviary, where it lived for several months. It at first evinced little desire for food, and refused all the dainties set before it in the shape of live and dead fish, &c., but after having had two or three mealworms placed in its mouth, it developed an appetite for those grubs which eventually became of alarming dimensions. It later began to take other food, live minnows and portions of fresh fish, but not if there was a mealworm about. He was in full nuptial or summer dress when obtained, with the curious wrinkled, orange-coloured skin around his eyes and at the corners of his mouth; his beak had the large horny casing with its orange and blue coloration which reminds one of an abnormally developed parrot's beak. This horny covering is part of the summer dress and is cast off in the autumn. This particular bird began casting his horny casing on August 19th.

It was a peculiar and interesting pet, becoming quite tame and taking mealworms and fish from the hand; but although a small pond in the aviary was stocked with minnows for his especial benefit, Billy, as he was called, could not be induced to

fish for himself; in fact, we think that it was only in hope of getting a mealworm that he condescended to accept the fish from our hand. It is extraordinary what a fondness birds have for this grub, which is the larva of a beetle. Another bird we have in this aviary, and which likes the mealworm diet, is a Great Spotted Woodpecker (*Dendrocopus major*). It was also for some time extremely tame, and would fly on to one's shoulder or breast to be fed on its favourite diet of mealworms. We have had several other interesting birds in our aviary during the past year, including the Bearded Reedling or Bearded Tit, one of the most beautiful of British small birds; also the Bohemian Waxwing, a most docile bird in confinement, with its sleek silky plumage and red waxen appendages to the ends of the secondary wing feathers. We also had a Redstart which lived over winter, but unfortunately died in an early effort to moult.

During the last year or two numerous letters have been written to us recording rare plants found in the district, also animals other than vertebrates. When the "Record Bureau" at the Carlisle Museum was initiated, it was proposed to deal only with the vertebrate animals of the district—Cumberland and Westmorland and a radius of fifty miles around Carlisle—but we wish to state now that if those persons who are students of any branch of Natural History, including the lower animals (Invertebrata) of all or any orders, botany, palæontology, or mineralogy, care to correspond with us upon such matters, we will be pleased to place on record, in the same way in which we treat the vertebrate animals, all records of invertebrate animals, plants, fossils, or minerals.

Mr. J. C. Varty Smith, of Penrith, writes that in June, 1908, he found examples of a rare aquatic plant, *Ranunculus circinatus*, in Thacka Beck, Penrith, previous records of this plant in Cumberland being doubtful.

Messrs. Chas. Platt and David Dickenson both record the rare orchis *Goodyera repens*, respectively, from Great Corby and Armathwaite in July, 1910.

The following are the vertebrate notes and records sent in to the Bureau during 1910:—

January 4th.—Song-Thrush singing at Troutbeck, Windermere (Eric B. Dunlop).

5th.—Redwings singing at Troutbeck, Windermere (Eric B. Dunlop).

6th.—Mistle-Thrush singing at Troutbeck, Windermere (Eric B. Dunlop).

29th.—Grey Lag-Geese (fourteen) seen near Silloth; Peregrine Falcon frequenting shore at Skinburness (W. Nichol).

31st.—Wild Geese (unidentified) and Red-throated Divers (three) seen near Silloth (W. Nichol).

February 1st.—Chaffinch singing at Troutbeck, Windermere (Eric B. Dunlop).

2nd.—Song-Thrushes singing at Stanwix (Linnæus E. Hope).

9th.—Barn-Owl hawking in daylight in Carlisle (T. L. Johnston).

10th.—Tawny Owl hooting at Stanwix Bank (Linnæus E. Hope).

12th.—Chaffinch singing at Carlisle (H. Marks).

14th.—Sky-Lark singing near Stanwix (Linnæus E. Hope).

17th.—Grey Lag-Geese (seventeen) seen near Silloth (W. Nichol).

22nd.—Blackbird first heard singing at Troutbeck (Eric B. Dunlop).

25th.—Curlews passing over Stanwix during day and returning to Solway at evening (Linnæus E. Hope).

26th.—Lapwings first seen on the moors, Windermere (Eric B. Dunlop).

27th.—Curlews passing inland near Windermere (Eric B. Dunlop).

March 4th.—Wild Geese, three separate parties of twenty-five, thirty, and sixty seen near Silloth (species unidentified) (W. Nichol).

6th.—Corn-Buntings commenced singing near Carlisle (T. L. Johnston).

9th.—Redwings heard singing at Troutbeck, Windermere (Eric B. Dunlop).

13th.—Hawfinches (two) seen at Crosby-on-Eden (E. Hodgson). Sand-Martins (two) seen at Crosby-on-Eden by four independent observers (J. B. Cairns). Dipper's nest with one egg at Westward, Wigton (R. W. Barwise).

17th.—Corn-Buntings (flock of sixty-two) on wires at Todhills (J. B. Cairns).

21st. — Rooks begin to stay overnight at rookeries near Carlisle (T. L. Johnston). Brent Geese (eleven) seen near Silloth (W. Nichol).

22nd.—Redwings heard singing at Troutbeck, Windermere (Eric B. Dunlop).

26th.—Wheatear first seen near Silloth (W. Nichol).

28th.—Wheatear seen at Silloth (D. Losh Thorpe).

31st.—Wheatear first seen at Windermere; a Raven's nest contained young (Eric B. Dunlop).

April 2nd.—Two of the four Whooper Swans which have spent the winter on the River Eden left to-day. They appeared restless and greatly excited all day before leaving (D. Losh Thorpe).

7th.—Barnacle Geese (flock) seen near Silloth (W. Nichol).

10th.—Knots in aviary showing signs of summer dress (D. Losh Thorpe).

14th.—Swallow first seen near Windermere (Eric B. Dunlop).

15th.—Wheatears first seen at Carlisle Cemetery (J. T. Charlton). Swallow first seen near Silloth (W. Nichol).

16th.—The two remaining Whooper Swans, one of which was our regular visitor, missing at intervals of a day or two since the other two went northwards, finally left on this date (L. E. Hope and D. Losh Thorpe). Ring-Ouzel first seen near Windermere (Eric B. Dunlop). Grey Lag-Geese (sixteen) seen near Silloth, Solway (W. Nichol).

17th.—Willow-Warbler and Swallow seen near Carlisle (T. L. Johnston). Willow-Warbler seen at Westward, Wigton (R. W. Barwise).

18th.—Swallow first seen at Carlisle Cemetery (J. T. Charlton).

19th.—Redshanks visiting flood-water at Crosby-on-Eden (E. Hodgson). Swallows arrived at Westward, Wigton (R. W. Barwise). Goldcrests (one pair) nesting in Cemetery Grounds, Carlisle (J. T. Charlton).

20th.—Swallow first seen at Toddell, Cockermouth (W. F. Dixon). Willow-Warblers first seen at Windermere (Eric B. Dunlop).

21st.—Sand-Martin first seen near Windermere (Eric B. Dunlop).

22nd.—Wild Geese very numerous on Rockcliffe Marsh (G. F. Saul).

24th.—Redstart first seen near Windermere (Eric B. Dunlop).

26th.—Richardson's Skua (adult) seen near Silloth (W. Nichol).

28th.—Cuckoos (three) seen at Todhills, Carlisle (J. B. Cairns).

29th.—Corn-Crake first heard at Westward, Wigton (R. W. Barwise). Yellow Wagtail first seen near Windermere (Eric B. Dunlop).

30th.—Cuckoo first heard at Westward, Wigton (R. W. Barwise). Cuckoo first heard near Silloth; Shoveler Ducks (two) seen on Solway (W. Nichol).

May 1st.—Corn-Crake heard at Harker, Carlisle (J. B. Cairns).

2nd.—Cuckoo first heard at Troutbeck, Windermere (Eric B. Dunlop). Lesser Terns arrived on Solway; White Wagtails (three) seen near Silloth (W. Nichol).

4th.—Grasshopper-Warbler heard near Carlisle (T. L. Johnston). Swift seen at Etterby Scaur, Carlisle (D. Losh Thorpe). Grasshopper-Warbler heard at Todhills Moss (J. B. Cairns). Swifts (two) seen at Gretna (J. B. Cairns).

5th.—Wood-Warbler first heard at Troutbeck, Windermere (Eric B. Dunlop).

8th.—Spotted Flycatcher first seen at Troutbeck, Windermere (Eric B. Dunlop).

16th.—Sedge-Warbler singing at Etterby Scaur (D. Losh Thorpe).

19th.—Whimbrel (six) seen near Silloth (W. Nichol).

21st.—Knots (two) and Bar-tailed Godwits (three) seen on Solway (T. L. Johnston). Dotterel seen in Lake District (G. F. Saul).

28th.—Sanderlings (flock of over two thousand) on shore at Silloth (W. Nichol).

June 1st.—Black-headed Gull nesting (one nest) at Bassen-thwaite (W. J. Farrer).

8th.—Sanderlings extremely numerous and very tame; over three thousand on the shore near Silloth (W. Nichol).

28th.—Oystercatchers (pair) on the Eden above Crosby (E. Hodgson).

July 4th.—Hawfinch and young seen at Crosby-on-Eden (E. Hodgson).

5th.—Cuckoo heard (last time) near Windermere (Eric B. Dunlop).

22nd.—Manx Shearwaters (twelve) seen on Solway (J. W. Armstrong).

30th.—Cormorants (three) flying up Windermere (Eric B. Dunlop). Turnstone in summer dress seen near Silloth (T. L. Johnston). Knots and Bar-tailed Godwits (three hundred to five hundred of each species) on Solway; mostly in summer dress (W. Nichol).

August 1st.—Greenshanks (two) seen on Newton Marsh, Solway (T. L. Johnston).

4th.—Crossbills (several) seen at Troutbeck, Windermere (Eric B. Dunlop).

5th.—Greenshanks (two) seen near Silloth (W. Nichol).

6th.—Skua seen near Silloth (W. Nichol).

12th.—Greenshank, Spotted Redshank, Little Stint seen near Silloth (W. Nichol).

22nd.—Mistle-Thrush heard singing near Windermere (Eric B. Dunlop).

September 1st.—Greenshanks (eleven) seen on Newton Marsh, Solway (T. L. Johnston). Green Sandpiper seen on Newton Marsh, Solway (T. L. Johnston). Wigeon (eight) and Shovelers (three) seen on Solway (T. L. Johnston).

10th.—Swift seen at Etterby Scour (late date) (D. Losh Thorpe).

12th.—Wood-Warbler uttering a few notes near Windermere (Eric B. Dunlop).

17th.—Black Tern (immature) seen on Solway (T. L. Johnston).

19th.—Wild Geese arrived on Burgh Marsh (T. L. Johnston). Barnacle Geese arrived on Newton Marsh (T. L. Johnston). Barnacle Geese near Silloth (W. Nichol).

October 1st.—Song-Thrush singing at Troutbeck, Windermere (Eric B. Dunlop).

4th.—Swallow seen at Silloth (D. Losh Thorpe).

5th.—Swallow seen at Wigton (W. H. Redmayne). Peregrine Falcon frequenting Solway, near Silloth (W. Nichol).

6th.—Peregrines (two) seen near Silloth (W. Nichol).

8th.—Shovelers (three) seen near Silloth (W. Nichol). Swallow last seen at Troutbeck, Windermere (Eric B. Dunlop).

9th.—Wild Geese (one hundred and fifty) flying south-east over Carlisle (D. Losh Thorpe).

11th.—Redwings first seen this season near Windermere (Eric B. Dunlop). Fork-tailed Petrel seen near Silloth (W. Nichol).

18th.—Peregrine Falcon, Red-throated Diver, Red-breasted Mergansers (two) seen on Solway, near Silloth (W. Nichol).

20th.—Fieldfares first seen at Troutbeck, Windermere (Eric B. Dunlop).

22nd.—Bramblings first seen at Troutbeck, Windermere (Eric B. Dunlop).

November 2nd.—Goosander seen on Windermere Reservoir (Eric B. Dunlop). Manx Shearwaters (two) seen on Solway (J. W. Armstrong).

3rd.—Pheasant attacked by Stoat (note in introduction) (W. Nichol).

4th.—Bewick's Swans heard passing down Solway at night (W. Nichol).

9th.—Great Crested Grebe (immature) shot at Anthorn (T. L. Johnston).

14th.—Wigeon (about four hundred) on Solway (W. Nichol).

15th.—Mallards very numerous on Solway (W. Nichol).

16th.—Whooper Swans (seven) arrived on the River Eden, Carlisle (T. Hudson).

18th.—Wild Swans (seven) seen on Solway (W. Rutherford). Whooper Swans (two more adults) arrived on Eden (T. Hudson).

28th.—Red-breasted Mergansers (three), Red-throated Divers (three), seen on Solway, near Silloth (W. Nichol).

December 13th.—Bohemian Waxwing shot at Glasson, Burghby-Sands (Jas. Bryson).

15th.—Grey Lag-Geese (twelve) seen at Skinburness, Silloth (W. Nichol).

24th.—Hawfinch seen at Crosby-on-Eden (E. Hodgson).

27th.—Peregrine Falcon attacking Curlew and Barnacle Goose (noted in introduction) (W. Nichol).

28th.—Little Stint seen at Skinburness, Silloth (W. Nichol).

30th.—Grey Lag-Geese (fourteen) seen at Skinburness, Silloth; pack of Bewick's Swans heard in flight down Solway (W. Nichol).

NOTES AND QUERIES.

A V E S.

On the Interbreeding of the Song-Thrush and Blackbird in Middlesex.—I think that most naturalists will hesitate to accept the conclusions which Mr. Adamson seems to me too readily to draw from what he has seen with regard to these two species in Middlesex (*ante*, p. 194). In the first place, with regard to the Thrush's nest found on March 30th containing three eggs resembling those of the Redwing; I would suggest that the probable explanation is that a hen Blackbird had laid her eggs in a Thrush's nest. It is not an uncommon thing for a wild bird to appropriate the nest belonging to another species, but I think that naturalists will expect much clearer proof than Mr. Adamson furnishes before they can agree with his conclusion that in certain districts Blackbirds and Thrushes freely interbreed. Then as to Mr. Adamson's assertion that he has always found that the male bird has the influence over the external appearance of the shell of the egg—may I ask him for a clear proof of this assertion? Judging from the fact that domestic hens of a breed which lay pure white eggs when mated with cocks of a brown egg-laying breed still continue to lay pure white eggs, and that white egg-laying ducks when mated to a drake of a green egg-laying breed still continue to lay white eggs, I should have supposed that a hen Thrush when mated to a Blackbird cock would lay an egg precisely similar to an ordinary Thrush's egg; in other words, that the male bird would have no influence over the external appearance of the shell of the egg. Mr. Adamson further says: "In nine cases out of ten the eggs are unfertile, and are never incubated by the female." I would ask him how he ascertains that the eggs are unfertile except by their being incubated, and also, whether he believes that an egg which had not been fertilised would be influenced by the male bird in the external appearance of the shell?—E. W. H. BLAGG (Cheadle, Staffordshire).

Hedge-Sparrow's Nest inside a Blackbird's Nest.—When staying at Aston-le-Walls, Northamptonshire, in April, I found the nest of a Hedge-Sparrow built inside an old Blackbird's nest in a yew hedge. Two eggs were laid, but disappeared. The Hedge-Sparrows, relying

on the walls of the Blackbird's nest, had not put nearly so much material as usual into their own nest—merely lining on one side.—W. G. N. APLIN (Bloxham, Oxon).

Pied Flycatcher in Warwickshire.—On May 6th last a friend and myself observed a Pied Flycatcher near here. Whether this species has been recorded for Warwickshire or not, I am unable to ascertain *definitely*, although it has probably been observed, as I understand is the case with neighbouring counties. As it is necessarily of rare occurrence, I thought it worthy of record.—BERNARD STARLEY (46, Holyhead Road, Coventry).

Pied Flycatcher in Northamptonshire.—A male Pied Flycatcher, which I examined while it was still in the flesh, was shot at Aynho about May 4th. I have only known of one previous occurrence of this species in that part of Northamptonshire, and Lord Lilford only mentions some half-dozen more instances in other parts of the county.—O. V. APLIN (Bloxham, Oxon).

The Mobbing of Cuckoos and Hawks.—*Apropos* of the remark made by Mr. Edmund Selous (*ante*, p. 183) that the Cuckoo is more frequently followed by small birds than the Sparrow-Hawk, I would add that in Ireland, where I have frequently seen the Cuckoo attacked and driven from place to place by small birds, the small birds that I have seen so engaged have almost invariably been of one species, the Meadow-Pipit. In other words, the only species of bird that in Ireland is commonly victimised or duped by the Cuckoo, and has frequently to rear the latter's young, is also the only bird that is much addicted to mobbing it. For this reason I have long been satisfied that the Cuckoo is mobbed in this country simply and solely because it is recognized as a Cuckoo, and that its superficial resemblance to a Hawk has nothing whatever to do with the matter. Judging from descriptions, it seems to be far more generally mobbed in England; but then it would also appear that English Cuckoos are far more indiscriminate in their choice of foster-mothers. I must add that I have also frequently seen the Sparrow-Hawk mobbed, but never by Meadow-Pipits; and the aggressors have, as a rule, the good sense to confine their attacks to occasions when the Hawk is encumbered with booty, and so cannot retaliate. Their observance of this sort of discretion leaves, I venture to think, no room for the theory that they give chase to the Cuckoo at first sight through mistaking it for a Hawk.—C. B. MOFFAT (36, Hardwick Street, Dublin).

Osprey in Renfrewshire.—On May 19th last I found an Osprey (*Pandion haliaëtus*) lying dead on a grass-ledge in a glen in the north-west corner of Renfrewshire. It was a male bird in fine plumage, but had been dead some time, and the head was destroyed. The skin has been preserved as far as possible. The dimensions are—Length $22\frac{1}{2}$ in.; wing-spread 5 ft. 5 in.; closed wing 20 in.; beak $1\frac{5}{8}$ in.; base of beak to base of tail $13\frac{1}{4}$ in.; tail $9\frac{1}{2}$ in.; tarsus $2\frac{3}{4}$ in.—THOMAS MALLOCH (Mount Pleasant, Johnstone, Renfrewshire).

The Honey-Buzzard.—I am grateful to Mr. Jourdain for his comments on this subject (*ante*, p. 149), and regret that so well-informed an authority cannot add any definite records of eggs or young birds to my scanty list. To some of the records of “breeding” which he mentions, I referred in my former note, and others did not furnish the particulars I required, or were unsatisfactory. But I am now able to add Durham to my list. Mr. Isaac Clark has kindly given me particulars of a nest built in some beech-woods on the banks of the River Derwent, which contained two young birds early in August, 1899. I have to thank Mr. Noble for telling me of this nest in the first instance.—O. V. APLIN (Bloxham, Oxon).

Decrease of Corn-Crake, Nuthatch, and Wryneck.—The scarcity of the Nuthatch noticed here (*ante*, p. 114) extended as far north as the southern part of Warwickshire, where the bird used to be very common and has been scarce of late years. But I hear that the tide seems to have turned, and a few birds have been noticed again lately. Here, too, it may have turned. There are one if not two pairs about the village this summer. A pair still (May) comes for nuts, but have scorned a Berlepsch nesting-box I put up just over the nut-board, and Blue Tits took it. The Nuthatch has many admirers outside the ranks of professed ornithologists, and it is easy to get some idea of its status. All round here the tale has been the same for some years. As to north-west Oxon and Oxford, *cf.* Mr. Fowler’s note, “Where are our Nuthatches?” (*Zoologist*, 1909, p. 155). With regard to the *increase* of this bird with Mr. Noble, may it not be possible that this is partly, at all events, owing to the ample provision of nesting-boxes? Birds like the Nuthatch (and the Wryneck, too) must have suffered a good deal, not only from usurpation of nesting-holes by the increased Starlings but also by the destruction and removal of old “useless” trees, often full of old Woodpeckers’ and other holes. The old trees have been disappearing steadily and surely; and as the birds named cannot make holes for themselves, and will not put up with tin-pots and kettles as readily as Tits do,

the housing question has been (too literally) a burning one with them for some time past. I have often been urged to sweep away about a dozen old pollard ash trees—partly hollow and with many holes in them—on the ground that they are useless, “only suck the ground,” and would make a lot of firewood. I always feel that obstinate silence on the subject is better understood than the only reason I could give for leaving them standing! Whatever the real cause or causes of the present scarcity of the Corn-Crake in parts of England may be, I do not think the use of mowing-machines is one. The mowing-machine was in use many years before the scarcity of the birds was noticed. Corn-Crakes were common down to 1885, after which the falling-off was more or less sudden, not gradual. And I should think that nests were more likely to be mown out in the days of the scythe, when mowing generally began earlier. I do not remember hearing much of old Corn-Crakes being killed here either by the scythe or the machine, and should think the rattle of the latter would be more likely to warn the bird to leave her nest than the gentle swish of the scythe. But I do think that telegraph-wires may have had a good deal to do with the decrease, by the destruction of the old birds on their arrival in the spring. For no birds suffer more in this way than the Crake family. I attribute to the wires also the greater scarcity nowadays of the Spotted Crake, which I have often known killed by the wires in years gone by. I do not think protection by law would have the least effect—here at all events. I never once remember hearing of a Corn Crake’s nest being found here unless it had been mown out; and when mown out no further harm could result from taking the eggs. It would be far better to take them than to leave them for the Rooks to eat, and so encourage the latter in the very bad habit they have got into of searching every field as soon as the grass or clover is down for nests and eggs. Then, as to shooting the birds in the autumn, I can only say that we have as many of these passing migrants as ever. They evidently hail from some distant locality where the bird still breeds in numbers, and shooting them has no effect whatever on the breeding stock in this part of the country. The idea that protection is a remedy in *all* cases for the present-day scarcity or the growing scarcity of a bird has been overdone, and is, I hope, an exploded notion. Protection has not saved the Stork in Holland. Take the case of Ray’s Wagtail. I took a long walk in the Cherwell Valley one day in May, and I saw one of these birds. Some years ago I should have seen—I feel sure—a dozen pairs, perhaps more. The

bird has been scarce for years. Yet I do not suppose anyone would contend that it has suffered in the least from human persecution, direct or indirect, or that any amount of protection and County Council orders would have any effect on its future status.—O. V. APLIN (Bloxham, Oxon).

Breeding of the Honey-Buzzard in England.—In reply to Mr. Heatley Noble's note under the above heading (*ante*, p. 200), I should like to say that my reference to Burnham Beeches, "Berks," is a quotation from the 'Ibis' for 1865, p. 13. Cf. Charlesworth's 'Magazine of Natural History,' p. 539.—F. C. R. JOURDAIN (Clifton Vicarage, Ashburne, Derbyshire).

AMPHIBIA.

Palmate Newt in Shropshire.—In May last I had brought to me several Newts out of about thirty taken by some children from a pond at Church Stretton. All those which I saw were *Molge palmata* in full breeding dress. This is quite a new locality for the species, which has previously been recorded in Shropshire only from the Forest of Wyre, where it was first discovered by Mr. J. Steele Elliott. A dried-up specimen sent to me from Shifnal some ten years ago was, I believe, of this species, but it was so withered that I could not be certain of its identity.—H. E. FORRETT (Shrewsbury).

OBITUARY.

ROBERT SERVICE.

MR. ROBERT SERVICE died at his residence in Maxwelltown, Dumfriesshire, on May 8th, at the age of fifty-six. He had for some time been in poor health, mainly owing to worries connected with his business of nurseryman and seedsman. He was an accomplished naturalist and a keen observer, with a thorough knowledge of the birds, beasts, fishes, and insects of the South of Scotland, and of their haunts and habits.

Much that he knew is lost with him, but many of his original observations are recorded in the notes and papers which he contributed to 'The Zoologist,' the 'Annals of Scottish Natural History,' and the 'Transactions' of the Natural History Societies of Dumfriesshire and Galloway, Glasgow, and Edinburgh. He was the author of

a chapter on the Natural History of Kirkeudbrightshire in Maxwell's 'Guide Book to the Stewartry of Kirkeudbright.' Of his memoirs on Mammals, special mention may be made of one entitled "The Old Fur Market of Dumfries," written in 1891, and containing much of interest about the skin trade, the causes of its decline, and the animals that supplied the staple; and of another, "Mammalia of Solway" (1896), in the form of an annotated list. The Solway Area includes Lochs Grannoch and Dungeon, which hold Char, Loch Ken, famous for its large Pike, and Lochmaben, the home of the Vendace. A good deal about these interesting fishes is to be found in Mr. Service's paper, "The Freshwater Fishes of the Solway Area" (1892). He considered the disputes and claims arising out of the Salmon fisheries to be a public scandal, unsatisfactory to everybody except the lawyers, and wrote:—"The late Frank Buckland would have found a very large number of people here to agree with him, if in his famous statement that more lies have been told about the Pike than about any other fish in the world he had substituted 'Salmon' for 'Pike.'"

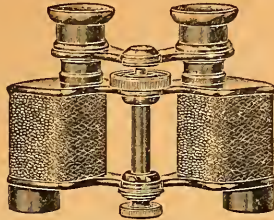
Mr. Service took a great interest in the production of Mr. H. S. Gladstone's recently issued book on 'The Birds of Dumfriesshire,' and his co-operation is thus acknowledged by the author in the preface:—"With so many willing assistants it becomes almost invidious to mention any by name; it is, however, quite certain that pre-eminent among them stands Mr. Robert Service. The frequent mention of his name throughout the volume testifies to my obligation to him, and he has, moreover, helped in the revision of the book in all its various stages."

We have endeavoured to indicate above the wide range of Mr. Service's knowledge, and the varied nature of his attainments. In glancing through his published memoirs and notes one is especially struck by the fact that whatever subject he was writing on—bird-migration, insect-life, colour variation, the Vole plague, new, rare, or extinct animals, &c.—he always had something to say that was well worth saying, and knew how to leave out that which was trivial and unimportant. He was generous with his knowledge, and many knew him as a valued correspondent, who took a delight in giving information.

C. T. R.

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THE ZOOLOGIST

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EXPERIMENTS WITH SALMONOIDS AND TURBINES.*

BY Prof. McINTOSH, M.D., LL.D., F.R.S., Gatty Marine
Laboratory, St. Andrews.

DURING the progress of the investigations by the Irish Inland Fisheries' Commission of 1899 and 1900 many statements were brought forward as to the injuries to Salmonoids caused by the turbines so frequently used in Irish mills—indeed, complaints of this kind had been brought before the authorities more than ten years previously, and Sir Thomas Brady had been deputed to investigate the subject in 1892. As, however, the matter seemed to be important, and as the experiments carried out by Sir Thomas were few in number, it was resolved again to make careful inquiries. Accordingly the writer carried out experiments both in Scotland and Ireland in 1900, a record of which, by the kind permission of the Department in Dublin Castle, and Lord Justice Walker, Bart., Chairman of the Irish Inland Fisheries Commission, is given in the following pages.

Before detailing the work of 1900, it is well to premise by giving a brief account of the inquiry by Sir Thomas Brady, late Inspector of Fisheries in Ireland. In May, 1892, experiments with Smolts and turbines were carried out by Sir Thomas, under the authority of the Select Committee on the Salmon Fisheries (Ireland) Acts Amendment Bill. He used a small-meshed net

* Printed by permission of the Irish Executive, Dublin Castle, and Lord Justice Walker, Chairman of the Irish Inland Fisheries Commission, 1899 and 1900.

in the form of an eel or coghill net for capturing the fishes after they had passed through the turbines and had reached the tail-race. This net was twelve feet wide, and tapered to a pocket or narrow, kept open by hoops, and fishing into a floating box covered with perforated zinc. The ground-rope of the net was heavily weighted with lead. In all five experiments were performed, *viz.*: (1) at Devil's Mills (Mr. Shackleton's), Lucan; (2) Messrs. Hill's Mill at the same place; (3) at the Salmon-Leap (Mr. Wookey's), on the same river; (4 and 5) at Coagh Mills (Messrs. Duff's).

In the first experiment the turbine was an Alcott, sixty-six inches in diameter, with seventy revolutions, and a fall of seven feet. Ten Smolts were put in the turbine-pit. In ten minutes the net was lifted, and no trace of the fishes observed. Four dead Smolts were then placed in the pit with the turbine in full operation. In ten minutes they floated down the stream and were secured with a landing-net. "Two were uninjured in appearance; one was broken across the back." Two other dead Smolts (specially marked) were placed in the pit, and they were secured in the tail-race, apparently uninjured. In all probability the ten Smolts placed in the pit by Sir Thomas Brady resisted the efforts of the turbine to engulf them, or, if they passed through, kept to the stream above the net, or passed by the side or beneath. A sickly, dying, or dead fish would soon have appeared in the tail-race or the net.

In the second experiment a Leffell turbine, of fifty-six inches, with a fall of seven feet, was used. The number of revolutions is not given. Twenty-three Smolts were put in the turbine-pit, and after ten minutes the net was raised. In it were six living Smolts, six dead and two dying; four "mashed up"; one living Trout of $1\frac{3}{4}$ lb.; one Eel about $\frac{1}{2}$ lb. There were no marks of injury in the living, dead, or dying Smolts. Sir Thomas thought the marked Smolts had been subjected to two or three revolutions, while the Trout had been in the tail-race before the net was fixed. He does not express any opinion as to the effects of the turbine on the fishes.

In the third experiment (at Mr. F. Wookey's mill) a Hercules turbine of twenty-one inches, three hundred and twenty-five revolutions, and a fall of twenty-eight feet was used. The net

was fixed in the tail-race a considerable distance below the discharge from the turbine. Thirty-one Smolts were placed in the turbine-pit. In twenty minutes the net and box were examined. In the box were ten Smolts—one alive, one decapitated, one with neck injured, and seven dead without marks. Another was taken out of the tail-race with its head crushed and partly severed. The large number (proportionately) which passed through the turbine in twenty minutes is noteworthy. Vigorous fishes often resist the suction of the turbine for a longer period.

The fourth experiment was at Coagh Mills (Messrs. Duff's), with the large Sabelly turbine, seventy-two inches in diameter, and with thirty-eight revolutions per minute. Instead of the ordinary net, Sir Thomas Brady used a wire-net on poles leading into a box in the centre, fixed and held in the tail-race as close to the turbine as possible. Six Smolts were placed in the pit whilst the turbine was working. No Smolts were captured. Water, however, broke over the netting, and may have carried fishes away. Three Smolts were seen shortly afterwards swimming over the case of the turbine, and about it, when the turbine stopped.

In the fifth experiment a McAdam turbine in the same mill (Messrs. Duff's), of sixty inches in diameter and sixty-five revolutions per minute, was used. The ordinary net and box with perforated zinc were placed "at a convenient distance from the turbine." Eight Smolts were placed in the turbine-pit. In fifteen minutes the net was raised. Two Smolts were found in the box alive, one Trout dead and with its head injured, "but it was quite evident that it had not been recently killed." In this as in the others no examination appears to have been made of the turbine-pit.

Sir Thomas Brady concludes:—"I got so very few fry alive that I cannot help thinking that they must have been killed at once as they went through, and dropped into the deep water below as they were struck. I used such precautions that I do not see how the fry could have escaped my net otherwise. In two places I admit they could." He said, further, that the danger would be increased where hundreds and thousands were "whirled round and shot out again." He had seven or eight men from Lucan, including Mr. McDermott, a mechanical

engineer, assisting him; yet it was most difficult to make a satisfactory test, and he stated that his was not so thorough as he could have wished. Moreover, he had difficulty in keeping the fishes alive. Some were procured from Sion Mills, on the Mourne, and he lost many. Those he used, however, were in good condition.

In considering these experiments it must be borne in mind that the turbine-pit does not appear to have been searched after the machinery was stopped, and no details are given of the stream flowing into the pit in connection with the possibility of escape thereby.

The following series of experiments was carried out on the 15th August, 1900, at the Stormontfield Bleaching and Calendering Works of R. W. Mackenzie, Esq., on the Tay, and whose kind permission deserves due acknowledgment. The first turbine experimented with was a 24-in. Hercules turbine. The turbine-pit is supplied by a "leat," which is guarded by iron bars two inches apart, and the water falls about 8 ft. into the concrete pit, which is about 8 ft. square and 12 or 13 ft. deep. The revolutions of the turbine are 250 per minute. After rushing through the blades of the fan the water escapes by the tail-race. The latter was carefully guarded by a fine-meshed pollan-net, and further down the stream the fine median gauze of a sand eel-net was stretched across. The stream was easily inspected from the purity of the water, and it was confined to this turbine.

(I.) At 10.40 a.m. a tank containing fourteen Salmon-Trout and Trout, ranging from $\frac{1}{4}$ lb. to about 3 lb. in weight, was emptied into the turbine-pit. Two of the Salmon-Trout had been injured by the net in capturing them, and floated with their bellies uppermost in a moribund condition in the small tank. In fifteen minutes one of the latter, about 15 in. long and weighing 1 lb. 2 oz., was taken (dead) from the "leat." It had dropped to the bottom of the turbine-pit, and had not sufficient vitality to keep out of the suction-current. Its surface presented only slight abrasions of scales, caused in all probability by the net used in capture, or in handling to replace it in the tank from which it had leapt during the night. So far as could be detected there was no injury to bony structure, and no ecchymosis was visible. The viscera were healthy, with the exception

of the posterior third of the liver touching the left abdominal wall. Such may have been due either to pressure in handling or to the turbine. The brain, heart, and ovaries were normal. On dissecting the muscles from the vertebral column an ecchymosed region was found along the tips of the neural spines in front of the first dorsal fin, and another smaller area over the neural spines in front of the tail. It is not certain, however, whether these injuries were due to the turbine or the ring of the net in capture.

In two or three minutes the second and smaller Trout (of the two already alluded to) came down the tail-race, apparently lifeless, though when taken out the mandible moved once or twice. Its surface showed similar slight abrasions, but no lesion to osseous structures could be discovered. The posterior third of the liver was ecchymosed, but no rupture was visible. All the other organs were normal, the ova in the ovaries being somewhat less than in the previous example. Further minute examination disclosed a slight ecchymosis in the tissues over the neural spines in front of the tail.

An efficient watch and a diligent search of the tail-race and nets proved that none of the other Trout had passed through and entered the tail-race. A pole was also used in the turbine-pit to drive them towards the suction area, but without effect. They resisted the currents and avoided the pole. The men, indeed, asserted that they occasionally find Trout in the turbine-pit, and they considered that some of these remained therein for a long time.

(II.) At 11.42 a.m. fifty vigorous yearling Lochleven Trout were put in the same turbine-pit where the rest of the larger Trout still remained, and the turbine went steadily on, the flow of water being equable. In thirteen minutes two of these Trout appeared in the tail-race, and at intervals one or two darted down stream. All were in full vigour and capable of taking care of themselves. So few appeared that the pole was several times put in operation in the turbine-pit. In thirty-five minutes about eight had passed down stream, and two were under the stone arch. Subsequently one would dart downward so quickly that even in the pure water it was difficult to see it. After a further period of half an hour the water was turned off the

turbine and the tank nearly emptied, only seven inches of water remaining on the bottom, and this was full of fragments of sticks, grass, leaves, and plants of various kinds. Dr. H. M. Kyle, of the Gatty Marine Laboratory, and Mr. Lumsden, Superintendent of the Tay Fisheries, carefully searched the turbine-pit with hand-nets, and secured seven small Lochleven Trout (of the fifty), and eight of the larger Trout captured by Mr. Lumsden in the Tay. The largest fish—a Salmon-Trout of 3 lb.—was not in the tank, so that it must either have been in the turbine, which the men did not think probable, or it had escaped observation. If it had been killed its dead body, either entire or otherwise, could not have escaped observation in the clear water of the tail-race. The two gentlemen above mentioned also waded up the tail-race, but caught no Trout, though a few swiftly darted down stream.

The two nets were now examined. No fishes occurred in the pollan-net, the small and nimble Lochleven Trout having passed through its meshes. Seven Lochleven Trout (of the fifty) were captured in the sand eel-net. The rest had evidently escaped at the edges or underneath it, for many passed down stream, and it was difficult to retain such active forms. No trace of an injured or sickly example was seen.

During this experiment some of the small Trout were noticed near the fry-guard put over the 2 in. guard of iron bars of the head-race, showing that they can get out of the turbine-pit when they please. Indeed, at a subsequent experiment one came outside the iron bars (the fry-guard having been removed), but darted inward again as soon as it noticed a figure at the edge of the stream. The men stated that the Trout often get out of the pit in this way when it is full of water, and the fall from the stream is slight. On the other hand, Kelts of 24 in., as they descend, may, if the bars are too wide, get into the turbine-pit, and the sickly ones are occasionally killed.

(III.) As the works also possessed a powerful breast-wheel, 8 ft. in breadth at the edge, in two sections, and with "buckets" 13 in. across, it was thought desirable likewise to investigate its action in connection with the Smolts. Moreover, connected with it was a regulator (said to be a somewhat rare appendage to a water-wheel), which manipulated a sluice, opening or closing

it according to the flow of water. Unfortunately only a few Trout were now available, and all had been used in the previous experiments, and some of those removed from the *débris* at the bottom of the turbine-pit had been injured. At 3.20 p.m. four Sea-Trout, over 2 lb. in weight, and seven of the smaller Lochleven Trout were placed in the rushing current of the breast-wheel, close to the "buckets." One or two were sickly, and one appeared to be dead. In a few minutes the dead Trout came into the swift tail-race. No trace of the others appeared. If the others had been killed, their bodies would in all probability have been discovered in the tail-race. So far as could be observed all the living had escaped serious injury. It was stated that occasionally Trout are crushed between the wall and the edge of the wheel, but in this case they were in the middle of the current.

The next experiments were carried out at the Maine Works, Cullybackey, Ireland, September 25th, 1900, in the presence of Mr. Hely Hutchinson, the Secretary of the Commission, Mr. McDermott, Mr. King, and various fishery officers. The head-race here is a capacious one, and the water passes through sluices on the right bank, then through a grating of vertical iron bars from $\frac{3}{4}$ in. to $1\frac{1}{4}$ in. apart, according to curvature, and with their convex edges to the stream, and then falls into a turbine-pit, 19 ft. deep by 12 ft. broad, close to the wall of the mill, and, indeed, proceeding under the building for some distance before reaching the Hercules turbine, which makes one hundred and thirty-seven revolutions per minute. As the Trout had previously resisted the suction of the turbines, and apparently only were drawn in voluntarily or when dead or enfeebled, a tube of wood 22 ft. long by 9 in. square had been prepared, with a forward bend at the bottom, so as to convey the fishes as near the turbine as possible, and thus compel them to pass through it.

(IV.) About forty mixed Trout, from 4 in. to 6 in. in length, and consisting of Lochleven, Rainbow, Brook, and Common Trout, were placed in the wooden tube at 1.30 p.m., and shortly after a pailful of earth was sent after them. Further, a chimney-sweeper's brush (unguarded) was passed down the tube, which had its bent extremity in close proximity to the turbine, so as to send them out. In five minutes a Trout struck the net placed

in the tail-race. Mr. Armitstead reported that when the brush was withdrawn from the tube several Trout were brought up, and an inspection of the tube showed several Trout swimming at the surface of the water. Subsequently it was stated that the head had separated from the brush, and was at the bottom of the wooden tube, and that the man in charge of the brush had moved it up and down the tube with vigour before the head separated. The net in the tail-race was of fine twine with $\frac{3}{4}$ in. mesh, and the centre extended into a pocket. It was fixed at the platform near the edge of the stone arch, and from its situation and the curve of the tail-race the pocket streamed toward the right bank. The bottom or sole-rope was furnished with pieces of lead, and in addition heavy iron bars caused it to cling to the bottom. The brownish hue of the water (from peat) made it difficult to see the fishes, and was in contrast to the pure water of Stormontfield.

On stopping the turbine after fully half an hour's work and examining the net in the tail-race, only a single fish, having an eye destroyed, was found in it, and in all probability this injury was due to a stiff fibre of the brush penetrating it in the wooden box. When the long wooden tube in the pit of the turbine was drawn up, five living fishes were found in it, and one crushed, the latter having been struck by the heavy brass end of the head of the brush after it became free. When the pit of the turbine was emptied twenty-two active fishes were taken out, and one dying, the latter having been struck by the landing-net. All these had resisted the suction of the turbine, and might have remained in it for weeks until an opportunity for escape presented itself, and it was noteworthy that they were more readily caught by the hand-net at first, but as soon as they understood the purpose of the net it became difficult to secure them. Captain Dannevig had the same experience with the adult Cod in the spawning-tanks at Floedevig, in Norway. The great fall of the water into the turbine-pit was a feature in this mill. Further, it was clear that a naked chimney-sweeper's brush is a dangerous piece of apparatus to use amongst young Salmonoids.

(V.) At 2.58 (Irish time) one hundred and seventy-five Trout of the kinds and sizes before-mentioned were placed in the same turbine-pit when three-fourths full. The pit was completely filled

at 3.1 p.m. In a few minutes a number of the Trout appeared in the tail-race, and they continued to drop down at intervals. Shortly after commencing, however, the right pole of the net in the tail-race gave way, but in a few minutes (five) it was put in position and fixed. In half an hour the net in the tail-race was lifted, and a dead fish dropped from it, whilst a few escaped from the pocket. Only one of those put in was secured, though two Parr, considerably larger in size, were captured, but these may have come only from the tail-race. Many of the young Trout of the series placed in the pit were observed at the right wall of the tail-race above the net, but though Mr. Armitstead carefully fished, after stopping the turbine, the tail-race above the bridge to which the net had been fixed, he caught none. They were too nimble in the dark water.

The turbine-pit was in this instance emptied by a great rush outward, and unfortunately every Trout was swept out with the current. No dead or mangled fish was observed in any part of the apparatus, with the exception of that already mentioned.

(VI.) The sixth experiment took place at Mr. Webb's Mills, Randalstown, Co. Antrim, on September 26th, 1900, with one of a pair of turbines situated in a large chamber (pit), into which the water had a fall of 12 ft., entering from a wide sluice-gate through iron bars. By the inexperience of the men to whom Mr. Armitstead had committed the charge of the Trout (for he had missed the night-train), the box—containing two hundred and fifty Trout 4–6 in. in length—was carried under the gates, and all escaped except twenty-two. At 12.48 p.m. the twenty-two Trout were placed in a box having a bottom of perforated zinc, with various holes in the sides and lid, and with long stays or struts reaching to the platform, where they were held. The lid was hinged, and could be lifted by a cord, so that the Trout on escape were within the powerful currents entering the apertures of the turbine. The fishes were thus brought close to the apertures of a 33-in. Achilles turbine, having one hundred and twenty-five revolutions in a minute. During the first few minutes of the experiment, indeed, the revolutions were three hundred per minute. As the machinery was used solely for electric light, a steady rate was necessary. The tail-race led into a broad open pit, from which the water

coursed through two arches of 6 ft. and 7 ft. respectively, and with a median pillar between them. These were guarded by wire-netting of $\frac{1}{4}$ -in. mesh, attached to a framework of wood about 15 ft. long by 4 ft. deep. The floor of the race above the netting was temporarily paved with broad boards of white wood held down by large iron weights, for the purpose of showing the Trout as they passed. The deep brown hue of the water, however, rendered this device of little avail. The fine wire-netting, nevertheless, demonstrated one thing, *viz.* that a great current of water flowed easily through it without interfering with the working of the turbines. Leaves, grass, and *débris* would necessitate cleaning, but they did not stop the current. Everything worked smoothly for twenty minutes, but as not a trace of a Trout was observed, the machinery was stopped. An examination of the tail-race—now in quietude—showed numerous small Trout (of the series put in the turbine-pit) in the shallow part, but none went near the white boards. Amongst them were several larger (7–8 in.), which must either have been in the tail-race previously or passed through the turbine—probably the former. On the fine wire-netting was a single dead Trout, which had been carried against it when in a sickly condition by the current. The same occasionally happened at Stormontfield breeding-ponds in the case of even active but very young fishes. In the pit of the turbine one hundred and fourteen young Trout were captured, besides three which were killed by the hand-nets in the process. As usual, they resisted the powerful suction caused by the turbine, and preferred to remain in the pit.

(VII.) At 2.25 p.m. thirty young Trout were placed in the perforated box, and lowered to the edge of the other Achilles turbine, one of the most modern type, 48 in. in diameter, and 170 horse-power, with eighty to ninety revolutions per minute. In working this and the previous turbine it was found that water escaped in considerable quantity from the upper part of the pit of the turbine, but it was stated that no Trout could pass through. This flow by-and-by became less. The machinery started at 2.47, and in a few minutes the rush of water in the tail-race carried away the left guard so as to leave a gap of 20 in., and, as this could not readily be repaired, the experiment was necessarily imperfect. When the box was pulled out of the

turbine-pit a single living Trout was in it, whilst in the turbine-pit a considerable number of Trout (twenty to thirty) remained, partly from the previous experiment and partly pertaining to this. No dead fish was seen.

(VIII.) In this instance a 48-in. Leffell turbine, having ninety revolutions per minute, was used. The pit of the turbine was 8 ft. square by 9 ft. deep. Sixty-two Perch, about $4\frac{1}{2}$ in. to 5 in. long, were placed in the box formerly described, and released close to the edge of the moving turbine at 3.45 p.m. In a minute and a half one or two passed into the net at the tail-race, and in four minutes another struck the ladder at the net. Many leaves, weeds, and other *débris* were carried into the tail-race where the net was placed, about 25 ft. from the turbine. In eleven to twelve minutes the revolutions of the turbine were slowed to fewer than eighty, and again increased in velocity. At 4.12 p.m. they were seventy per minute. By clearing the iron guards, between each of which there was a space of $1\frac{1}{4}$ in., the flow of water was increased, and the number of revolutions was eighty-six. The machinery was stopped in forty minutes. In the net stretched across the tail-race were thirty-eight Perch in fair condition, which were placed in water for further experiments. All these had passed unscathed through the turbine. No dead or wounded Perch could be found, for the turbine-pit was thoroughly searched by Mr. Armitstead, and no trace of a fish was found in it. These fishes (Perch) are, compared with the agile Trout and Smolts, stiff and rather thick fishes; yet, so far as could be ascertained, the mortality was trifling. A considerable number probably lay in the tail-race above the net, or had escaped by chinks at the side.

(IX.) Into the same turbine-pit, at 5.15 p.m., one hundred and thirteen mixed Trout were placed by aid of the box close to the apertures of the turbine in action. In five minutes the revolutions were seventy per minute, in four minutes after eighty revolutions; at 5.25, seventy revolutions, and in three minutes thereafter eighty-six revolutions. These irregularities were due partly to changing gear, and partly to the clearing of the iron guards of the head-race. The machinery was stopped in twenty-nine minutes. Out of the net came three Perch which had passed through the turbine in the previous experiment, and

had been lurking in the tail-race, a Gudgeon, and one wild Parr from the tail-race (which had not passed through the turbine). No trace of the mixed series of Trout was found either in the net or in the turbine-pit, which was carefully searched. Some may have lurked in the tail-race, but it is unlikely that all could have been thus disposed of. It is possible that these agile and active fishes escaped by the head-race, but this could not be proved.

(X.) The conditions connected with this and other experiments at Bushmills were altogether different from the previous experiments. The mill is used for generating the power for the Giant's Causeway Electric Tramway, and it is situated at the Bush Falls, about a mile above Bushmills. At this point there is a steep cataract on the river, with a total average fall of 25 ft., which is the fall used for working the engines. The head-race, having an average depth of 5 ft., is led from a point about sixty yards above the highest reach of the falls to the turbine-chamber, whilst about forty yards above the latter is a by-wash for excess-water, immediately below which (and in the head-race) is a 2-in. bar fish-guard, placed at an angle to the stream. Below this is the main sluice of the race, which is so constructed that the remainder of the channel can be completely emptied. A short distance above the turbine-chamber is a small valve or sluice in the bottom of the race, which removes any water collecting there. The up-stream face of the turbine-chamber is protected by a fry-guard of a fine mesh.

Before detailing the experiments it is well to explain the peculiarities connected with the turbines at Bushmills. An Alcott and a Hercules turbine are placed side by side at the bottom of a precipitous cliff, a little below the falls of the river. As mentioned, the head-race is taken from the falls, and the water is conducted by a deep channel to a turbine-chamber, 18 ft. by 8 ft., and 6 ft. deep, and this, as stated, is guarded by strong wire cloth originally of $\frac{1}{4}$ -in. mesh, but certain wires have been removed, leaving, as a rule, two together transversely. In some places a space of a square inch occurs, so that a Smolt could escape into the head-race, and *vice versa*. The water is conveyed to the turbines by two nearly perpendicular shoots constructed of old boilers, each with a butterfly valve at the

top. The descent is 26 ft., and, further, the water is confined round the turbine by a case of cast-iron, so that it can only escape by the tail-race. The arrangements, therefore, differ considerably from those hitherto met with, since the Trout have to be transmitted along the iron shoots, and have no option in the cavity of the turbine but to pass through. Moreover, in the Alcott turbine this space is limited, its widest part at the top being 9 in., and it narrows to $2\frac{1}{2}$ in. at the bottom, so that there a Trout could not swim with its head at right angles to the rim. Within the foregoing iron case are the fixed gates, which are set obliquely. These, again, enclose the movable gates, which can be adjusted so that more or less water enters by a cog-wheel working within a limited space marked by stops on each side. The centre is occupied by the revolving vanes with the spindle in the middle, the vanes having a diameter of 27 in. There is little or no space between the revolving centre and the case outside, so that the fish, unless it enters obliquely with the water, could not escape injury. When fully open the oblique aperture seemed to be about 2 in., as the band could pass freely.

(XI.) The Alcott turbine was first experimented with, at two hundred and fifty revolutions per minute. At 1.6 p.m., September 28th, 1900, fifty mixed Trout (Lochleven, Rainbow, and Brook) were placed in a square wooden shoot or tube which passed the butterfly valve. The fishes were gently pushed out of the tube by a sweeper's brush covered with cloth, but this was not satisfactorily done. When fresh cloth was procured the fishes, some of which swam at the surface of the water in the wooden shoot, were more dextrously pushed out of the tube. The net had been previously fixed to a framework erected close to the escape-pipe from the turbine. In this case peculiar eddies carried the upper part of the net inward, and, indeed, the tail-race at this part was a surging mass of water, as if boiling. This was partly due to the swollen condition of the tail-race and the river, which was about 4 ft. above its normal level from a flood. The turbine was stopped at 1.45 p.m.—that is, after more than half an hour's work—and the head-race was emptied. Out of the net came two uninjured Trout and three dead. One of the dead dropped from the net into the water and was lost. The other was caught in a pail. One of the dead fishes

had lost an eye, probably from injury by unskilful use of the brush in pushing it out of the wooden shoot, another had its gills exposed by removal of the head, while the third had its body crushed behind the pectorals, the skin being drawn over the ruptured muscles. A fragment of a candle about 2 in. in length was also in the net. It had been put in the shoot by Mr. McDermott. No trace of the rest of the Trout was seen, but the dark, surging water prevented minute observation, though the bodies of the dead would readily be carried against the net. There was ample opportunity for the concealment of the living in the tail-race.

(XII.) The next experiment was with the Hercules turbine of about seventy-five horse-power, and having two hundred and fifty revolutions per minute. In this instance the wooden shoot or "trunk" was lowered 6-8 in. further into the iron shoot, so as to bring the fishes more directly into the current. At 2.57 p.m. fifty small Trout and four larger (9 in.) were pushed through the wooden shoot, along with a candle to which lead was attached, the total length being $6\frac{1}{2}$ in. The current issuing from the Hercules turbine was less involved than in the previous case, so that the bag of the net was carried out more satisfactorily. At 3.10 p.m. a portion (about 2 in.) of the candle appeared in the water around the turbine, and ten minutes later the rest of the candle floated out. It seems that Mr. McDermott thought that by attaching a string and a leaden ring the specific gravity of the candle would be adjusted to that of a fish, but this probably caused its fracture. The turbine was stopped at 3.25 p.m. In the net at the tail-race were two injured fishes which lay on their sides. The larger was bruised behind the gill-cover, and the smaller had a pale patch about the middle of the body below the first dorsal fin. Both were paralysed. The larger fish soon died, and the smaller remained paralysed.

In the turbine-pit on the top of the cliff a single large Trout was found. The rest of that size had passed through either during the action of the turbines or subsequently. Of the smaller series, one was captured in the pit, but others were observed gliding over the rim as the water rushed down the shoot.

(XIII.) The same turbine was employed in this experiment.

As the larger Trout (six in number) had again been lost in the stream by careless fastening of their box, only small Trout of the same size as previously were available. Fifty of these small Trout were pushed through the wooden tube, as before, at 4.36 p.m. The turbine was kept in action for half an hour. No fish occurred in the net, showing that the Trout had either lurked in the tail-race or had escaped by chinks. Fragments of lacerated forms would in all probability have been carried against the net by the currents. In the turbine-pit a single example was secured, but others were observed escaping by the iron shoots. These had refused to be carried down the shoots during the action of the turbine. A single large Trout appeared behind the wire guards as the man entered. It had either lurked in the pit after the previous experiment, or found an aperture large enough for entrance, though the latter is unlikely. It could scarcely have passed up the iron shoot.

(XIV.) In this case the Alcott turbine was employed. At 5.46 p.m. fifty small and two larger Trout were pushed as before down the long wooden tube into the iron shoot. The eddies in the tail-race, as previously, pushed the upper part of the net inward, and thus it was less fitted for service. The turbine was in action for half an hour, and was then stopped. On raising the net a portion (4 in.) of the posterior end of a large Trout was found. Such evidently had been lacerated in the turbine. No evidence of the smaller Trout was obtained.

(XV.) Both turbines (Alcott and Hercules) were put in action at 6.30 p.m., and, the wooden tube having been removed, fifty-two small Trout, two Perch, and one larger Trout were placed in the general cavity of the pit, which had both butterfly valves open. The fishes thus had perfect freedom in the large cavity formerly indicated. The current rushing out at the tail-race floated the bag of the net more satisfactorily than when either turbine was worked singly. The turbines were stopped in twenty-five minutes, as darkness was coming on. Only a single Perch, devoid of its head and with the body split, was in the net. Two small Trout were caught in the turbine-pit, whilst three or four escaped over the edges of the iron shoots as the water drained off. As before, these and probably others declined to be drawn into the vortex over the shoots. In the ordinary working

condition of these turbines comparatively few Smolts could find entrance into the turbine-pit if the wire-netting is left intact. The removal of some of the strands, however, may admit some into the chamber. One difficulty in experimenting with these turbines was the backwater and flooded condition of the tail-race.

The succeeding experiments were made at the Anna Liffey Mills (corn and flour) of Messrs. G. Shackleton and Son, October 2nd, 1900. The supply of water comes from the Liffey by an oblique and rather long dam, from the lower angle of which a deep (6-8 ft.) head-race, about 8 ft. broad, runs to the first building (wood), where the race is guarded by strong iron bars, which seem to have been originally about 3 in. apart. It flows through, turns to the left, and reaches the turbine-pit after a fall of $6\frac{1}{2}$ ft. The turbine is an Alcott, 60 in. in diameter, and of forty horse-power, with fifty to fifty-two revolutions per minute. Here, as elsewhere, considerable difficulty was experienced in fitting on the net at the tail-race, close to the exit of the water from the turbine, this position being chosen so as to minimise the chance of the Trout escaping observation in the tail-race, which had to be reached by crawling under beams after descending the ladder at the turbine. Notwithstanding the energetic efforts of Mr. Shackleton, Junior, a gap of about a foot was left at each side of the net.

(XVI.) At 1.57 p.m., on October 2nd, 1900, fifty small Trout from 4 in. to 5 in., and consisting of a mixed series of Lochleven, Rainbow, Brook, and two large Rainbow Trout of 9 in., were placed in the long wooden tube, the lower end of which was close to the "gates" of the turbine, and all were pushed out by the brush with its cover of cloth. In half an hour the net was examined and five living Trout secured, besides two Parr of 6-7 in., which did not pertain to the official series. Doubtless others escaped through the meshes of the net, or by the gaps at the side. No dead fish was observed.

Mr. Shackleton stated that he had seen Smolts coming down the river tail first, then enter the head-race, become suspicious, turn back, and finally go over the weir. Salmon swim up the water over the weir, not leap up, in a full river.

During the forenoon the mill above this (*viz.* Mr. Hill's) was not working, so that a full supply came downward, but in the

afternoon the case was altered, the upper mill being in active operation. The river consequently was so much lowered that no water flowed over the dam, which was composed of stones with a coping of concrete, the latter also forming the sides of the head-race. The diminution of the river caused the Trout to descend to the deeper pools below the dam.

(XVII.) At 3.22 p.m. a hundred mixed Trout, as before, and two larger (9 in.) Trout were pushed down the wooden shoot (12 ft. long), which had on one side of the extremity an opening next the turbine. The fishes were thus compelled to escape into the water around the turbine. At 3.25 p.m. a Common Trout, 13 in. long, and well-nourished, was also sent down, and the aperture plugged by the brush with its cotton covering. At 3.40 p.m. an Eel, 13 in. long, was marked by having the tip of the tail removed, and also put, by aid of the shoot, in the vortex of the turbine, the speed of which was fifty revolutions per minute. In drawing out the brush from the wooden tube for the purpose of inserting the Eel, a small Trout came up uninjured on the top of the cloth covering the fibres. This shows how tenaciously they cling to any place of safety under trying circumstances. After fully half an hour's work the net was found to contain ten small Trout, the largest, a Rainbow Trout, being 6 in. long, and the Eel—all uninjured. The rest either remained in the turbine-pit or escaped by the gaps at the sides of the net. No sign of an injured Trout appeared.

When the water in the river was lowered in the afternoon by the resumption of work by Mr. Hill's mills above (parts having been under repair), the stones along the foot of the weir at Anna Liffey Mills were left dry, and Mr. Armitstead was able to capture the Trout and the Eel without difficulty. The fishes made off rapidly, as the river became low, for the deeper pools beneath. On the conclusion of the experiments a Pike, about 5 lb. in weight, was noticed swimming upwards in a pool. One of the men, taking an iron pipe, waded into the stream, drove the fish to shallow water, and killed it by blows on the head. It was a male with well developed milt. No food was found in the stomach, and little in the intestines. The removal of water is important in connection with the welfare of the Salmonoids, which are thus placed at the mercy of persons disposed to

interfere with them. A large Salmon, though much more active than the Pike, the right eye of which suffered from corneal opacity, would have fallen a prey to poachers.

Experiments at Messrs. Hill's Woollen Mills on the Liffey, October 3rd, 1900. The water is brought from the Liffey, across which a long oblique dam is placed below the bridge, the head-race or "lead" conveying about a third of the water in the river. A fish-pass exists at the end of the long dam nearest the bridge, but the plan is somewhat old, the steps being short, so that with one or two exceptions the fishes could not rest in their progress upward. At the top of the weir a board about 8 in. deep had been put into a groove in the concrete, so as to dam up the water for the purposes of the mill. This appears to require attention. The fall from the weir seems to be 10 ft. or 12 ft.

The turbine is an Alcott, 60 in. in diameter, and of seventy horse-power, with seventy-four to seventy-six revolutions per minute. It is placed in a pit 12 ft. deep and 12 ft. square, and is with difficulty reached for observation. After clearing the hole in the floor for fixing the net in the tail-race, a steam-vat formed a step to the greasy beams. The wooden shoot used at Anna Liffey Mills was courteously brought by Mr. Shackleton, who yesterday and to-day exerted himself in many ways to aid the Commission—for example, by bringing a skiff and boat, both of which were of material service in the underground and expanded tail-race. Without such aid the work would have been done much less expeditiously, if it could have been accomplished at all. The roof over the turbine-pit was so low that only one length of the sweeper's brush could be manipulated at a given time. It was intended to fix the net close to the edge of the turbine-pit, but this was found, after persevering efforts by Mr. Skackleton and others, to be unsuitable, since the strong current and absence of points for fixation prevented the net closing the space satisfactorily. It was therefore fixed across the stone arch about five feet from the edge of the pit. The great strength of the current probably sent the majority of the fishes which passed the turbine into it, though a gap of a foot, due to irregularities of the masonry, existed at each side. Every mill presents certain difficulties of its own, and without the use of a boat the

net could not have been adjusted; moreover, Mr. Shackleton was thus enabled to enter the tail-race from the rear, a distance of about eighty yards. A lining of fine gauze was placed in the bag or pocket of the net.

(XVIII.) At 2.53 p.m. fifty small Trout, 4-5½ in. long, two Parr, and two larger Trout (9 in.), were placed by means of the wooden shoot close to the turbine, and thrust out by means of the brush covered with cloth, which was left so as to block the return of the fishes. At 2.40 p.m. the net was reached from the rear. The strength of the current had entangled the bag of the net, and carried the end under the leaden weights in front, and the force used in extricating the net apparently had caused the death of a large Trout, which had no external signs of injury. A living Trout (small) was also in the net, but the condition of the net was such that it was difficult for any Trout to enter, since it formed a loop on itself. The end of the net had not been fixed by the cord. In all these experiments also it has to be borne in mind that, while a dead fish might be held by the meshes, they permitted the egress of small active Trout.

(XIX.) At 3.25 p.m. one hundred Carp of an average length of 5 in. were pushed down the wooden shoot close to the openings of the turbine. The conditions and the number of revolutions were the same as in the previous experiment. At 4.5 p.m. the net was taken up with the following fishes, all of which were uninjured: fifty-six Carp, three small Trout, which had passed the turbine either now or during the former experiment, *viz.* one Lochleven, one Rainbow, and one Brook Trout. Two of the living Carp were left in the net.

(XX.) The next and last experiment took place at 4.38 p.m., when the following fishes were pushed through the wooden shoot close to the apertures of the turbine: Fifteen small Trout (mixed), fifteen small Trout (mixed) used formerly in the Anna Liffey Mills, five Rainbow Trout 9 in. long, one Parr 6 in. in length which already had been twice through turbines. The turbine made about sixty revolutions per minute. At the end of half an hour there were in the net: Two Carp, formerly left in it; one Parr, 6 in. long, which thus for the third time passed through turbines; nine small Trout, consisting of Lochleven, Rainbow, and *S. fontinalis*. All were in perfect condition. On

removing the wooden shoot from the turbine-pit, after withdrawing the plug formed by the sweeper's brush covered with cloth, there were found in it thirty-six small Trout and one larger Trout (9 in.), all in good condition. They had taken refuge in the cavity from the vortex near the turbine after removal of the foregoing plug. The interior of the tube would in all probability be the only quiescent region in the pit.

REMARKS ON THE FOREGOING EXPERIMENTS IN AUGUST,
SEPTEMBER, AND OCTOBER, 1900.

In all the experiments, which were twenty in number, one feature was marked, *viz.* the comparative ease with which healthy Trout in the turbine-pits kept free from the vortex caused by the action of the turbine. They appeared to go through the turbine only when they pleased, or by accident. Moreover, when circumstances were favourable, they swam out of the turbine-pit to the head-race, and thus, as at Stormontfield after the fry-guard was removed, could have passed up-stream to the nearest by-wash, if such existed. Large Trout as well as small seemed to hold their own in these pits, which varied in size from eight feet square to more than double the dimensions. This feature, which was noticed in the first experiment as well as in every subsequent one, might readily account for the absence of fry in the nets in the tail-race, and will explain some points in Sir Thomas Brady's experiments. The disappearance of the large Salmon-Trout in the first experiment at Stormontfield is to be explained either in this way or by supposing that it was caught in the turbine and held. As it weighed about 3 lb., some indications of its entanglement in the turbine would have been forthcoming during the four or five hours in which the tail-race was closely under supervision. It certainly was not in the turbine-pit nor in the tail-race. That Trout, and consequently Smolts, surpass certain other fishes, such as Carp and Perch, in the vigour and dexterity of their movements was plain—from the comparative rapidity with which both of the species mentioned (Carp and Perch) passed through the turbines and appeared in the net. The larger and more wary Sea-Trout and Trout, from $\frac{1}{2}$ lb. to $2\frac{1}{2}$ lb. in weight, declined to enter the turbine, and

either kept the turbine-pit, or probably passed by the head-race upward through the 2-in. spaces between the bars when it was in their power to do so. The smaller Trout also refused in many cases to leave the turbine-pit, even though long rods were moved in the water to drive them downward to the turbine. They preferred the gently moving water of the pit to the vortex at the edge of the turbine or the flow from the head-race, yet when they had the shelter afforded by the wooden trunk or tube in the midst of the pit, they chose it, and hence the numbers present when the trunk was drawn out. As the head of the chimney-sweeper's brush was enveloped in cotton cloth so as to make a rammer to fit the tube or trunk, and as it was kept in most cases in position at the bottom till the experiment was finished, it is clear that, as at Messrs. Hill's at Lucan, the Trout had returned to the shelter of the trunk after removal of the rammer a few minutes before being drawn up. The ramming of the Trout out of the trunk directly into the currents rushing into the turbine required care, so as to prevent the Trout gliding upward above the plug of the rammer. It was best done slowly, and with water poured in from above. In the first experiment at Cullybackey the head of the brush was unguarded, and the fibres injured the Trout (removing an eye), whilst the loose brass end crushed others beneath it. The Trout readily rose above the unguarded brush, and appeared at the surface of the water in the trunk, and, even when guarded, unskilful use was followed by the appearance of a few at the surface of the water in the tube.

Less active fishes than Trout pass out of the pit through the turbine more quickly. Thus, for example, more than half the Carp were caught in the net at Lucan in half an hour. Many others probably escaped by the sides of the net, which could not be closely fitted to the walls of the tail-race. These stouter, stiffer fishes would have suffered more severely than the Trout if the turbine had inflicted injuries on them.

In reviewing the different forms of turbine, it would appear that those of the type of the Hercules turbine, placed in a pit of some capacity and with a moderate and free fall, have, as a rule, comparatively little effect on Trout of a size approaching Smolts, and, further, that fishes of a size considerably larger may pass

through unscathed. The passage of moribund Sea-Trout (15 in. long and 1 lb. $\frac{1}{2}$ oz. and 13 in. long, respectively) through a 24-in. Hercules turbine, with two hundred and fifty revolutions per minute (Stormontfield), with comparatively slight lesions, gives a considerable margin to the Smolts, if they should pass the ordeal. On immersion these moribund fishes fell to the bottom of the turbine-pit, and were drawn in at once.

Where the Hercules turbine is in a deeper pit, as at Cullybackey (19 ft.), and Bushmills (26 ft.), accidents are more liable to take place, though it cannot be said that the mortality at Cullybackey was serious (barely 1 per cent. on the total). The unskilful use of the unguarded sweeper's brush in the wooden tube caused greater loss. At Bushmills the closure of the turbine case and the great depth (26 ft.) of the iron shoots were unfavourable, and caused the losses detailed. The fishes in the pit above the shoots could prevent themselves from passing down just as in the other cases, and under ordinary circumstances the wire-guard would probably have shut them out. As the turbines at Bushmills were apparently the most destructive met with, it may be well to examine the results in greater detail, premising the remarks by observing that the net throughout fished unsatisfactorily—from the swollen condition of the river and the tail-race, which was 4 ft. above its usual level. Besides, the small size (Alcott, 27 in., Hercules, 18 in.) and considerable speed (two hundred and fifty revolutions), as well as the almost vertical iron shoots of 26 ft., placed these turbines on a different footing from the others. The small number of Trout captured below the turbines, further, is noteworthy, and probably was due to the unsatisfactory condition of the tail-race for experiment.

In the case of the Alcott turbine, there were three dead to two living Trout (out of fifty) in the first experiment, and only 4 in. of the tail of one of the larger Trout in the second experiment. In the first experiment with the Hercules turbine two injured small Trout only (out of fifty small, and four of 9 in.) were obtained by the net. In the second experiment none were recovered by the net. No fragments of Trout were seen in the surging water near the turbines, though a careful watch was kept throughout the experiment, and a search with a hand-net subsequently. When both turbines were in action the captures

by the net were as scanty, for out of fifty-two small and one large Trout and two Perch, only a single crushed Perch was obtained after twenty-five minutes' work.

The experiments at Bushmills, while demonstrating the dangers to Smolts, did not sufficiently show the fate of those passing through the ordeal alive. As in former experiments, both large and small Trout in the turbine-pit resisted the suction downward.

Turbines of other forms (such as the Alcott and Leffell), standing in ordinary pits with a moderate fall, and with sixty to eighty revolutions, have slight effect on fishes of the size of Smolts. Even less active and supple forms, like Perch, escape serious injury. A Parr as large as a Smolt may be sent through a turbine of this kind three times without apparent diminution of vigour. Such turbines usually have from fifty to one hundred and twenty-five revolutions per minute.

Where the water is pure, as at Stormontfield, a minute dead fish or a fragment is readily perceived. The movements of the living fishes are also conspicuous. In Ireland, on the other hand, the tinted water (from peat-bogs) often considerably obscures observation, even white boards, placed at the bottom of a foot or two of water, giving little help in detecting small fishes which, further, appeared to shun them.

The net employed at Stormontfield had a central bag or pocket, with a smaller mesh than that used in Ireland; yet the Lochleven Trout (of the size of Smolts) went through the larger meshes at the edges ($\frac{1}{2}$ in. and $\frac{5}{8}$ in.), and were only detained by the sand eel-net placed across the stream beneath it, and which was a strong white net, having apertures about one-thirteenth of an inch. The paucity of the captures in some cases in Ireland was clearly due to the small Trout passing through the meshes of the net. While the active and uninjured thus might escape through the net, at the edges, or in some cases beneath it, the net retained dead fishes or fragments.

In performing such experiments the greatest care must be taken in handling the Trout, or in capturing them in the stream or in the turbine-pits with a ring-net, for injuries are thus often inflicted.

BREAST WATER WHEEL.

So far as could be observed, the action of this wheel on Sea-Trout of $\frac{1}{2}$ lb. to 2 lb., and Trout (Lochleven) of the size of Smolts was nil. A dead fish came down at once, but the living remained in the tail-race.

TROUT AND CARP USED IN EXPERIMENTS IN IRELAND:—

9-in. Rainbow Trout	were hatched in April,	1898.
Small ,, (4 $\frac{1}{2}$ in. to 6 in.)	,, April,	1900.
,, <i>fontinalis</i>	,, March,	1900.
,, <i>levenensis</i>	,, February,	1900.
Common Trout	,,	1900.
Carp, about 5 in.	,, June,	1899.

THE DEVELOPMENT OF THE SNIPE.

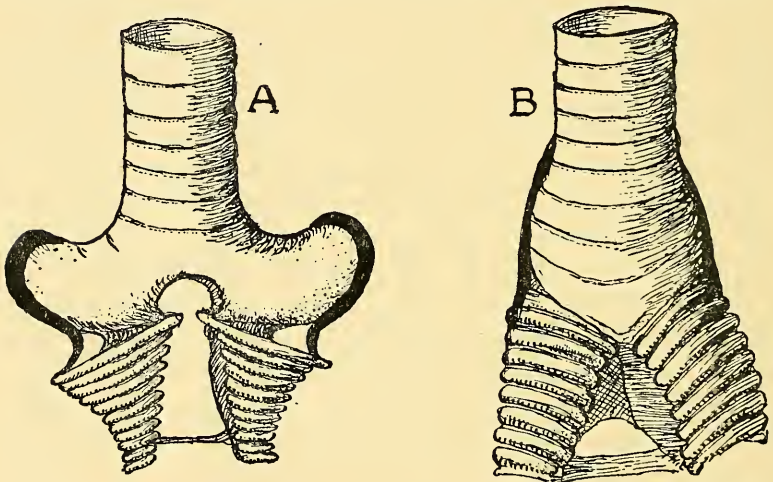
BY F. J. STUBBS.

(Concluded from p. 212.)

It has been said by a high authority that the sternum, and especially its hinder portion, must not be used for taxonomical purposes, and it is a wise warning applied to those who seek to learn the affinities of great groups of birds. But it is a manifest error to ignore it in cases like the present one of these two Snipe. For instance, if we assume that the two species belong to the same genus, basing our opinions of their relationship on the fact that their plumages and outlines have much in common—in a word, that they are intimately related, and have progressed together since leaving the ancestral stem—what factors caused the tremendous changes in the internal and (for all we know to the contrary) useless elements of the hinder end of the sternum? If the birds are really related, and have kept their plumages alike throughout thousands of generations, the internal changes, carried out, too, without modifying the outward form, must provide one of the most remarkable problems in the whole field of zoology. The structural differences are not confined to the bones: I refer particularly to the sternum, which, in the Jack-Snipe, has *four* deep notches in the hinder margin, twice the number of those in the larger bird. There are other points of dissimilarity not so noticeable as those provided by the notches, but I do not propose to treat of them here. Yet I would draw attention to the syringes of the two birds, for they differ to a very high degree. This organ of the Common Snipe has been already figured by Wunderlich ('Nova Acta der Ksl. Leop.-Car. Ak. Nat.' Bd. xlvi. No. 1) and erroneously described by Gadow (Bronn's 'Thier-Reich,' and also Newton's 'Dictionary of Birds'), who gives it *two* pairs of intrinsic syringeal muscles—a particularly unfortunate error. Really, the bird has but a single pair, in this agreeing with all other waders. I believe

the syrinx of the Jack-Snipe has not yet been described or figured.

It is difficult to describe the syringes in the two birds, but as both are accessible the interested reader can readily examine them for himself when the occasion arises. Briefly, the syrinx of the Jack-Snipe is *twice as broad* as that of the Common Snipe, and is totally different in shape. In the former bird the *bronchidesmus* is narrow, in the other it is wide; the Common Snipe possesses a *semi-lunar membrane*, the other bird has none. I hasten to add that I do not believe the syrinx to be the organ of voice; the modern English opinion has no other basis than the mere assertion of one or two old anatomists, and there



Syrinx of—A, Jack Snipe; B, Common Snipe. Muscles figured black.

are several very serious objections to accepting this opinion.* I can recommend the dissection of the "vocal organs" of the Turnstone as a disquieting business to those who hold without question the views of Cuvier or Owen.

No one can deny that these two Snipe resemble one another very closely to all except expert eyes. I should think that few outside the ranks of sportsmen and professed ornithologists could state offhand the differences between the two birds, and I have a vivid recollection of the time when I could not always

* On this point a paper by J. M. W. Kitchen on the "Function of the Inferior Larynx" ('Auk,' ii. 24-31) might be consulted.

be certain, although handling the birds and seeing them in the fields. It is now easy to recollect that if the bird has any cross-barred feathers it is a Common Snipe, while if all are longitudinally streaked it is a Jack.

As a matter of fact, there must be hardly a bone or a single feather that is not different to the corresponding bone or feather in the other species. Even on the wing the two birds are not alike, for the rounded contours of the flying Jack-Snipe (reminiscent both of the Curlew and the Heron) separate it at once from its angular and impetuous neighbour. Strange to say, although the young at all ages differ vastly in the two species, the eggs are much alike, and it is said that some eggs of the Common Snipe are quite indistinguishable from those of the Jack-Snipe.

Although living side by side with the Jack for so many months in the year, the Common Snipe is not so well fitted to its habitat. The long bill, while enabling the owner to reach a greater depth of soil, is apparently useless for surface feeding when the ground is hard with frost, and, besides, the colours of the plumage are not so suitable. I have seen many Common Snipe on the ground, but, although far from easy to see, they are conspicuous compared with the smaller birds. For one thing, the colours are different; they are too warm. There is a lack of the purples, greens, and cool greys that match the light-reflecting mud, and enhance the brightness of the dorsal streaks. In the Common Snipe these streaks are not so distinct, and I have often noticed that the component feathers are not properly arranged, so that the stripes are broken, and unlike sedge or grass. In some individuals the cross-barred flanks are curiously successful in counteracting the effect of the remainder of the plumage, a fact that helps us to understand why the bird should substitute longitudinal markings for the bars. (If a Snipe is shot and falls on a green field or a bare fallow it may often be easily seen, and the observer may perhaps make the error of attaching too much importance to the fact. Yet a little thought will show that the colours are not intended to harmonize with short grass or bare soil, and are effective only in the environment for which they are designed.) It is a matter of common knowledge that the Common Snipe lacks the quiet

instinct of confidence in its colours that is so marked a feature of the Jack. Although, indeed, on occasion suffering an approach of a few feet, it more often rises at from twenty to a hundred yards, and usually advertises its going in no weak voice. It is a mistake to hold the opinion that the bird never rises in silence—it does so frequently.

The careful study of the growth of the individual Common Snipe and the examination of the adult plumage show at once that the bird is in a state of transition, *and that the livery worn by the Jack-Snipe is the end towards which it is progressing.* The young bird in its first plumage (after the down stage) is heavily cross-barred, but as it gets older the bars become less distinct, and arranged to form a *longitudinally* marked mosaic. Under the wings, where they will not show in the crouching bird, the transverse markings are well-defined, but on the exposed parts of the flanks, which must match the grass and sedge if the bird is to remain inconspicuous, one can trace the development from cross-bars to stripes. On the sides of the lower neck each feather is undeniably barred, yet the general effect is that of a streaked plumage (a state of affairs stated erroneously to be unknown in birds; *cf.* Newton's 'Dictionary of Birds,' p. 99). Really, this should be carefully observed in the dead bird, for it is difficult to describe except at considerable length.

The Common Snipe is notoriously instable in size, structure, colour, habits, and even geographical range. In a single batch of birds I have noticed bills varying in length from 2.30 in. to 2.80 in. It is hard to express bodily size in inches, and weight depends largely on the presence or the absence of fat, but the bird certainly varies in bulk. Normally, in England, the bird possesses fourteen tail-feathers, but occasionally odd ones are *detected* with twelve or sixteen. In North America the latter form is the usual one, and in Asia there is one form with tail-feathers varying from twenty to twenty-eight. This last is the "Pintailed Snipe" (*Gallinago stenura*) of ornithologists. I have had the opportunity of making careful dissections of some half dozen birds of this form, and comparing every part with the corresponding features of the Common Snipe. They are absolutely identical. The only differences are in the shape and

number of the feathers of the tail, and in the more heavily cross-banded plumage of the Asiatic bird.

It is worth noting that the American Snipe (*G. delicata*) is also *usually* more heavily banded than our own bird, and in this resembles the Asiatic form. Our own Snipe is found also in Asia, living side by side with the Pintailed Snipe, and in India Hume says that individuals with *sixteen* feathers are "common enough," and states also that "melanoid" varieties of the Pintailed Snipe occur. Presumably these belong to the variety so well known in England as "Sabine's Snipe." I have only examined the feathers, bill, and feet of the American form, and know nothing of its main structure; yet I do not hesitate to say that its anatomy will be in every way that of the Common Snipe.

I cannot think I am straying away from observed facts if I say that the above-mentioned forms of Snipe are nothing but varieties of a single species. For all I can learn to the contrary they differ only in the heaviness or otherwise of the transverse markings on the plumage, and in the number and shape of the feathers in the tail. Of course, I speak now from a biological standpoint, and not according to the views of those ornithologists who hold a difference in colour that is capable of being easily made by the careful use of methylated spirit sufficient grounds for forming a new "species." The characters adopted as "specific" in birds would be rejected with the utmost scorn by the botanist or the entomologist of to-day, and I am not sure that this is not true also for some "varieties" or "subspecies" that depend entirely upon faint differences in colour.

At any rate—to resume this particular discussion of the Snipes—we have first of all the Jack-Snipe, a remarkably stable bird, with no geographical races anywhere in its range; and, on the other hand, the Common Snipe, one of the most variable birds in the world, whether or not we include the so-called species *stenura* and *delicata*. In Great Britain the Common Snipe resembles the Jack-Snipe so closely that none except the expert is able to distinguish between them, and many ornithologists refuse to believe that they do not belong to the same genus.

Outwardly, so far as plumage is concerned, the two birds are alike; therefore, many students believe they are related. But

there are certain highly important features in which they do *not* agree. There is the syrinx; there is the skeleton, with the marked difference in the proportions of the ribs to the sacrum and the breastbone, and in the fact that while the hinder margin of the latter bone has *two* notches in the Common Snipe, it has *four* in the Jack. In the Jack-Snipe the tail has invariably ten feathers; in the Common Snipe the number, normally fourteen, varies from twelve to sixteen, and their shapes are entirely different. The two species show tremendous differences in *voice*, *breeding range*, *temperament*, *flight*, and *phylogenetic development*, and this dissimilarity extends in a lesser degree to the skull, bill, feet, food, and digestive organs.

Turning back to the main points of resemblance, we shall find that these are all special features fitting their owners to a particular habitat. Both live under much the same conditions, and for this life they require a special bill, foot, long inner secondaries, specially situated eye and ear, and a protective livery. It is perfectly clear that all these features would be acquired sooner or later by any bird living under similar conditions. They should not be used for purposes of classification.

We can take, now, for clearness sake, a single one of the details of internal structure in which the two birds differ, and I think the best feature will be the sternum. This bone is, genetically, built up from the ribs, and during development it throws out lateral and posterior processes which partly enclose the well-known "notches" so conspicuous on the hinder margin. Now, the Common Snipe has two of these notches, the Jack has four. They are absolutely structural characters, and are assuredly indications of the lines on which the sternum has developed.

For argument's sake we will assume that the two birds are really related, *and throughout their entire history have never been farther apart, systematically, than they are to-day*; and this is only another way of saying that they belong to the same genus. Yet, while remaining alike to all outward appearance, the internal skeleton has been undergoing tremendous changes. Without giving any external signs the Jack-Snipe has grown a second pair of *intermediate lateral processes*, enclosing an additional pair of notches. Why? I cannot imagine even a fantastic explanation.

I am unable to bring myself to accept this interpretation. It is clear to me that the two birds are *not* related except within the common relationship of the *Limicolæ*. The Jack-Snipe is a bird that has adapted itself (unconsciously, of course) to a life in marshes, just as the Ring-Plover has occupied the shingly seashore, and the Woodcock the forest. The fortunes of time have preserved its sheltering habitat, but destroyed its enemies, and it is therefore a secure bird. On the other hand, we get the Common Snipe, abundant, increasing, and variable to the verge of caprice.

I have shown that, although it has invaded the ancestral haunt of the Jack-Snipe, it is not yet quite fitted for its new place, but each *favourable* variation is used to establish the species, and in time, there is little reason to doubt, it will be as comfortable as its rival. This niche in the scheme of things is a desirable one, for it means security and food throughout the winter. So far this is largely a question of mere observation, but the theoretical aspect is rather interesting.

It will simplify matters if we assume that all marshes are alike, and assume, too, that the Jack-Snipe has reached its *optimum* of fitness for life in a marsh. It is rather difficult to imagine any vertebrate reaching the exact *optimum* of fitness, when not a cell can be changed or altered without a fall in suitability, but, for the sake of the theory, the reader must agree that this bird has done so. He will assume, too, that the Common Snipe is striving also towards the same goal, and then, logically, we must assume that *when it reaches the exact optimum of fitness* the two birds will be, *cell for cell*, alike, but unrelated.*

So much, then, for the theory. Such a state of affairs seems altogether impossible, but really our knowledge is not sufficient to state that it is impossible. Put in other words, it amounts to this: that *the place makes the organism* from whatever material happens to be on the spot. The marsh, in any country, makes the Snipe. The conditions that in America moulded the Humming Birds from a Coraciiform stock, in the Old World moulded the Sunbirds from the Passerine material most handy.

* Compare this with the interesting material gathered by Romanes in support of his theory of "Physiological Selection"—there are no records of hybrids between the Jack and Common Snipe!

One could go on for page after page giving such instances: Meadow-Lark and Kalkoentje; Auk and Penguin; the Common, Golden, and Marsupial Moles (an excellent instance—a century ago they would have gone assuredly into a single genus!); Swallows and Swifts; Gulls and (certain) Petrels; Diving Ducks and Divers, &c.

When two species closely resembling one another live side by side, the explanation of “mimicry” has been used. One might legitimately use it in relation to the present subject, and say with truth that the Common Snipe, although structurally not even nearly related, is mimicking the Jack-Snipe. In such cases naturalists have attempted to find some connection between the two parties to a case of “mimicry,” yet it should be clear that, even though both are striving towards the same goal, and within a short distance of it, they may still not be in contact in any way.

I am afraid I have dragged the subject out too far, but really I have not said half that I would have said. The important question of food and feeding habits must be left for a separate paper, as must also be the subject of voice. I have accumulated many observations on other “pairs” of birds—Grey and Golden Plovers, Common and Dusky Redshanks, Common and Green Sandpipers—and hope to show that the relationships in these cases are merely superficial, and to show also how the patterns of the plumages have been directly changed under the influences of the habitat that each species has been forced, in the stress of competition, to occupy. One result of this study is that I always doubt the relationship between two organisms, either plants or animals, if they appear very closely allied and occupy the same country; yet the difficulties of investigating such sets as our three Leaf-Warblers (*Phylloscopus*), where one must work with, so to speak, a microscope in one hand and a field-glass in the other, are extremely discouraging, in spite of the high interest of the problems they present.

NEW ANNELIDS.

BY THE REV. HILDERIC FRIEND, F.L.S., &c.

THE work of investigating the Annelids found in Great Britain, which I am aided in doing by a Government grant, is resulting in the addition of many new species to our lists. In the present paper I purpose alluding to two new species which have recently been received from Kew. In May a Wardian case arrived from Peru, which was found to contain some small worms. At first I discovered only two immature Perichætids, which I have so far not examined for actual identification. After keeping the soil in which they arrived for some weeks I found two specimens of a new Enchytræid, which I have named *Fridericia peruviana*. A full description of this species has been submitted to the Royal Microscopical Society, and it would therefore be out of place to repeat the details here.

A later examination of the earth has resulted in the discovery of a further addition, which I will now proceed to describe. The new worm is at once seen to possess three gizzards, and this points to the genus *Trigaster*, founded some years ago by Dr. Benham. It is not necessary that I should repeat his description in full. I therefore take the brief summary which Beddard gave in his invaluable 'Monograph of the Order Oligochæta,' published in 1895:—

“ Genus TRIGASTER, Benham.

“ *Definition.* — Setæ strictly paired. Clitellum extensive, xiii–xl. Three gizzards in vii–ix; calciferous glands absent. Nephridia diffuse; a mucous gland present. Penial setæ absent.

“ This genus only contains one species: *Trigaster lankesteri*, Benham (Q. J. M. S. xxvii. 94).

“ *Definition.*—Clitellum xiii–xl; from segment xvii onward there is a ventral area free from glandular modification. Pro-stomium not imbedded in the buccal segment. Setæ strictly

paired. No dorsal pores. Intestine begins in xiii. Spermathecae without any apparent diverticula.

“*Habitat.*—St. Thomas, West Indies.”

In 1900, when ‘Das Tierreich’ was published, the species was split up into a type and two subspecies (*intermedia* and *calwoodi*), and four new species of *Trigaster* were recorded, but with only two gizzards in each case. So far as I am aware, there has been no true *Trigaster* (with three gizzards) added to the list, and if that is so the worm I have received from Kew is new to science.

1. *External characters.*—It would appear that the specimen upon which this description is based emerged from the cocoon in England, and it is therefore immature. It was of a light brown colour when living, and almost transparent when viewed in water under the microscope. Length 15 mm., breadth 1 mm., number of segments 50. The prostomium is small and delicate, and was seen when alive to be drawn in to and everted from the buccal aperture. Setae arranged as in *Lumbricus*, i. e. four pairs on each segment, but not equal in size and length in the dorsal and ventral bundles. When the worm moved, it reminded one rather of a planarian than of an oligochæt, and it had more flexibility than our British earthworms.

2. *Internal characters.*—Owing to the small size of the animal and its delicate structure it was possible to examine it as one might examine a Tubifex or Enchytræid under the microscope. The worm was rich in blood, the dorsal vessel large, and covered with chloragogen cells, which in front of the intestine formed a dark mass. In advance of the gizzards the blood-vessels form a rich plexus or network which enabled the red blood to suffuse the whole of the organs. Pulsating hearts between the gizzards and the intestine made that portion a bright red, in striking contrast with the dark chloragogen cells which were here amassed. The gizzards lay in segments 9, 10, 11, and the foremost one was of quite a different texture from the other two, being composed of fibres which crossed each other so as to give the appearance of woof and warp. The principal hearts lay in segments 12–15, and the intestine commenced in 19. A very striking peculiarity of the intestine was observable in the fact that the hinder portion, from about the 33rd to the 50th segment, was only half as large as the foremost portion.

The main points of difference from Benham's type are to be found in the much diminished size, the position of the gizzards and hearts, and the segment which marks the commencement of the intestine. If we place these points side by side their value will at once be seen. In column I. I give details of the subspecies of *T. lankesteri*, in column II. those of the type, and in column III. the particulars relating to the new species:—

Details.	I.	II.	III.
Length	240-280 mm.	?	15 mm.
Segments	580	?	50
Diameter.....	4-6 mm.	?	1 mm.
Gizzards	5, 6, 7	7, 8, 9	9, 10, 11
Hearts.....	Last in 13	?	Principal in 12, 13, 14
Intestine begins	?	13	19

If we turn to the allied genus *Benhamia*, we find that the species range from 16 mm. in length in *B. curta* to 540 mm. in *B. rosea*, so that we are prepared to find a similar divergence in *Trigaster*. I should assume that the new species may grow to double the present dimensions when adult, but the very limited number of segments shows that it is comparatively a pigmy form. Unfortunately, the very juvenile condition of the specimen renders it impossible to say anything about the sexual organs, but in every other respect our information is definite and conclusive.

On account of the small size and the paucity of segments I propose for this new annelid the name *Trigaster minima*.

NOTES AND QUERIES.

MAMMALIA.

The Lesser Shrew (*Sorex minutus*) in Yorkshire.—This smallest of British mammals is no doubt much commoner and more generally distributed than is often supposed, it being easily overlooked unless systematically trapped for, and published records not being very numerous. I have for many years been familiar with it in Northumberland and on the Scottish Border, and have likewise met with it in Merionethshire, Devon, and Cornwall, and having during the last two years taken upwards of a dozen specimens in the immediate neighbourhood of Ilkley-in-Wharfedale (where it had hitherto been looked upon as not at all common, though a single example had already been taken near Bolton Abbey, and one or two have since been reported from neighbouring localities), perhaps the fact may be worth putting on record. My first specimen was rescued from a cat, on the edge of Ilkley Cemetery, during a hard frost with the ground covered with snow, in January, 1909, since which date others have been trapped on both banks of the Wharfe, as at Middleton, Bow Gill, and on the slope of the moor between the town and the well-known Cow and Calf rocks. And, as at least one example has been taken in almost every spot in which traps have been set, it is obvious that the species is not uncommon here. Specimens have been presented to Ilkley, Bradford, and Keighley Museums. — GEORGE BOLAM.

AVES.

Nidification of the Whitethroat (*Sylvia cinerea*).—The Common Whitethroat is generally a rare bird about Hebden Bridge; it is outnumbered both by the Blackcap and the Garden-Warbler. This year it has returned in even less numbers than usual, but on June 9th I watched a male in vigorous song, but did not see a female. The following day the bird was singing in the same tree, and J. Fenton Greenwood and myself searched closely for a nest, but were unsuccessful. On the 11th the bird was still singing lustily, and Mr. Greenwood saw it descend to a blackberry-bush. Examining this later he found a completed but empty nest, undoubtedly belonging to this species. The nest was kept under observation, but

no eggs have been deposited, and, though the male continued to sing in the vicinity for more than a week after, no traces of a female have ever been seen. It may be assumed, therefore, that the nest was constructed entirely by the male bird, which for some reason, most probably because of a scarcity of females, never paired. The case may be exceptional, and merely due to circumstance, or it may illustrate the general custom. Naturally, where males and females are equally represented, it would require a great amount of observation to definitely decide whether one sex only in this or any other species is concerned with nest building.—WALTER GREAVES (Hebden Bridge, Yorks).

The Grasshopper-Warbler (*Locustella naevia*).—While sailing on the Norfolk Broads a few days ago we perforce became quite familiar with the song of the Grasshopper-Warbler. One of these shy little birds was singing near the river not far from Wroxham, when I sallied forth with a candle-lantern one evening about 11 p.m. It was quite dark, and my intention was to catch a glimpse of this Warbler, so elusive when approached in the sunny hours. When within a yard of my quest, to judge by the sound, I passed the lantern under and around a solitary bush from which the song appeared to originate, but my action, however, failed to reveal the form of the songster. I then gently pulled aside a projecting twig, and was startled, not to say chagrined, by the flutter of a soft wing against my hand, but it was not long before the stridulous notes began again on the other side of the bush. This time, after creeping carefully round and peering with the lantern into a gap in the foliage, I was rewarded by a perfect view of the Warbler perched on a branch not more than two feet in front of me, and pouring forth its lonely torrent of song. As it sang the bird's throat quivered continuously, but the rest of its body was absolutely motionless. In a moment, however, a movement of mine caused it to turn about, and I was able to make a detailed observation from the side. In the act of singing the head is tilted upwards, while the tail is slightly depressed, perhaps by way of compensation. The legs are fully bent forwards, lying in close contact with the body wall. The singing position is thus rather a crouching than a craning attitude. The twig selected for a stance was situated towards the centre of the bush, and not easily visible from outside. At first, while watching, I held the lantern just to one side of my head, and possibly the light may have partially dazzled the bird, and thus covered my movements. In this connection it was most interesting to find that,

whether the light was withdrawn to a distance or concealed or waved slowly across the bird's field of vision, the singing continued as before without a pause. I found also that the noise caused by a savage kick amongst the undergrowth at the bottom of the bush was immediately followed by a cessation of singing, but only for a moment, and six kicks in succession at intervals of a few seconds were promptly sandwiched with five snatches of song. On the other hand, a stealthy or gradual movement was followed by a much longer silence which remained unbroken for a minute, or even longer. Finally, before leaving, I pushed the lantern slowly into the bush and followed it up with my face, which I succeeded in placing within nine inches of the songster before the slightest exception was taken to my presence.—A. P. SAINT (Nottingham Terrace, Marylebone Road).

Yellow Wagtail (*Motacilla raii*).—In Mr. O. V. Aplin's notes on decrease of Corn-Crake, &c. (*ante*, p. 237), mention is made that "Ray's Wagtail is decreasing in numbers compared to some years ago. The usefulness of protection for this or any bird is doubted." I would like to state that in Upper Airedale and Wharfedale, where we are great believers in protection, the Ray's is now our commonest Wagtail. In one small triangular, three-acred field alongside the Wharfe there were three nests each with six eggs; similarly in Airedale, it seems to be yearly increasing as a breeding species. Last year (1910) it was particularly abundant in Upper Airedale. Thirty years ago it was comparatively scarce. Perhaps this species is extending its breeding range further north, and this, with the protection afforded, accounts for its thriving in the districts mentioned.—W. H. PARKIN (Studholme, Shipley).

Alpine Swift in the New Forest.—I recently saw an Alpine Swift (*Cypselus melba*) at Brockenhurst, and the appearance of this rare visitor to our country is perhaps sufficiently interesting to be recorded in 'The Zoologist.' It was on the morning of Sunday, May 28th, that my friend Mr. E. A. Waterhouse and I saw the bird flying at no great height close to Brockenhurst Bridge. In fact, it was flying only sufficiently high to clear the thorn-trees and high bushes by the river, the course of which it appeared to be following from west to east. As the bird was coming towards us in bright sunshine, we were able to see it distinctly, and its white breast was conspicuous, so that we had no doubt of the species. Indeed, it was so obviously a large Swift that it was impossible to mistake it for any other bird.—R. S. MITFORD (35, Redcliffe Square, South Kensington).

Marsh-Harrier in Kent.—On June 22nd I observed a Marsh-Harrier (*Circus aeruginosus*) in Thanet. The bird was battling vainly against the stiff south-west wind that was blowing at the time. It finally settled in an open field, where I managed to get a very fair view of it, though it would not allow me to approach nearer than eighty or one hundred yards. — COLLINGWOOD INGRAM (Sussex Mansions, Westgate-on-Sea).

A Pelican Fifty-two Years of Age.—A White Pelican (*Pelecanus onocrotalus*) forty-one years of age, and then still living in the Zoological Gardens at Rotterdam, is recorded in 'The Ibis' for 1899 (pp. 32, 38), on the authority of Dr. J. Büttikofer, Director of the Gardens, and well known as a zoologist. Assuredly there are not a great many instances of birds passing the age of fifty years which are capable of verification, but this is one. The bird died, as I now learn from Dr. Büttikofer, in November, 1907. As it had been received from the Zoological Gardens at Amsterdam in May, 1857, and entered as being then an adult bird, it could not have been less than fifty-one and a half years old, and probably was more. It was marked by an easily recognizable incision in the membrane of one of its feet, and Dr. Büttikofer considers any mistake of identity to be out of the question.—J. H. GURNEY (Keswick, Norwich).

EDITORIAL GLEANINGS.

A 'STANDARD OF EMPIRE' cable, dated Cape Town, March 15th, says:—"A sensation has been caused in Cape Town by a thrilling encounter between a large Octopus and a number of men at the docks. A native was standing on a step close to the water, when he was suddenly seized by the Octopus. Three other natives were also clutched by the long tentacles of the great creature, which strove to drag them into the water, where they would have been completely at its mercy. Help fortunately arrived in time to prevent that contingency, and the Octopus was drawn out of the water. It retained its grasp on the men, however, despite the endeavours that were made to chop off its tentacles with spades. Only after a long conflict was the Octopus finally despatched. The adventure is without precedent in the annals of Cape Town."

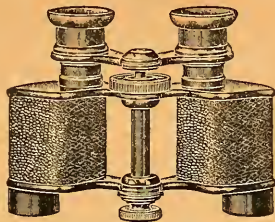
YOUNG EELS TWO HUNDRED MILES INLAND.—Mr. R. B. Marston, writing in the 'Fishing Gazette' of June 3rd last, says :—"Mr. W. G. Ashford, of Messrs. Milward's, of Redditch, was telling me recently of the fine Eels they get in their Barnt Green Fishing Club's water, of which he is Hon. Sec. He said they saw the small Eels come up and the large ones go down. I asked him if he could get me specimens, and he kindly sent me a fine Eel of nearly three pounds, which was excellent eating ; also, on May 24th, he sent me in a bottle with some damp moss some small live Eels, 6 in., 7 in., and 8 in. in length. I gave them to Mr. Green, the naturalist, at the east end of Covent Garden Market. Mr. Ashford says :—"These young Eels were caught above a little waterfall a mile from the source of the Arrow, in Worcestershire. The Arrow is a tributary of the Avon, which again is a tributary of the Severn. The distance from the sea, as the crow flies, is about one hundred and twenty miles, but the distance they must have travelled can certainly be taken as two hundred miles. Of course, the distance they travelled in *salt* water is vastly more than that.' "

At a meeting of the Zoological Society of London, held on June 27th last, Dr. W. T. Calman, F.Z.S., exhibited a number of living specimens of the Brine Shrimp (*Artemia salina*) which had been bred from Tidman's Sea Salt. He remarked that this sea salt, as sold in the shops, was found frequently to contain living eggs of *Artemia*, and that it was easy to obtain a supply of living specimens. An eight per cent. solution, allowed to stand for a few days, produced a swarm of larvæ, and these could be fed on the strained juice of green leaves and raised to maturity.

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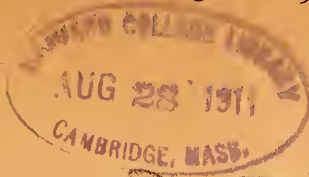
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THE ZOOLOGIST

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MISCELLANEOUS NOTES ON ZOOLOGICAL INSTITUTIONS RECENTLY VISITED IN EUROPE.

BY CAPT. STANLEY S. FLOWER, F.L.S.

THE following notes on some of the Zoological Gardens, Museums, and Aquariums, which I have visited while on leave in Europe during the last three years, may be of interest, both as a sort of guide to other travelling zoologists (the ordinary guide-books give little information on our subject), and to record a few interesting facts about animals in captivity.

The towns I propose to mention in this series of notes are:—1. Birmingham. 2. Brighton. 3. Brunn am Gebirge. 4. Cologne. 5. Halifax. 6. London. 7. Lyons. 8. Marseilles. 9. Munich. 10. Naples. 11. Paris. 12. Southampton. 13. Stuttgart. 14. Vienna.

1. BIRMINGHAM, ENGLAND.

(i) *Zoological Gardens.*

Several "Zoological Gardens" have existed for short periods in the district of Birmingham.* In 1870 an attempt was made to form a Midland Zoological Society, with gardens and a menagerie at Birmingham, but apparently nothing was actually done.

In May, 1873, the late Morris Roberts, the ex-prizefighter, opened a menagerie in the grounds of the Sherbourne Hotel,

* *Vide* 'Birmingham Post' and 'Birmingham Mail'; both of February 16th, 1910.

Balsall Heath, but three years later the collection was dispersed. There were also "Zoological Gardens" at Aston Lower Grounds and Sutton Park.

In 1910 a new collection of live animals was started in the Botanical Gardens at Edgbaston, the property of the Birmingham Botanical and Horticultural Society.

This Society was founded in 1829, and their gardens, planned by J. C. Londoun, were opened in 1831. Lately the annual cost of maintenance has been about £1600, and the subscriptions under £1000, so the Society are making the experiment of adding a menagerie to attract more visitors to their grounds.

These really beautiful gardens are on the slope of a hill, the highest portion of the ground (near the entrance gate) being occupied by some artificially heated glasshouses, in which the reptiles are kept. The most attractive part of the institution is the "Hugh Nettlefold Alpine Garden," opened May 29th, 1895. When I visited Birmingham early in July, 1910, the animals already installed in the collection were five African Monkeys, representing three species, three Black Lemurs, some Grey Squirrels, fourteen or fifteen species of birds, several Tortoises, one medium-sized Alligator, a small Crocodile, seven (or more) species of Lizards, including some nice specimens of an *Agama*, four (or more) species of Snakes, including a *Boa constrictor*, and also a few Batrachians. Various cages in process of construction gave promise of a larger stock being on exhibition before long.

(ii) *Museum.*

A new Zoological Museum for Birmingham is proposed, and when visiting that city in July, 1910, I was told that the buildings were already in course of construction, and the collection meanwhile housed at Aston Hall, which I accordingly visited and very much enjoyed, but it must be confessed that the interests and beauties of the building exceeded those of the specimens that it contained.

Sir Thomas Holte (1571-1654) began the building of Aston Hall in 1618, but it was not entirely completed until 1635. The Hall now belongs to the city of Birmingham, and is open free to the public daily.

The Natural History collections are chiefly exhibited in

rooms Nos. 2 and 3 on the ground floor, and Nos. 16 to 19 on the first floor.

In room No. 2 is a case containing two Cranes (*Grus cinerea*), shot at Knowle, in Warwickshire, Dec. 1st, 1903, and mounted by Mr. E. F. Spicer, of Birmingham.

A 'Handbook to the Collection of British Birds in Aston Hall,' written by Prof. T. W. Bridge, F.R.S., was published in 1908, on page 12, of which we read:—"The British birds here exhibited originally formed part of the Natural History Museum of the Queen's College, but were presented to the City by the Council of that Institution. Unfortunately there exists no accurate record of the precise locality from which the specimens have been obtained, and hence it cannot be positively affirmed in all cases that they are really British."

2. BRIGHTON, ENGLAND.

(i) *Aquarium.*

When visiting Europe in 1905 and 1907, to see the principal zoological gardens and aquariums,* I proposed going to Brighton to inspect the aquarium, which I had not seen since about 1883, but was assured by several zoologists that this once famous institution was a thing of the past. "There is nothing to see there now," was the refrain.

However, in October, 1909, I went for a short holiday to Brighton, and was delighted to find that the Aquarium contained a large and most interesting collection; only excelled in Europe by that of Amsterdam. The following list gives a comparative idea of the size of the Brighton collection of fish compared to other important European aquariums that I have visited during the last four years:—

Amsterdam	...	...	...	80 species of fish seen.
Brighton	...	...	...	54 " " "
Berlin	...	...	...	52 " " "
Naples	...	...	40 to	47 " " "
Stibbington Hall (Capt. Vipan's)	...	...	...	44 " " "
Blackpool	...	...	...	34 " " "
Hamburg	...	...	about	30 " " "

* See 'Report on Mission to Europe, 1905,' and 'Notes on Zoological Collections visited in Europe, 1907,' both published by the Egyptian Government Zoological Gardens.

The Brighton Aquarium has had a chequered career; the original cost of the building is stated to have been over £130,000, it was opened in 1872. In 1900 the Aquarium and its contents were purchased by the municipality for £30,000. The Corporation took possession in 1901, and soon after leased the building to a private company, but resumed occupancy in 1906. It is now open daily to the public at a small charge.

The Superintendent at the time of my visit was Mr. E. W. Cowley, and the Keeper Mr. F. B. Brown, who has had so many years' practical experience of the management of fish and other aquatic animals in captivity.

There is no need in this paper to describe the building or the system of water supply, but the large size of some of the tanks should be noted, especially No. 6, which is said to be 110 ft. (or 33·53 metres) long, and capable of holding 110,000 gallons (or 500,060 litres) of water.

The collection of live animals is by no means restricted to fish, and deserves longer notice.

The Mammals consisted of fifteen Monkeys, representing three African and three Asiatic species, a curiously coloured Bear, which Mr. Brown told me has now lived for over twenty years here, and four Seals (*Phoca vitulina*), one of which was remarkably tame.

Of Birds there were Guillemots and representatives of two species of Sea-Gulls.

Besides one small Alligator-Terrapin, nineteen European Pond-Tortoises, and one small and one medium-sized Alligator, the Reptile collection contained two noteworthy individual animals. First, a Snapping Turtle (*Macroclemyis temmincki*) of enormous size (in Tank No. 20), which Mr. Brown told me has lived in the Brighton Aquarium since about 1879, thus about rivalling in age the old Snapper of the same species in the Amsterdam Zoological Gardens. Secondly, a Mississippi Alligator, now about eight feet in length (in Tank No. 18), which was received here in 1877 when but fifteen inches long, so almost as old as the celebrated Alligator "Old Dick," which arrived in Regent's Park in 1876, and which still flourishes there.*

* "Old Dick" died June 8th, 1911

Of Batrachians there were a few white Axolotls, labelled as bred here, and representatives of two species of Newts.

I counted fifty-four species of fishes living in the Brighton Aquarium, twenty-three of these were in fresh water and thirty-one in salt water. Of the former, three Sterlets (*Acipenser ruthenus*) should be specially mentioned; these are the survivors of nine specimens imported from Russia in 1873, so that at the time of my visit (1909) these three fish were at least thirty-six years old, thus even older than Capt. J. A. M. Vipian's Sterlets in his private aquarium at Stibbington Hall, which were given to him by the Czar of Russia in 1888, and also of the four Sterlets which I saw in the Amsterdam Aquarium in 1907, which had then lived twenty-five years there. Among the sea fish I was very interested to see three individuals of the Monk Fish (*Rhina squatina*), the largest being perhaps four feet in length. There was a shoal of Herrings (*Clupea harengus*) in Tank No. 32, and some Mackerel (*Scomber scombrus*) in Tank No. 37; Mr. Brown told me that individuals of both these species have lived from three to four years in captivity here.

The most remarkable exhibits among the Crustacea were perhaps a Red Lobster in Tank No. 10, and a very large Edible Crab in Tank No. 30.

The Cephalopoda were well represented by thirteen fine, lively specimens of the Octopus (*Octopus vulgaris*), nineteen of the Squid (*Loligo vulgaris*) (the shoal of Squids in Tank No. 40 formed a very attractive exhibition), and two of the Cuttlefish (*Sepia officinalis*).

Tanks Nos. 1, 31, 32, and a table tank contained Sea Anemones. The other invertebrate animals in the collection call for no special remarks.

(ii) *Museum.*

The Booth Museum of British Birds on the Dyke Road, Brighton, is too well known to require any description in the pages of 'The Zoologist,' but I would like to devote a few paragraphs to call attention to the Brighton Museum, as I have been surprised to find that it does not appear to be as widely known as it deserves.

This Museum is part of the "Public Library, Museum and Fine Art Galleries" of the County Borough of Brighton, and is

housed in a large building (close to the celebrated Brighton Pavilion), which was reconstructed for its present purpose, and opened in 1902. This Museum, as well as the Booth Museum, is open free daily.

The Director is Mr. Henry D. Roberts, and the excellent official guide-book is sold for the small price of one penny.

The general effect of the Museum is very pleasant; it appears clean, cheery, light, and instructive. Among the more interesting zoological exhibits, the following may be perhaps specially mentioned:—Three stuffed Sudan Bush-Babies (*Galago teng*) and two stuffed Hunting Dogs (*Lycan pictus subsp. incert.*), all collected by Mr. Leonard Gorringer near Roseires, on the Blue Nile. The specimens of *Lycan* are particularly valuable, as this predaceous beast rarely appears in that part of the Sudan. An unusually large skull of a Crocodile, labelled as being from Borneo; and a Long-nosed Skate, caught off Brighton in 1908, which was exhibited alive in the Aquarium, and is said to have weighed 170 lb., and been 6 ft. 3 in. in length, and 4 ft. 11 in. in width.

3. BRUNN AM GEBIRGE, LOWER AUSTRIA.

The firm of Karl Gudèra, animal dealers and game exporters, established in 1867, has its headquarters office in the Millergasse in Vienna, and two establishments in the country to the south of Vienna.

One at Mauer, about six and a half miles from Vienna, I did not have time to visit. Herr Fritz Schmeidler (Herr Gudèra's manager) told me that it is chiefly devoted to sporting dogs and Skye terriers, and to domestic poultry.

The second, the Tierpark at Brunn am Gebirge, about eight and a half miles in a straight line from the centre of Vienna, is more interesting to the general zoologist, and on May 3rd, 1910, I had the pleasure of visiting this institution in the company of Herr Schmeidler. It consists of a villa, farm buildings, and garden on the slope of a hill. The garden is prettily laid out, and includes a rock-garden, ponds for aquatic plants and a small hot-house. Between the garden and the animal enclosures are the sheds for storing the nets used in the capture of Hares, Partridges, &c., in Hungary. The partridge-nets are 656 ft.

(200 metres) in length and 23 ft. (7 metres) in height, so it may be imagined that trained men are required to manipulate them with celerity and success.

The live stock that I saw at Brunn comprised many breeds of domestic dogs, European wild Carnivora, Marmots, Squirrel, Roedeer, three species of Asiatic Deer, Ravens, Rook, Owl, Buzzard, Merlin, and large series of Anserine and Gallinaceous birds, the collection of Pheasants being particularly rich. Two Capercaillies (*Tetrao urogallus*), both hens, were the most interesting birds I saw at Brunn, as this grand species is but seldom seen living in menageries.

4. COLOGNE, GERMANY.

(i) *Zoological Gardens.*

I have visited these Gardens in 1876, 1887, 1892, and 1905, and in May, 1910, had the pleasure of again seeing them in the company of Dr. Wunderlich, the Director.

Among the very many objects of interest in this collection the following may be specially mentioned.

MAMMALS.—Two male Sacred Baboons (*Papio hamadryas*), which were received here as young specimens in 1886, and are now both well-grown beasts with fine grey mantles; they have therefore been twenty-four years in captivity and appear very flourishing.

Two Red Ruffed Lemurs (*Lemur varius ruber*).

A Panda (*Ælurus fulgens*), in beautiful condition and very lively and active, in the well-warmed Monkey House. The Panda and Red Ruffed Lemurs were in cages next to each other, and it was curious to notice how the colour of the fur in these two very different species of animals exactly matched in appearance.

Two Asiatic Wild Dogs (*Cuon alpinus*), which were born in the Breslau Zoological Gardens. Dr. Wunderlich told me that this species had formerly bred in Cologne, but that both the old pair and their descendants were now dead.

A young male Musk Ox (*Ovibos moschatus*).

A male North African Red Deer (*Cervus elaphus barbarus*).

A very fine pair of Sudan Giraffes. The tassel on the tail of the bull was so well developed that the ends of the hairs reached the ground.

An Echidna, which has lived nearly ten years here.

BIRDS.—A Racket-tailed King-Crow (*Dissemurus paradiseus*), now twelve years here. Dr. Wunderlich tells me that it grows a good tail every year.

I saw seventeen Owls of ten different species, including *Bubo turcomanus*.

The Accipitres numbered sixty, representing thirty-five species; perhaps those least often seen in captivity were the Crowned Harpy Eagle (*Harpyhaliaëtus coronatus*), a Marsh-Harrier (*Circus æruginosus*) (one year here), and the Vultures (*Vultur occipitalis* and *Neophron pileatus*). A Caracara (*Polyborus*), which had been obtained in 1881, died the week I was in Cologne, having therefore lived twenty-nine years in captivity.

The collection of Geese and Ducks is particularly rich, and there is a good series of Storks and Herons, including the Australian *Ardea pacifica*. I saw examples of five different species of Pelicans, and no less than seven species of Ibises.

Dr. Wunderlich kindly gave me some notes on the longevity of birds in the Cologne Gardens, which are of general interest:—

Common Flamingo (<i>Phœnicopterus roseus</i>),	living over 20 years
Scarlet „ (<i>P. ruber</i>)	„ 25 „ [here.
Manchurian Crane (<i>Grus japonensis</i>)	„ 15 „
Asiatic White Crane (<i>G. leucogeranos</i>)	„ 30 „
The Canadian Crane (<i>G. canadensis</i>) breeds here with success.	

In the large bird house of the Cologne Gardens is a small collection of Reptiles, Batrachians, and Freshwater Fishes, including seven small individuals of the African Electric Cat-Fish (*Malopterurus electricus*), and many specimens of the curious eel-shaped fish, without paired fins, *Symbranchus*, from South America.

(ii) *Museum.*

The Municipal Natural History Museum was started in 1892. In January, 1895, the “Verein zur Förderung des Museums für Naturkunde zu Cöln” was founded, and under its auspices the collection was increased and arranged, and in May, 1902, opened to the public in its present handsome quarters, the first and second floors of the Stapelhaus, a restored sixteenth century building on the bank of the Rhine.

Excellent popular guide-books to the collections, written by Dr. O. Jansen, have been lately published.

The leading features of this museum are the large groups of stuffed mammals and birds, which are well calculated to catch the eye of the casual visitor and to excite his interest, so as to lead him on to further enquiries about the animals he sees, and so to spread popular knowledge of natural history amongst the public.

Unfortunately the majority of the specimens are not protected by glass, and, under the conditions in which the collection is exhibited, it is to be feared that neither fur nor feather can be preserved for many years.

The entrance hall on the lower floor contains two large groups illustrating very different sides of the European fauna, one the coasts of the North Sea and one the high mountains of South Europe. In this hall there are also microscopes arranged on tables for the use of visitors (a feature I also noticed in the Brighton Aquarium), and the preserved skins of various large animals that have formerly lived in the Cologne Zoological Gardens.

The main hall on this floor is devoted to general and local series of mammals and birds. The fine family groups of all the principal European mammals, from Red Deer, Wild Swine, and Bear to the smaller Carnivora and Rodents, should be specially mentioned, and also a less complete series of European birds mounted in their natural surroundings. There is also a series of nearly three hundred pairs of horns and antlers, collected by the late Dr. Hermann von Wissmann (1853-1905), formerly Governor of German East Africa.

On the upper floor, the chief attraction is the large collection of stuffed mammals and birds made in East Africa by Herr Bernhard Kreuser in 1906, and mounted in Cologne during 1907 and 1908.

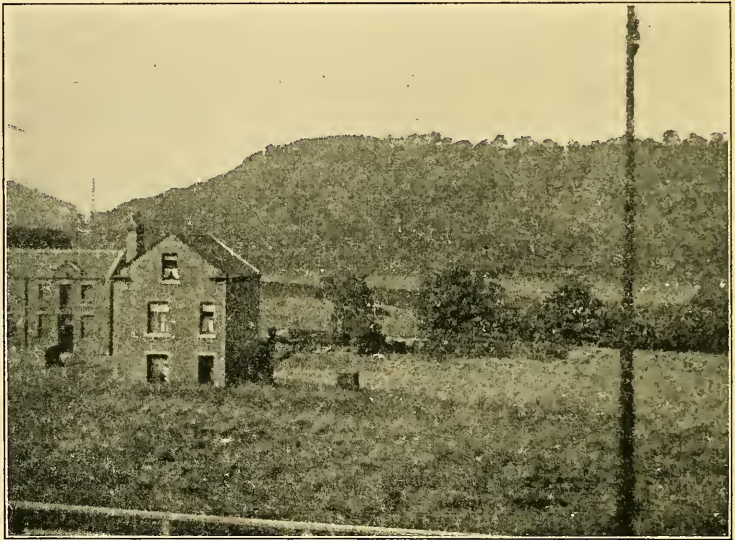
Mention must also be made of the method employed in this Museum of exhibiting those species of fish which are of local interest. Stuffed specimens, mounted amongst suitable surroundings, are shown in five large glass cases, under the following divisions:—1. Pond fish. 2. Brook fish. 3. Rhine fish, stationary. 4. Rhine fish, migratory. 5. North Sea food

fish. This arrangement is both instructive to the local public and of interest to the visitor from abroad.*

5. HALIFAX, ENGLAND.

Zoological Gardens.

In July, 1910, the Zoological Gardens at Chevinedge, Salterhebble, near Halifax, in Yorkshire, were only fifteen months old, but they were well worth going a long journey to see, and they reflected great credit on Mr. A. R. McKill, the Director.



Chevinedge, Yorkshire. Site of Halifax Zoological Gardens.

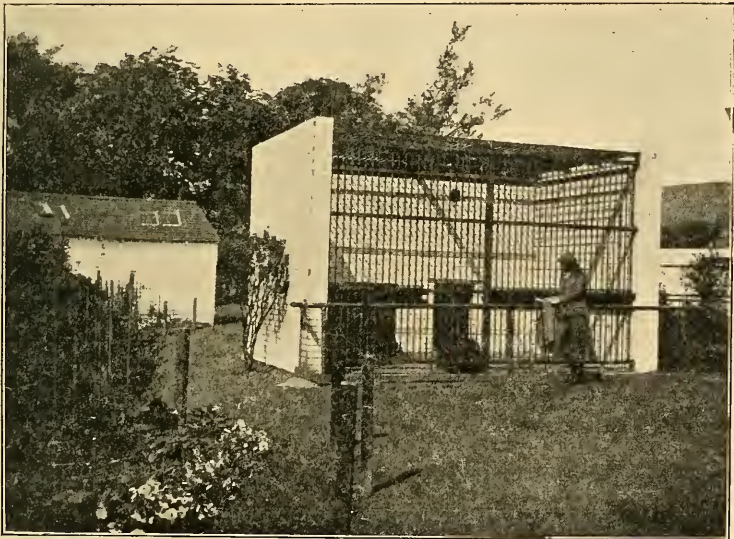
The site is very fine. On the projecting angle of a plateau is a level garden of green trees dotted here and there with white and red cages; from the edges of this plateau there are grand views of hills and dales, and wooded rocky banks slope down to the river in the valley below, and all in a strong, healthy hill air.

The area at present occupied is twenty-four acres, but another twenty acres can be eventually taken in if necessary, and among the various schemes proposed for the future perhaps the most

* The Aquarium in the "Flora" Gardens, Cologne, which I had seen in 1905, I revisited in 1910, and found all the tanks empty.

attractive is that of enclosing one of the steep hill-sides between the plateau and the river as a large paddock for Ibex to live in.

The grounds are divided into two sections—the zoological garden and the “amusement park.” In the former the principal features are the “Mansion,” containing the administrative offices and the restaurant, the combined Elephant and Monkey House, the “Miniature Farm,” the conservatory, the ponds for waterfowl and seals, and a number of solidly built separate cages, faced with white glazed bricks. In the latter is a Theatre, with a small collection of stuffed birds in a side gallery, a



Halifax Zoological Gardens. Bears' Cage. July, 1910.

“Miniature Railway,” and a “Winter Garden” and Reptile House in course of construction.

I saw in the menagerie just over one hundred mammals of fifty-two species, and representatives of sixty species of birds. So far no reptiles, batrachians, or fishes were being exhibited. By far the most interesting animal to a zoologist was a fine Cape Jumping-Hare (*Pedetes caffer*), which I was told had now lived about fifteen months here, and appeared to be in excellent condition. The following beasts must also be mentioned: a very

large Red Fox, two very attractive little Seals, a female Chapman's Zebra with white rings above her hoofs, a Duikerbok, and a giant domestic Goat.

6. LONDON, ENGLAND.

(i) Zoological Gardens, Regent's Park.

The British Museum (Natural History), the most important zoological museum in the world, needs no mention in this article, nor does the great menagerie of the Zoological Society, but I cannot pass on to the smaller institutions without giving a list of a few of the rarer animals which I saw alive in the Regent's Park:—

One Siamang (*Hylobates syndactylus*), from Perak; presented by Mr. E. M. Hawes, Aug. 7th, 1909.

Two Aye-Ayes (*Chiromys madagascariensis*); purchased Sept. 12th, 1908.

One Takin (*Budorcas taxicolor*), from Bhutan; presented by Mr. J. C. White, June 22nd, 1909.

One Vaal Rhe-bok (*Pelea capreolus*); presented by Mr. F. Burgoyne, April 3rd, 1908.

One Tasmanian Wolf (*Thylacinus cynocephalus*); purchased March 12th, 1909.

Two Tree Kangaroos (*Dendrolagus ursinus*), from Arfak Mountain, New Guinea; purchased June 25th, 1909. This pair looked very nice, out in the open, by the "Squirrel's Tree."

The Birds of Paradise!! On Oct. 7th, 1908, I counted no fewer than fifty individuals of these wonderful birds, and during various visits in 1908, 1909, and 1910 saw examples of no fewer than eleven different species.

Six Cocks-of-the-Rock (*Rupicola crocea*), from British Guiana; deposited June 14th, 1910.

One Eagle (*Pithecophaga jefferyi*), from Luzon; purchased Sept. 2nd, 1909.

Two Green-legged Flamingoes (*Phoenicopterus ignipalliatu*s); purchased June 7th, 1909.

One Tuatera (*Sphenodon punctatus*); purchased June 9th, 1908.

Two Musky Caymans (*Caiman palpebrosus*); presented by Mr. E. Salis-Schwabe, May 16th, 1908. And last, but perhaps the most interesting of all:

One South American Mudfish (*Lepidosiren paradoxa*); presented by the Goeldi Museum of Para, Sept. 4th, 1908.

(ii) *Crystal Palace, Sydenham.*

In September, 1908, I visited the Crystal Palace, and was most impressed by the number of wild birds to be seen in the grounds. The restorations of Extinct Animals (though naturally open to criticism in the new light thrown by palæontological discoveries since the days when Hawkins made them) are also very impressive and of great historical-zoological interest. I also saw the Aquarium and the Leadbetter menagerie, then on exhibition at Sydenham.

The Crystal Palace Aquarium proper only consists of ten wall-tanks and four table-tanks, but a small menagerie and some aviaries are attached to it. The collection of live animals on Sept. 28th, 1908, comprised twenty-two Monkeys representing eight common species, one Ring-tailed Lemur, one Palm-Civet, one Suricate, two Badgers, many domestic Rats, Guinea-pigs and Rabbits, specimens of fifty-three species of birds (including eighty-one individual Parrots), about thirteen reptiles of seven species (the most remarkable being two Crocodiles of a species seldom seen in captivity in Europe, possibly *Crocodylus palustris*, but I did not have an opportunity of examining them critically), one Toad, Newts of two species, one white Axolotl, and representatives of eighteen species and varieties of fresh-water fish.

The Leadbetter collection deserves longer notice. It was formed by Mr. Robert Leadbetter at Hazlemere Park in Buckinghamshire, where I believe many wild animals, including Lions, Leopards, Hyenas, Wolves, Jackals, Bears, and Zebra, were bred with success. When I saw them exhibited at the Crystal Palace the animals all appeared to be in excellent condition. A good barrier had been erected to keep the visitors at a proper distance from the animals, and the following notice was posted up: "The Public are cautioned not to FEED, TOUCH, or ANNOY the Animals." If this rule was posted and enforced in all menageries the mortality of wild animals in captivity would be greatly reduced.

This Leadbetter menagerie is unfortunately no longer in

existence ; it was sold by auction by Messrs. Moss and Jameson at East Croydon on July 14th, 1910, the total sum realised being, according to the 'Daily Mail' of July 15th, 1910, about £1400.

The menagerie, when I saw it, contained seventy-four mammals, representing thirty species, and there were also fourteen Parrots and two Emus. At the sale the African Lion, "Prince," born in the menagerie May 30th, 1905 (so, then, five years one and a half months old), fetched £100,* but his mother, "Victoria," a Lioness imported from Somaliland, only realized £14; "Emperor," an imported Indian Tiger, believed to be about nine years old, went for £105. A Bear only fetched £2. Jackals were bought for £1 15s. to £1 5s. each, and Wolves at £1 each. The Ceylonese female Elephant, "Lowla," said to be nine years old, sold for £190, and the male Indian Elephant, "Babs," said to be five years old, fetched £150.

(iii) *Earl's Court, London.*

The Hungarian Exhibition at Earl's Court in 1908 contained several things of zoological interest; omitting the models of domestic animals and the purely agricultural-zoological exhibits, the following may be mentioned:—

First, the exhibit of the Hungarian Central Ornithological Office, consisting of feeding-boxes, artificial nesting-holes, stuffed birds, coloured plates, maps of bird migration, &c., carefully arranged by Mr. Titus Csörgez, under the direction of Dr. Otto Herman.

Secondly, the large group of stuffed Hungarian animals, including Red, Fallow, and Roe Deer, Chamois, Mouflon (introduced into Hungary from the Mediterranean), Boar, Lynx, Bear, Eagle, Waterfowl, &c., mounted by the Budapest taxidermist, Mr. Frederick Rosonowsky.

Thirdly, the Menagerie (proprietor, Mr. Frank C. Bostock; manager, Mr. R. J. Aginton), which I visited on three occasions. Excluding horses, ponies, and domestic dogs, it contained about one hundred and five mammals, representing about twenty-seven species, three birds, and a few reptiles. The large *Felidae* formed the chief part of the show. I saw twenty-six Lions

* Prices, *vide* 'Daily Mail,' July 15th, 1910.

(including cubs), one Tiger, eight Leopards, five Pumas, and one hybrid between a male Lion (*Felis leo*) and a female Jaguar-Leopard (*Felis onca* × *F. pardus*), bred in captivity in the United States of America. This was the animal that had been deposited in the Regent's Park Zoological Gardens on April 14th, 1908. Some Californian Sea-Lions should also be mentioned.

(iv) *Shepherd's Bush, London.*

"The White City" Exhibition, in 1908, contained a few wild animals in captivity. The Beavers and five young Bears in the Canadian Section attracted much attention on the part of the public, and Mr. Gustave Hagenbeck had a show, where I saw, besides horses and a dog, one Sloth-Bear, six Indian Elephants, a white Deer, a Bactrian Camel, and, what was of more interest, a male Blackbuck (*Antilope cervicapra*), trained to take part in a performance, a very much rarer sight than a performing Lion or Bear.

In 1909 Mr. Carl Hagenbeck exhibited a small menagerie in "The White City," with some trained animals under the skilled charge of Mr. Schilling. Besides domestic dogs, the show consisted of eight Lions, eight Polar Bears, seven Sea-Lions, one Seal, one Gannet, two Cormorants, about thirty Seagulls, and a Walrus. Mr. Schilling told me this Walrus was a male, about three years old, and that it was then eating 50 lb. (over 22 kilos.) of fish per day!

(v) *Covent Garden, London.*

Robert Green & Co.'s "Bedford" Aviaries and Aquarium at Covent Garden Market are always interesting to visit; in 1908, 1909, and 1910 I found representatives of about a hundred species of vertebrate animals (small mammals, birds, reptiles, batrachians and fishes) usually on exhibition, and also a few aquatic invertebrates. The celebrated old White Axoltl died about June, 1909, having lived, Mr. J. Barrow (the manager) told me, over twenty-five years in Covent Garden.

(To be continued.)

LAPWINGS (*VANELLUS VULGARIS*) IN THE PAIRING SEASON.

BY S. E. BROCK.

IN the arable portions of the Lothians, Lapwings are present, as a rule, throughout the winter in considerable flocks, showing preference by day for particular fields, but scattering more widely to feed as dusk approaches. Only during a prolonged period of frost do they disappear entirely, and in a mild and open winter their numbers are greatly in excess of the local breeding stock. Towards the close of February or early in March the latter reappears on the nesting grounds, and the activities characteristic of the pairing season are at once initiated, although confined in the first place to a few birds, the other arrivals remaining apart in a loose flock. From the numbers of the latter it would appear that a proportion is composed of foreigners, and the gradual dwindling of the flock from day to day goes to support the supposition; while occasionally, on the passage overhead of a band of migrants, one or two individuals may be seen suddenly to take wing, and, answering the call of the travellers, follow them in hasty flight northwards.

If the birds are disturbed at this early season, the looseness of their connection with the nesting ground is shown by their tendency to desert it—a tendency equally apparent in the birds still flocked, and in those individuals which have separated from their fellows and commenced their spring activities. It is, however, interesting to note that the latter, before quitting the nesting ground, frequently circle overhead for a little, emitting notes of alarm and anger, and acting in a manner closely approaching their behaviour when eggs have been laid—a good illustration of the “association by contiguity,” so characteristic of avian psychology. The field thus deserted by the birds may remain tenantless for hours, frequently until the dusk of evening. Apart from outside disturbance, at frequent intervals the birds leave the grounds of their own accord, particularly during early afternoon, and until mid-March, or even

later, this phenomenon may continue, more especially in the event of cold or stormy weather.

In the early days after the arrival on the nesting ground signs of dawning sexual instincts amongst the flocked birds are evinced by a slight increase of jealousy on the part of the males, which tend to make sudden unprovoked attacks on each other, which attacks, however, are only momentary and of slight extent. Soon a few males separate entirely from their companions, and take up certain more or less definite positions in the field, showing considerable jealousy of any trespass on the part of their neighbours. Here they spend a large part of the day, occupying themselves in the formation of scrapes, in aerial combats with other males, or in courting any female bird which may happen to settle not too far off, while at intervals they indulge in prolonged song-flights, ranging over a wider area. The limits of the ground claimed by each male are, however, of very vague definition, and appear to be modified with the advance of the season, or with the little group of scrapes with which the male interests himself, since a group formed in the earlier days may be deserted later in favour of a fresh set at some distance. While present during a considerable portion of the day in his especial "estate," the bird does not by any means confine himself entirely thereto, being sometimes absent for hours, during which he may resort to neighbouring fields in search of food, or to some pond or watercourse in which to bathe.

A feature of early March is the high proportion of males to females present, a discrepancy largely due to the fact of the weaker attachment of the females at that season to the nesting grounds. When present, also, the females, owing to their more retiring and less active habits, are much less in evidence than the other sex. Nevertheless, there is reason to believe that the large numerical difference between the sexes is not merely apparent, and that the males are actually somewhat in excess.

Spring Flight.—Rising slowly from the ground the male executes a few laboured flaps, moving the wings with exaggerated slowness—owl-like; thence he quickens his pace, and, rising suddenly at an abrupt angle, commences the song, the greater part of which, however, is emitted as the bird falls again. During the utterance of the song, in a pause occurring after the

penultimate note, the performer throws himself sideways almost on his back, instantly recovering himself with a flurry of wings. The bird now scuds rapidly over the ground at a moderate height, making a pronounced humming sound with the motion of his sharply-driven pinions, and occasionally tilting himself from side to side, much in the manner of a Snipe when flushed. From this scudding and humming flight the bird may, and frequently does, recommence the song, repeating the whole of the previous performance with the exception of the owl-flight, which appears to be confined to the initial movement. Such is the common course of the spring or "nuptial" flight, but its variations are infinite.

Song.—The spring song of the Lapwing runs a more regular and unvarying course than the accompanying flight, but, like all bird-notes, its representation on paper is difficult. The following phrasing is the result of several attempts and reconstructions: "Whey-willuchooe-willuch-willuch—cooe" (the first syllable long-drawn and hoarse of tone; the second and third "willuch" uttered rapidly and staccato; then ensues a pause, during which the previously described partial summersault is executed, followed by the loud, clear, and musical final note).

While the female takes part in the prolonged and intricate manœuvres so frequently gone through on the wing by winter flocks, she does not indulge during the breeding season in either song or song-flight proper.

A constant and salient feature of the pairing season is the aerial combat between two rival males. The two birds taking part rise slowly and almost perpendicularly in the air for some considerable height, their wings beating rapidly and legs slightly dangling, one endeavouring to rise above the other. At intervals the upper bird stoops suddenly on the lower, an attack usually avoided by an agile turn of the wing; but occasionally a distinct and hollow clap is audible, indicating an exchange of blows, dealt apparently with the wing. During the course of the affair the song is repeatedly uttered, but with the omission of the final notes. On at length parting company, both combatants break into the full song-flight, repeating it twice or thrice ere re-settling in their respective stations. These encounters, while usually individually of short duration, are in-

cessantly occurring at all hours of the day, and have at first sight the appearance of genuine rivalry. Despite the occasional blows given and received, however, it is doubtful how far such tussles are to be regarded as real struggles for mastership or for breeding ground. There is frequently about them an aspect more suggestive of play, and the fact that they persist in unlessened frequency throughout the pairing season and long after the eggs are laid is in favour of this interpretation. More realistic and suggestive of veritable antagonism are the occasional ground combats, less common than the aerial performances, but still not infrequent in the early part of the season. Usually one bird is here the aggressor, swooping repeatedly from one side or the other at its rival on the ground, or dropping on it from above like a hawk. The threatened bird twirls round each time to face the onset of the other, evading the blow by swerving aside or by little upward springs into the air. At length, bullied into flight, it rises and attacks in turn, or indulges in prolonged song-flight to a distant part of the field. Should it return and settle once more on the same ground the attack by the other bird is immediately renewed. Such struggles as this are at times most obstinately persisted in by the two birds—sometimes for as long a period as an hour or an hour and a half on end. So engrossed are they with each other that I have known them ignore the courting of a female on the disputed ground by a third male.

When not engaged in these frequent aerial exercises, the males go through certain peculiar movements on the ground, not a little puzzling to the observer. Standing upright in his chosen area, a bird utters a strange grating note, usually harsh in tone, but varying at times to a more plaintive pitch; meanwhile the tail and wings are swayed up and down in a rhythmical manner. This movement may be continued without further development for a considerable period, but on any stimulus, such as the passing overhead of a female—or even without extraneous cause—the male drops to the ground, and, lying far forward on his breast, shuffles the body and scrapes energetically with the feet, which, if sufficiently near the observer, may be seen in rapid motion. At short intervals the tail is spasmodically bent downwards, the action corresponding with energetic

foot-work. Rising again in a few moments, the bird commences to pluck from the soil stubbles and roots, jerking them backward over the shoulder in a haphazard manner, careless whether they fall in the scrape or, which is quite as frequent, outside it. Thence he gradually steps forward, a pace or two at a time, continuing to pluck straws and dispose of them in the previous way. Later he may return to the same spot, and go through similar actions a second time. It is in this manner that the hollows or "false nests" are formed, and each male in the course of the days elapsing before mating makes a number of such, usually in groups of two or three together, in which he works at intervals daily; and it is in one of these scrapes that the eggs are ultimately laid. The female, so far as I have seen, does not initiate such scrapes on her own account, although she later helps to deepen and line one or two previously formed by the male. The exact situation of the nest is thus primarily dependent on the choice of the male bird—a condition of affairs somewhat unexpected.

It is of interest to note that the males show greater jealousy of each other when scraping than on any other occasion, and when two birds chance to be standing quietly near each other, nothing is more likely to bring about hostility on the part of one bird than if the other should scrape or attempt to do so.

While the formation of scrapes is of common occurrence in the absence of the female, the proceeding is much more energetic and repeated in the near presence of a bird of that sex, and it has an important *rôle* in the "courting" display of the species. In its usual form courtship takes the following course: On catching sight of a female bird, or when the latter chances to settle somewhere not too far away from his usual stance, the male approaches her by means of a direct and rapid run. On arrival he stops, and describes a half-circle close round her, his pose and gait peculiarly constrained and stiff; the head and neck are held out in line with the body, and the crest depressed. He then, without further pause, stalks off stiffly directly away from the female, and makes for his nearest scrape, into which he instantly drops. He works now with exceptional and prolonged energy, pausing only occasionally to pluck straws and grasses, and dropping them over his shoulder or by his side. Should

the female make no sign, and many days may elapse before she does so, the male finally leaves his scrape, and, stepping forward a little, renews his stubble-plucking, throwing them over his shoulder as before. He may then return to the scrape, or perhaps to another one, and repeat the performance, but he rarely again approaches the female at that period. Tiring at length of his prospective mate's unresponsiveness, he seeks outlet for his energy in song-flight, or in aerial encounters with another male. A slight variation of the courtship is when he approaches the female on the wing. In such a case, on settling close beside her, he momentarily takes up a very erect attitude, towering over the other bird, his breast-feathers puffed out to their fullest extent, and the long crest inclined forward. From this position he passes to the usual procedure. The female usually receives the advances of the male with seeming indifference, but at times indicates annoyance or distaste by a rapid retreat, even taking wing and passing to a distant part of the field.

Females occasionally evince considerable jealousy of each other, indicated in a manner similar to the males. On such occasions the two rival birds, settled near each other, sway their tails up and down rhythmically, and scrape slightly, plucking a little at straws. Ultimately one may rush at the other, and a short bout of brisk sparring ensues. Several times I have been considerably interested to observe such encounters between two females ended by a male bird rushing up and separating the combatants, and, not content with terminating the strife, he attacks one of the females, driving it to some distance, a mode of behaviour only witnessed under similar circumstances. On one occasion a male, which was courting a female bird, suddenly desisted to attack and pursue a second female at a little distance. The common aerial encounters and more strenuous ground struggles of the males are, however, not to be seen in the other sex.

About a fortnight after the commencement of courting and scrape-forming on the part of the males, and some three weeks before laying begins, the females at length begin to show some response to the hitherto ignored advances of the males, and what may be regarded as a sign on their part of acceptance of a mate is indicated in the following manner: On a male having

courted in the usual way and dropped into one of his scrapes at a little distance, the female gradually approaches the latter spot by short and indirect stages. On her arrival the male rises from the scrape and takes a step forward, adopting as he does so a curious and striking pose. Keeping his back turned towards the hen, now very close beside him, he slowly lowers his bill to the ground and raises his tail almost perpendicularly in the air, his richly coloured under tail-coverts thus prominently displayed. The female now settles in the scrape, and goes through the usual actions of the cock when in that position, working with feet and body, the tail depressed at intervals in spasmodic fashion; but at first her motions are more leisurely, and lack the intense energy of the male. Several minutes may be passed by her either in the prosecution of these activities, or in sitting quietly in the scrape. During this interval the male retains his remarkable uptilted attitude, standing a yard or so in front of his mate, employing himself in the collection of nest-material, which is jerked backwards over the shoulder in the direction of the scrape. When the female later quits the scrape, moving off leisurely a short distance, the male usually returns to it and renews his previous labours. At times the hen fails to respond to this second invitation, but she may, on the other hand, once more approach the scrape, when the former scene is again enacted.

It is somewhat curious to note how the male, on all such occasions, or when scraping near a female, takes pains to maintain his back to the view of his prospective mate, and that this position is not mere accident is shown by his occasional scraping or standing in such an attitude with his back to a strong breeze—a position of discomfort avoided by all birds under normal circumstances.

Such a scene as this, of male and female working in turn in the same scrape, may take place with the same pair of birds at not infrequent intervals during a single day, and it is nearly always terminated for the time being by the retiral or loss of interest of the female. On the lapse of a day or two thus spent the scraping antics become less frequent, and the two birds are content to remain quietly in each other's company, usually at no great distance from the scrapes. For frequent short intervals both may disappear to feed on some recently

worked neighbouring field where food may be abundant, or the male to engage in song-flight excursions and harmless aerial encounters with other males, but sooner or later both return to the chosen ground. On the occurrence of coition, however, which first takes place a few days before egg-laying, a renewed activity is shown. Immediately following this rite the female proceeds straight to the scrape, and works in it with energy and thoroughness hitherto unequalled, the male frequently taking his place in a neighbouring scrape. Between her bouts of energetic foot-work the female plays with stubbles, jerking them over her shoulder. Exceptionally she so behaves when standing facing the scrape, thus dropping the nest-material in a direction contrary to the right one. In all their nest-building activities, in fact, both sexes behave in a strangely haphazard way, as though quite unconscious of what they are about. Since it is somewhat difficult to believe that the scanty lining which the nest-hollows receive can be of any practical utility to the species, one is tempted to regard the proceeding as possibly a degenerate survival of what was once a more perfect nest-building instinct in the earlier history of the race. On the other hand, it has been suggested that natural selection, acting on such rudimentary activities, may so develop the nest-building art; but it is not easy to understand what scope natural selection has in the present instance.

In the absence of her mate, the female shows her dislike or distrust of the approach of a strange male by running from his unwelcome advances, even taking wing to avoid him. Such encroachment rarely occurs during the presence of the legitimate male. The bird in possession, in fact, enjoys a strong moral advantage, which is seldom overcome. I have noted no serious attempt by unpaired males to forcibly deprive a male of his mate.

From the facts available it would appear that the scrape used by the female after coition is the one which is destined to contain the eggs; in some cases, at least, this is certainly the case, and it is probably the general rule.

When an egg has been deposited, I have seen the male proceed to the nest as though with the intention of scraping, but on reaching it he contented himself with standing erect over it, moving his tail gently up and down, and plucking at

straws. This latter habit persists throughout the period of incubation, but is principally displayed by the male. Apparently he does not attempt to sit on the eggs until the clutch is complete and incubation commenced by the female, but immediately thereafter he undertakes his full share of the duties.

In a general review of the habits of the Lapwing in the pairing season, the following would appear to be the salient points:—

1. Some males (and females) are considerably earlier than others in the initiation of pairing instincts (the earliest scrapes being formed in February).

2. Each male occupies a more or less definite area of ground, in which he passes much of his time, and in which he forms a variable number of "false nests."

3. Aerial encounters between two males are of incessant occurrence throughout the season, but these encounters appear to lack seriousness, and frequently bear the impress rather of play.

4. Ground struggles, where one bird persistently attempts to drive a rival off disputed territory, are not uncommon, but are less prominent than the last.

5. There is some evidence to show that the females are numerically inferior to the males.

6. The male does not attempt to secure a mate by forcible means.

7. Other things equal, the male which is most active in courtship is probably most likely to secure a mate.

8. After courting a female, a male repairs to a previously-formed scrape, and the first overt sign on the part of the female of acceptance of her mate is indicated by her following the male to the scrape and working in it.

9. On a male having obtained a mate, no serious effort is made by unpaired males to forcibly deprive him.

10. The female deposits her eggs in a scrape originally formed by the male.

On the evidence one may perhaps venture so far as to suggest that the female has considerable scope for choice in the selection of a mate. What directs her choice (supposing such to be employed) and what effect such discrimination may have on the species are problems apparently insoluble by observation in the field.

THE BIRDS OF THAT PORTION OF THE NORTH-EAST COAST BETWEEN TYNEMOUTH AND SEATON SLUICE, NORTHUMBERLAND.

By J. M. CHARLTON.

(Continued from p. 218.)

GOLDEN ORIOLE (*Oriolus galbula*).—One of the two specimens recorded for Northumberland by J. Hancock was a female killed in a garden at Tynemouth in the spring of 1821. This is recorded by Selby in his Catalogue, and, as is stated by J. Hancock, is probably the bird that is in the Hancock collection among the birds from the old museum.

GREAT GREY SHRIKE (*Lanius excubitor*).—A rare migrant. I know of six birds recorded for the district. A male was shot by John Laws, Jun., at Cullercoats in 1871, and is now in the Hancock Museum. Two were shot in about 1890 by Mr. John Ewen. Two more were observed by my brother and myself in the fields behind Whitley and close to Whitley Dene on April 14th, 1904. They flew from the sea chattering, and settled on a tree near us, after which they flew on inland. They had evidently just arrived, although this is an unusual date for them to do so, for this species has not been known to breed in England. Possibly they were making for the west coast, and thence north. Another was shot in Holywell Dene in 1900.

WAXWING (*Ampelis garrulus*).—A very rare visitant. The only record is of a pair in fine plumage which were shot near Earsdon on Feb. 8th, 1848 (Zool. vol. vi. p. 2064), and recorded by T. J. Bold. In the following year nineteen specimens were captured in South Durham, and there was a considerable irruption of these birds on the north-east coast at that time.

SPOTTED FLYCATCHER (*Muscicapa grisola*).—An uncommon resident during spring and summer, but more often seen while on migration in spring and autumn. It breeds in Holywell Dene.

PIED FLYCATCHER (*M. atricapilla*).—A rare spring visitant. Mr. R. Duncan tells me that he was once informed by Mr.

Hancock that he had shot a Pied Flycatcher near St. Mary's Island, and on going to pick it up found he had shot a Wryneck also. Very probably this would be in April, 1833, the date on which the only Wryneck which Hancock records for the district was shot. Mr. C. M. Adamson, in his 'Scraps about Birds,' states that a male in his collection was shot at Briery Dene on April 23rd, 1870; it was very tame, flitting from bush to bush before him. Mr. Richardson tells me he has set up several, got between 1900 and 1904.

SWALLOW (*Hirundo rustica*).—Arrives in fair numbers, but seldom breeds here. The average date of arrival is April 29th. My brother observed two young birds on the cliffs just north of St. Mary's Island on Nov. 1st in 1905; and on Nov. 13th in 1909 an adult was seen near the same spot; both of which are very late occurrences. Occasionally migration is to be observed in full swing on the coast as the following extract from the 'Transactions of the Natural History Society of Northumberland, Durham, and Newcastle-on-Tyne' (New Series, vol. iii. part i.) by E. Leonard Gill, Esq. (Curator, Hancock Museum), will show: "on the coast between Whitley Bay and St. Mary's Island on May 1st, 1908, we witnessed what was evidently a migration flight in progress. All the morning small parties of Swallows were passing north up the coast, flying chiefly just above the banks. In contrast to their usual manner of flight, the steady and undeviating way in which these birds pushed forward towards the north was very striking. We saw at the same time a single party of Swifts, similarly flying directly north but at probably three times the speed of the Swallows. There were many other evidences of migration that morning at St. Mary's Island. Numbers of Wheatears and Pied Wagtails were about on the rocks, and we also saw a pair of Yellow Wagtails, a rather scarce bird in this district at any time."

HOUSE MARTIN (*Chelidon urbica*).—A fairly common resident, which breeds among the cliffs near the table rocks, Whitley, and also on suitable houses in the district. More common at migration time in spring and autumn; the usual date of arrival being April 23rd or thereabouts.

SAND-MARTIN (*Cotile riparia*).—Formerly a fairly common resident, but now only seen on migration. Up to recent

years they used to breed in the sand-banks north of St. Mary's Island. The average date of arrival is April 1st.

GREENFINCH (*Ligurinus chloris*).—A common resident; frequenting the several denes chiefly.

GOLDFINCH (*Carduelis elegans*).—It has occurred at Holywell in winter among flocks of other Finches, but only very rarely.

HOUSE-SPARROW (*Passer domesticus*).—A very common resident. A pair nested in the signal-bell box at Cullercoats Station in 1906, despite the continual noise of the bell. Mr. J. Wright informs me that an entirely white specimen with hazel eyes was procured at Whitley Station in 1900. An occurrence which took place in our garden at Cullercoats will show how the common bond of species is more pronounced in this bird than in any other of the smaller kinds on the approach of an enemy. A party of five young Sparrows had come out of their nest, and in company with their parents were hopping somewhat gingerly along the garden-wall. Suddenly, however, one of them perhaps intoxicated by the unusual sights around him, lost his balance and toppled over into the road. I moved up to it, and having caught it, was about to replace it on the wall, when I suddenly found myself surrounded by chattering Sparrows. The mother had uttered a sort of hard squealing note of rage, and immediately all her neighbours in the district had assembled to aid her in protecting her young. She herself buffeted me in the face with her wings, and the rest flew chattering round my legs and head. They must have numbered at least fifty or more, and my friend Mr. A. King, who saw it, said that it was as if I had a swarm of bees buzzing round my head. Many of them actually pecked at me on feet and hands, and it was only after replacing the young bird on the wall that they disappeared as suddenly as they had come.

TREE-SPARROW (*P. montanus*).—Seldom seen except in autumn when numbers sometimes arrive from the Continent, but pass inland almost immediately. J. Hancock mentions that he has found it nesting at Whitley, never in trees, but in holes and coping-stones of old garden walls. But things have changed since then, and there are no such things as old garden walls. I have, however, observed a pair or two in recent years among the

disused lime-kilns in Whitley Dene, in which they appeared to be nesting.

CHAFFINCH (*Fringilla cœlebs*).—A resident, but not numerous. The local names are “Sheely” and “White Linnet.”

BRAMBLING (*F. montifringilla*).—An uncommon winter migrant; I have observed it during winter, but never in large numbers. I have not observed them later than February. The first records are three adult males in winter plumage shot at Cullercoats, Feb. 13th, 1860.

LINNET (*Linota cannabina*).—A fairly common resident.

LESSER REDPOLL (*L. rufescens*).—I only know of the occurrence of two individuals of this species, one of which I saw at Briar Dene on April 15th, 1904. It had evidently come to the coast preparatory to leaving for the Continent. The other I observed on Jan. 3rd, 1906, at the same place.

BULLFINCH (*Pyrrhula europæa*).—Of irregular occurrence in Holywell Dene and the surrounding district in winter.

CROSSBILL (*Loxia curvirostra*).—A specimen of this rare winter visitant was caught in Tynemouth Station in the winter of 1906. Two others, male and female, were shot in Holywell in 1909, the year of the large influx.

CORN-BUNTING (*Emberiza miliaria*).—A partial migrant; in spring and summer it is common, and breeds in the fields, but most depart in winter, going further south. During early spring the monotonous call of the male is to be heard from almost every hedgerow bordering the meadows. It is also very fond of singing from a tussock of grass, and I have counted as many as twenty males singing by the high road behind Cullercoats, within a space of half a mile.

YELLOW BUNTING (*E. citrinella*).—The Yellow Bunting is a very common resident. The local name is “Yaller-Yowley” (Yellow Howler). A hybrid between this species and the Reed Bunting was caught at Whitley on Jan. 30th, 1886, and lived in a cage at the Museum till June, 1887. J. Hancock thought this specimen a natural cross. It is now set up in the Hancock Museum. The coloration of this bird is as follows:—Crown and nape greyish olive with streaks of black, cheeks and throat sulphur yellow, of a more orange tint on lower part of neck; ear-coverts finely streaked by black up to eye; back and scapularies reddish

olive with large dark brown streaks; lesser wing-coverts brownish olive, quills and greater coverts dark olive-brown, the former edged by greenish yellow; tail dark brown, the inner webs of the two outer feathers white; feet pale yellow; breast greyish white with darker streaks on flanks.

[RUSTIC BUNTING (*E. rustica*).]—Mr. Duncan informs me that he saw one alive which had been caught near Seaton Sluice. He drew the attention of the late Canon Tristram to it, who, after examining it, confirmed his statement that it belonged to this species. Mr. Duncan compared it with a skin from Japan, where it is a numerous migrant, and it was proved to be an adult male. This was in the autumn of the year 1904, and the bird was afterwards exhibited at the Crystal Palace Cage-Bird Show in January, 1905 (*cf.* Zool. 1905, p. 279; Brit. Birds (additions since 1899), vol. i. p. 249). As some doubt has been evinced that the bird was caught at Seaton Sluice, I have included it in brackets. It was in the possession of a Mr. Slack, living at Winlaton, when Mr. Duncan examined it in December, 1904, and was a healthy bird in perfect plumage. Mr. Duncan examined it again in May, 1905, when he compared it with the skin from Japan, and with which it corresponded exactly. I am not aware what has become of the bird.

REED-BUNTING (*E. schœniclus*).—This bird is not uncommon, and breeds occasionally in Briar Dene. In early spring I have seen as many as ten of these birds together there. In winter they mix with flocks of Linnets and Yellowhammers.

SNOW-BUNTING (*Plectrophenax nivalis*).—An occasional winter visitant, formerly common, but owing to its constant persecution it haunts other shores. The first authenticated individual I can find is one which C. H. M. Adamson mentions in his 'Scraps' as being shot by him at Hartley as early as Sept. 21st in 1836. The local names are "Snowflake," "Snow-flight," and "Snow-fleck."

STARLING (*Sturnus vulgaris*).—A very common species both as a resident and migrant. Large numbers arrive from the Continent in autumn and depart again in spring. My brother procured a bird of this species on Jan. 31st, 1903, with an abnormally long and broad beak. Possibly it was a bird which had strayed from the Færoes, where these birds have large

beaks (Howard Saunders, 'Manual of British Birds'). These birds assemble in great numbers on the huge banks of seaweed washed up by the tide to the south of Curlew Point, St. Mary's Island. On lifting this seaweed up large numbers of insects are discovered, especially quantities of large white maggots. In the year 1900 a bird with a lot of white on it was often observed at Whitley, and another with white on the head kept caged for three years.

ROSE-COLOURED STARLING (*Pastor roseus*).—I have only one record of this bird for the district, and that lies on rather slight evidence, although I think that there is sufficient to allow its inclusion in this list. It is a specimen which was caught alive by someone signing himself "An Amateur Ornithologist" in the 'Newcastle Daily Journal' some time in 1870. He gave a full description of it, and said that the length was only six inches, and the crest very small. It is therefore to be presumed that the bird in question was an immature female which had just attained adult plumage, but was smaller than a mature bird.

MAGPIE (*Pica rustica*).—Formerly of very occasional occurrence at Holywell; now never seen.

JAY (*Garrulus glandarius*).—Has been observed in Holywell Dene up to ten years ago, but since then it has been unknown, owing to constant persecution.

JACKDAW (*Corvus monedula*).—Resident and migratory; I have frequently observed numbers passing north in April. This species breeds at Tynemouth Priory and in the adjoining cliffs. The following occurrence was mentioned in the 'Newcastle Weekly Chronicle,' May 21st, 1910, by "Charles Wain," Mr. H. S. Wallace: "A cunning Jackdaw watched two parent Thrushes leave their little citadel for some worms. This was securely placed high up on one of the girders of the roof of Tynemouth Station. The Jackdaw was in the act of raiding the nest when one of the 'grey birds,' prompted doubtless by the warning instinct of parenthood, swerved round and saw the threatening act of piracy. It communicated the fact to its mate, and the pair dashed back to their home. Then followed a spirited attack by the smaller birds on the Jackdaw. He soon began to get the worst of matters. So fierce was their onslaught that the daw was obliged to retreat, abandoning all thoughts of rapine.

Safety became his one desire. The thrushes, however, pecked at him and beat him with their wings till at length he was driven from the roof to the danger zone between the electrified rails. Here the buffetings were more vigorously maintained; not content with near at hand castigations, the birds in turn went aloft and drooped with bill downwards and rigid body, with the action and some of the force of a pile-driver, the lower bird holding the victim down the while. Then the bystanders intervened and rescued the stunned bird, and he was seen later in the day in a bedraggled condition, much chastened. He has been adopted by one of the staff at the station." A local name is "Jackjar." My uncle has observed Jackdaws pulling out the nests of Sparrows from the spoutings of the houses at Cullercoats to get at the eggs or young within.

CARRION-CROW (*Corvus corone*).—An uncommon winter visitant.

HOODED CROW (*C. cornix*).—An uncommon winter visitant, only passing on migration.

ROOK (*C. frugilegus*).—A common resident. Breeding in the vicinity of Holywell Dene. I have also seen them arriving on the coast in March, but only an odd bird or two.

SKY-LARK (*Alauda arvensis*).—A very common resident and migrant. I have noticed birds of this species singing while on the ground much oftener than in other districts. A light-coloured variety of this species was shot by Mr. Ewen at St. Mary's Island on April 4th, 1890, and is now in his possession. This is incorrectly termed a "Yellow Lark" in Mr. Tomlinson's book.

WOOD-LARK (*A. arborea*).—In examining some of the private notes of J. Hancock, I found that a specimen of the Wood-Lark was shot at Hartley Bates in 1876. It was shown to Mr. Hancock by Mr. H. Gemmell, of 13, Alexandria Place, Newcastle, in whose possession it then was.

SHORE-LARK (*Otocorys alpestris*).—J. Hancock, in one of his note-books, mentions that three of these birds were shot out of a flock of five by Mr. J. Robson, of Percy Street, Newcastle, on Oct. 26th, 1876, on the banks bordering Whitley Sands, near "Briar Burn." One was so much injured that it had to be thrown away.

[ALPINE SWIFT (*Cypselus melba*).]—In the middle part of November, 1910, C. Swan, Esq., of Cullercoats, when walking

along the banks at Tynemouth, saw a bird rise close before him which was undoubtedly a Swift, and had a white throat and belly, the rest of the plumage being brown. He informed my brother, and they went together to the Hancock Museum, where Mr. Swan immediately "spotted" this species as being that to which the bird he saw belonged. Although the evidence cannot be taken as quite complete where so rare a bird is concerned, yet it merits passing mention.

SWIFT (*C. apus*).—A resident in spring and autumn, breeding under the eaves of the Tynemouth Palace in small numbers, and also at Tynemouth Priory and Castle. This species is commonest in spring, when numbers arrive on the coast. The usual date of arrival is May 9th, but in the year 1908 Mr. Gill records a flock on May 1st. My brother observed one on Oct. 3rd; in 1903, on the same date, he observed a Fieldfare, and it is not often these two are seen on the same date.

NIGHTJAR (*Caprimulgus europæus*).—An uncommon spring and autumn migrant. Mr. Richardson informs me that there is one shot practically every season. I know of occurrences in 1904, and August, 1910.

WRYNECK (*Ijnx torquilla*).—A very rare spring and autumn migrant. The only specimen I can find a record of was one shot by J. Hancock in the autumn of 1833 at St. Mary's Island.

GREAT SPOTTED WOODPECKER (*Dendrocopus major*).—A rare autumn visitant; one was seen on the farm of F. Wilson, Esq., Cullercoats, between Sept. 30th and Oct. 16th, 1903, and very frequently observed pecking at an old gate-post. Another was shot at Holywell Dene in 1904, and was set up by Mr. Richardson, of Seaton Delaval. Another was observed by the park-keeper and Noel Leeson, Esq., on several occasions, some time in January, 1910, at Tynemouth Park. It flew to and fro between Shields and Tynemouth Parks for several days. It was very tame, and allowed a close approach.

KINGFISHER (*Alcedo ispida*).—Occasionally met with in severe winters on the coast, and probably bred formerly in Holywell Dene, where it is generally to be met with now in winter. In his 'Scraps about Birds' Adamson mentions one that was killed at Hartley during the severe winter of 1844-5. It had been driven

to the seaweed-covered rocks and pools to feed at low tide. The slaughter that was carried on among these birds yearly is incredible. Mr. Richardson, of Holywell, tells me that during the year 1896 he had fifty birds to set up which had been shot in the district. A local taxidermist informed me once that he never had the "satisfaction of shootin' one o' them bonnie bords." Where the satisfaction comes in it is hard to conceive.

ROLLER (*Coracias garrulus*).—A specimen is recorded by J. Hancock as shot "some years ago near Earsdon," probably about 1854.

HOOPOE (*Upupa epops*).—An extremely rare visitant in September, of which I have but two definite records. One which is mentioned by J. Hancock was shot on the coast between Cullercoats and Whitley on the coronation day of King William IV., Sept. 4th, 1831, by Thomas Harvey, in company with J. Hancock. This bird was only winged, and Hancock says he had the opportunity of seeing it alive, and of observing how the feathers on the crest were arranged when erected. This specimen is an adult male, and is in the Hancock Museum. A second example was shot by Mr. Ewen at St. Mary's Island on Sept. 30th, 1878, and is in his possession. It was stuffed by Bates, of Newcastle-on-Tyne. Mr. Hancock once informed my grandmother, the late Mrs. T. Vaughan, that one day, while walking on the banks at Cullercoats, he had flushed five birds, which flew straight away, and proved to be Hoopoes. I should probably say that this would be on the occasion that the bird he mentions was shot.

CUCKOO (*Cuculus canorus*).—An occasional visitant on migration in spring and autumn. A bird of this species was caught in the 'Huddleston Arms Hotel,' Cullercoats, while it was being repaired, about 1897. It had probably just arrived, and was much exhausted. This species seems to wander south early in summer, as my uncle observed several passing down the coast between June 20th and 25th, 1911, during the prevalence of north-east gales.

(To be continued.)

NOTES AND QUERIES.

MAMMALIA.

The Lesser Shrew in Yorkshire.—Referring to Mr. George Bolam's note (*ante*, p. 276), I think it wise to add a few words on the status of this small mammal, lest it may be considered to be much more numerous in this district than it really is. Although Mr. Bolam may have taken "upwards of a dozen" specimens during the last two years in the neighbourhood of Ilkley by persistent and often by almost daily trapping, it is really a rare animal here, more especially compared with the extreme abundance of its congener, the Common Shrew, or even with the Water Shrew. I can state this from my own experience, both in Wharfedale and in Airedale; in fact, I gave up systematic trapping chiefly from the havoc I wrought amongst the innocent Common Shrews. It became nauseous to me to turn out two or three of their dead bodies each time that I visited my traps, and I only took one Lesser Shrew during the whole time. For the past eighteen months Mr. Bolam has promised to catch a Lesser Shrew for me, but has only sent in such common things as Field-Mice, Voles, and Shrews, although I am aware that he has sent three Lesser Shrews to the Keighley Museum during that time. Mr. Bolam is scarcely accurate in saying that previously only a single specimen had been obtained in the "immediate neighbourhood of Ilkley" (*viz.* at Bolton Abbey, six miles away), because during the last three years I have examined specimens from Addingham and from Denton, neither place being more than two miles from Ilkley.—H. B. BOOTH (Ben Rhydding).

AVES.

Swallow's Curious Nest.—On July 24th I was punting up Speeney, a tributary of the old River Chelmer (now Chelmer and Blackwater Navigation), between Beeleigh and Ricketts Locks, with my son and daughter, when I found a nest in the outside branch of a pendent maple-tree hanging over mid-stream, over twenty feet from each bank. It looked like that of a Thrush, but I was surprised to find in it four Swallow's eggs of the usual spotted type, and both parent

Swallows were flying round, crying loudly. The nest was of the usual hard mud, lined with fine hay and feathers, quite round and deeply cup-shaped. There is no building within a radius of six hundred yards. When my two sons went to photograph the nest on August 5th there were four young birds in the nest, doubtless the second brood. This abnormal nest greatly resembles the vignette in Yarrell's 'History of British Birds' of one in a sycamore overhanging a pond at Penshurst, eighty years ago.—EDWARD A. FITCH (Maldon, Essex).

Decrease of the Corn-Crake and its Cause.—The present summer must be reckoned a "Corn-Crake Year" for Lancashire, at least, for there the birds are commoner than I have known them for many seasons; at Tandle Hill, between Middleton and Rochdale, I noticed five in ear-shot at once within a radius of a hundred yards on June 19th. Seeböhm says that Corn-Crakes are most numerous in wet seasons, but this is certainly not true for the present summer. Three-quarters of a century ago Dr. Skaife discussed (*Mag. Nat. Hist.* 1838) the well-known fluctuations of the Corn-Crake in Lancashire, and the question has occupied subsequent students in that county, as readers of Mitchell's 'Birds of Lancashire' will remember. I have elsewhere ('Lancashire Naturalist,' vol. iii. 286–287) offered an explanation that may be repeated here: in such places as the wilder parts of North Wales or the Lake District, where the bird is extremely abundant, the breeding grounds are frequently rough pastures that serve as admirable nurseries for the young. In haymaking districts like South Lancashire successful broods are rare, for the mowers invariably find and usually destroy the nests, and, as the Corn-Crake is a most unfortunate bird on migration, it is easy to understand how a local colony may become more than decimated, and a district lose nearly all its Corn-Crakes until a fresh stock is crowded in from the more favourable breeding grounds in other localities. I think I am correct in saying that "Corn-Crake Years" are purely local phenomena, and, although the birds are numerous now in Lancashire and Eastern Cheshire, it would not be safe to say that they are abundant in all other breeding counties.

This curious annual fluctuation has little to do with the disappearance of the Corn-Crake from the south-eastern counties of England. During the past two or three summers I have visited many parts of Essex, Middlesex, Herts, Bucks, Surrey, Kent, and Sussex, where it has been my luck not to hear a single bird, and I feel emboldened to add that the species is *quite* non-existent in summer

throughout the southern half of Essex. The literature of natural history abounds with notes relating to this state of affairs, but I shall content myself by saying that the contributors to the British Ornithologists' Union Report on Migration for the year 1907 are unable to record the Corn-Crake for Hants, Sussex, Middlesex, Bucks, Herts, Essex, and Suffolk—counties where in former years the bird was well known and even abundant. This deplorable change—although, indeed, some writers have commented as past victims of the sleep-disturbing voice of the bird, and have not mourned its passing—appears to date from about 1850, although the diminution was not generally noticed until a decade later. This alteration in the distribution of the bird can be, I think, ascribed to the change in agricultural methods that marked the early half of last century. I have no personal recollection of hearing a Corn-Crake actually in a corn-field. I have seen them driven out of the stuff at harvest time, but it has not been my experience to notice one in the breeding season in association with such a flora. I have met with them in marshes and in fields of rye, but not in wheat, barley, or oats. In many parts of the North of England “Corn-Crake” is not the native name, and if Rail or Land-Rail is not used one generally hears the creature spoken of as “Grass Crake” (with the puzzling pronunciation *Grey Shrake*), “Grass Drake,” or “Draker Hen”; and Mitchell gives the additional “Daker Hen” and “Draken Hen” for parts of Lancashire. Here the bird is a true “Grass” Crake, and not a “Corn” Crake, and I fancy we have in these names a hint at a solution of the problem.

If I have read the local ornithologists aright, the Corn-Crake formerly bred in the corn-fields of the southern counties. It does not do so now, because a modern corn-field is in many ways unfitted to be the home of breeding Corn-Crakes. Those who have watched or otherwise observed the quick and restless movements of the male bird can easily imagine its discomfort in a field lined with barriers of corn-stalks. To a man the corn-field of to-day may appear a safe jungle, but a child or a Weasel knows that it is really as transparent as a hop-garden. The Corn-Crake, above most birds, requires secrecy, and in a drilled corn-field this is not available. The nest could never be hidden, and the eggs or even the sitting bird would soon fall the prey of Stoat, Weasel, Rat, Hedgehog, Jay, or Crow. Under the old conditions of broadcast sowing the corn-field would be a real sanctuary, but I am unable to say of my own experience if the bird does actually nest in fields of corn where the drill has not been used,

for when I had the opportunity of investigating this point I had never thought of the matter in the present light. But here, no doubt, some other reader of 'The Zoologist' can supply an observation or two.

It seems to me that the Corn-Crake has disappeared from our southern counties because the drill has made the corn-fields quite untenable as nesting grounds, and as the meadows are unsafe for another reason, and the proportion of suitable pasture fields is inadequate as a reservoir (as I have explained in relation to the Lancashire stock), the bird has practically vanished from the avifauna as a nesting species.

I should like to add a little postscript, but I am tempted to make it a long one! The Corn-Crake says "crex, crex" about sixty-five times a minute, and will often keep it up for many minutes at a stretch. Once I decided to count how many times a bird uttered its note without a break, but after counting up to five hundred I got tired of the monotonous task and gave it up. I could hear it as I went upstairs to bed, and I reckoned it uttered at least two thousand consecutive calls before lulling me to sleep. A careful account of the physiology of the vocal organs of the Corn-Crake would be a valuable addition to the literature of birds.—FREDK. J. STUBBS.

Kite in Scotland, and other Notes.—I am very pleased to say that this rare bird can still be seen about fifteen miles from this town. On June 18th I had the great pleasure of seeing a very fine specimen. This bird has been observed by several people, but recently always alone, so I fear it has lost its mate. It is known that a gamekeeper fired at a Kite in April, but the shepherd tells me that he missed on that occasion. I have seen the keeper, and he says he is aware the bird chiefly feeds on young rabbits, and that he does not molest it. Still, it is strange how they have diminished in numbers. The "Gled," as it is locally called, came here about six years ago, and at first succeeded in rearing young. After that two pairs could be seen flying about, but in two recent expeditions I have only succeeded in viewing one bird. The Buzzard is unknown in this district, but the Peregrine can still be seen, despite the most shameful treatment meted out to it by six gamekeepers always on the watch. A pair nested on the Basta (or Bastard) Rock in May, but the keeper shot both old birds and destroyed the young. He also raked a Raven's nest near the same place, but failed to destroy the old birds. I have seen several Ravens about, but know of no nests. Another pair of Falcons nested on the west coast of Kintyre. I saw the two remain-

ing eggs, but one young one just born died as the keeper shot the female. The tiercel then disappeared, but was back again in two days with a fresh partner. I saw these two fine birds. The question is: Where do the Falcons go for their second partners? The local people say Ireland, as they seem to think the Kintyre birds have communication with the Irish. The second pair I saw were wild, and had not then commenced to nest. No Peregrine nested at the Mull this year, although two did last year. The keeper could not get at them, but he adopted this very effectual means of frightening them away: he put a dummy man on a pole and hung it over the nest. The birds deserted. The Merlin is now rare, or comparatively so, in this district. I know of two pairs which were destroyed. One had six young, which also paid the penalty. We have two Terneries close by. The graceful little birds can be seen flying about and diving in Campbeltown Loch and at Machrihanish throughout the summer. An Osprey was seen flying over Castlehill Loch here last spring, and managed to escape, and two years ago a Hen-Harrier in the brown plumage was trapped on the Laggan, just above Machrihanish Golf Links.—H. P. O. CLEAVE (Campbeltown, N.B.).

Notes on Nest-Boxes.—We have had during the past year in our nest-boxes, &c., the Great Tit, Blue Tit (several of each), Coal Tit (one), Nuthatch (one), Tree-Sparrow (many), House-Sparrow, Starling, Tawny Owl, and Stock-Dove (several). The first nest of the Nuthatch was spoiled by Tree-Sparrows after the first egg was laid, but the birds built again in another box. The Tawny Owls returned to the church-tower for the fifth year in succession, but only two eggs were laid, of which one was addled. After the owlet had gone I found a Mole in the nest. Another pair used a nest-box close to the house, and reared a brood of three. One of the owlets after leaving the box sat for a whole day almost motionless on a low bough of an adjoining yew. I have not seen a Redstart or heard a Wryneck this year, but Nightingales have been very abundant. Other summer migrants have returned in about their usual numbers. On July 12th I put up a Nightjar from the sand near Southwold, not more than a hundred yards from high-water mark, and found two half-grown young. There are many acres of bracken, &c., close by, and it is, I suppose, possible that the bird may have been disturbed, and moved either her eggs or small young to another place. On this subject Mr. Norgate has some interesting remarks in a Nightjar article in 'The Zoologist' for 1884 (p. 89). The only Cuckoo's egg I have seen this year was one I found with no other egg in a Robin's nest in an

ivy-wall on May 24th. Two days before the nest had contained one Robin's egg, and, as the owner seemed to have deserted, I took the Cuckoo's egg, which was a very good example of the dark brown type. Four days after the Robin returned, laid four more eggs, and hatched them off safely.—JULIAN G. TUCK (Tostock Rectory, Bury St. Edmunds).

A Protest.—Mr. W. H. Parkin, by putting the fourth line of his note (*ante*, p. 278) in inverted commas, makes it appear as if he were quoting my words. I am greatly surprised at this misrepresentation of the views I expressed.—O. V. APLIN (Bloxham, Oxon).

I AM planning a bird photography expedition for next year, and should be extremely obliged for information as to whether Iceland or Norway would be likely to give the better result in a six weeks' trip. If any readers of 'The Zoologist' care to give an opinion I should be grateful.—FRANCIS HEATHERLEY ("Endellion," Rock Ferry, Cheshire).

NOTICES OF NEW BOOKS.

Annual Report of the Board of Regents of the Smithsonian Institution for the Year ending June 30th, 1909. Washington, 1910.

THIS annual volume has only recently reached our hands, and in its "General Appendix," or reprints of selected scientific memoirs—not a few of them translations—from many sources, and written by authors of different nationalities, are comprised several papers of great interest to zoologists. We can only mention a few of them. Prof. Glangeaud's memoir on "Albert Gaudry and the Evolution of the Animal Kingdom" is translated from the 'Revue générale des Sciences,' Paris, 1909. This great evolutionary palæontologist and the work he did is well summarized by Prof. Glangeaud: "By the depth of the problems which he studied, by the influences which he exerted, and by his theoretical conceptions, Albert Gaudry stands with Lamarck. But he is also, in virtue of his remarkable observa-

tions, the Darwin of the vanished faunas, and his name should shine side by side with the names of these illustrious scholars." Another memoir translated from the same source is "The Instinct of Self-concealment and the Choice of Colours in the Crustacea," by Romuald Minkiewicz. The author rejects the proposed phraseology of "active variable mimicry" as being to his mind too anthropomorphic, and prefers the "new expression, instinctive synchromatism." This publication is suggestive to the last degree. Two papers of interest to speculative ornithologists are "The Origin and Development of Parasitical Habits in the Cuculidæ," by C. L. Barrett, reprinted from the 'Emu'; and "Some Remarks on the Protective Resemblance of South African Birds," by A. Haagner, reprinted from the 'Journal of the South African Ornithologists' Union.' "Recent Discoveries bearing on the Antiquity of Man in Europe," by George Grant MacCurdy, of Yale University, appears to be an original contribution—at least, no reference is made to an earlier or other publication—and is an excellent and well-illustrated *résumé* of the latest discoveries and conclusions on this vital subject. We have only mentioned these papers, but there are more appertaining to our science, and we may well welcome and value annual volumes that always draw our attention to important memoirs which might perhaps be sometimes overlooked, and, what is much more, are reprinted, and translated when necessary, in their pages.

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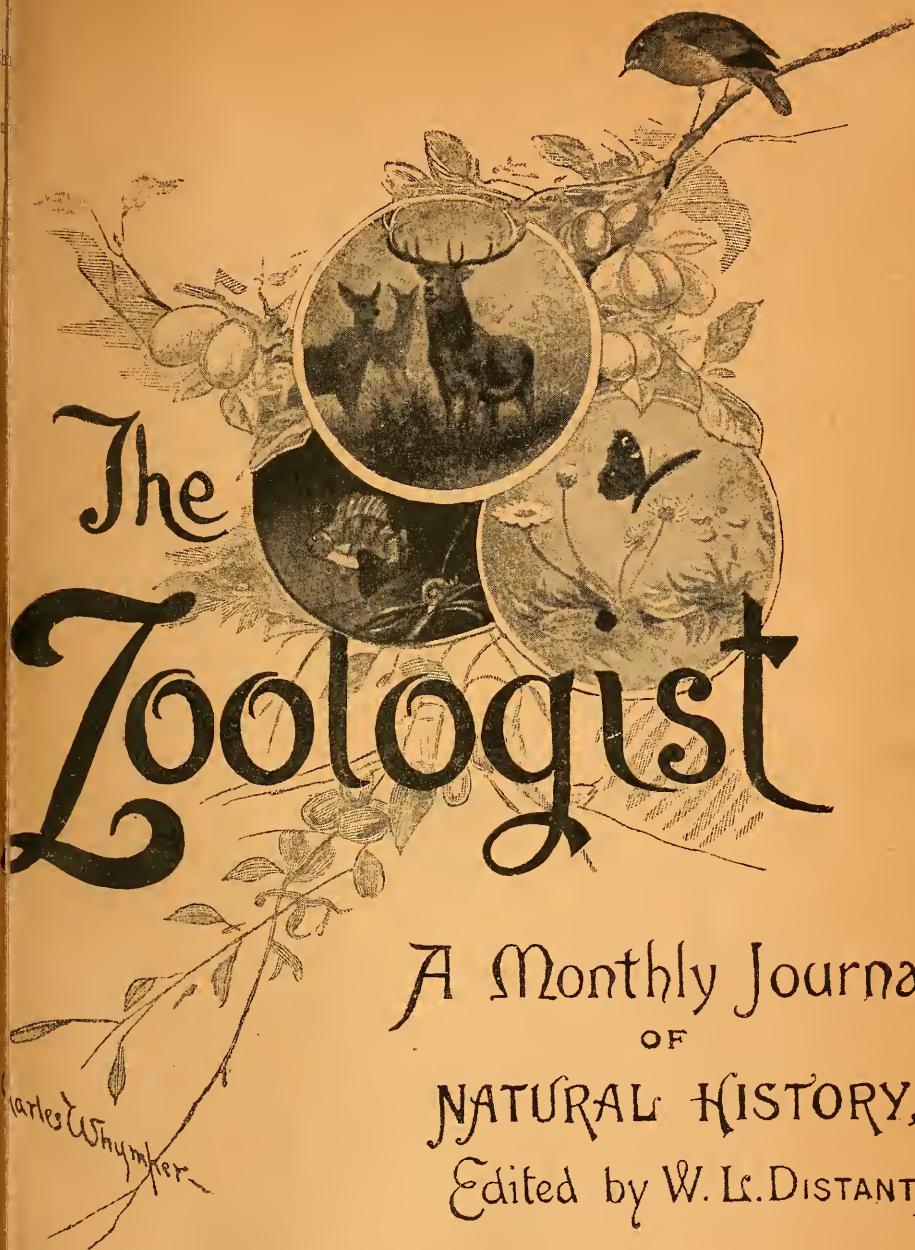
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FEMALE RAVEN AFTER FEEDING YOUNG.

THE ZOOLOGIST

No. 843.—September, 1911.

THE RAVEN AT HOME.

By FRANCIS HEATHERLEY, F.R.C.S.

(PLATE V.)

DURING the autumn of 1908 my friend, H. Earl, explored a likely locality and visited several sites, the points to be determined being accessibility and aspect. He reported on his return that the best site was a nest in a cliff beside a stream. The cliff had a bay in it, and the nest was in an alcove towards the top of the cliff. The hiding-tent could be erected on the other side of the bay just opposite the nest, a little above, and within twenty-five feet of it. The sun reached the nest about midday. He had obtained necessary leave from the landowner's agent, and had made friends with neighbouring shepherd and keeper, who promised to write in the spring.

At the end of March, 1909, we received news that our Ravens had two chicks and two eggs on March 20th.

Owing to the exceptional advantages this site seemed to promise for watching the domestic habits of the birds, I induced E. Selous to join us, and on April 7th we met. As Earl had reported that he could see no means of fixing the camera near the nest, I took with me a heavy platform, which could be slung for the camera from the top of cliff. The weight was intentional in view of prevalence of gales, but the only result was to bring the excess luggage charge up to eighteen shillings.

Whilst having supper at the inn, I asked the girl who waited on us if she knew anything about our Ravens. She told us that

a man was saying in the bar that the nest had been broken up and the birds carried off by some men on the previous Sunday.

April 8th.—Found our way across the fells and caught the shepherd at dinner. He told us that the birds were quite safe, but that the previous Sunday some men had tried to get them by breaking up the nest with a long pole. The young had fallen during the night to the foot of the cliff, where he had found them in the early morning, and he had climbed up and placed them in an old nest lower down than their own, and which, probably owing to its accessibility, had not been occupied during recent years. He took us to the nest, and told us that to the knowledge of his family the cliff had been occupied every year for the last century. He also said that they had no enmity towards the Ravens, as they only attacked dead or dying sheep and lambs, that they were not as harmful as the Carrion-Crow, and that the young were fed on sheep's placenta and carrion, of which latter the Ravens made hidden stores, which his dogs occasionally nosed out. Presently we caught sight of one of the birds soaring up over the edge of the cliff, soon joined by its mate, and then as we got nearer I heard for the first time the hoarse bark with which I was to become so familiar.

The nest from which the young had fallen was not in the alcove, as described by Earl, but in a dark chasm in the angle of the cliff—a much more difficult site; so that the marauders had done us a good turn. The shepherd told us that, although the alcove was a favourite nesting-site, as it could only be got at with a ladder, yet it was very exposed to gales, and he had known the nest to be blown out bodily. The young lay flattened out in the nest, each with a timorous wide-open grey eye cocked up at us.

The present nest was well situated for photographic purposes, but badly for watching, as the only site for the tent was about one hundred feet away and below the level of the nest, so that only the edge was visible.

Selous thought that to ensure the safety of the young the nest had better be watched day and night, and proposed watching the first night; so in the afternoon we hired a man to cart the tent and bedding to the cliff. We put up the tent, and, after covering it with heather, left Selous in it at 6 p.m.

9th.—Earl released Selous at 9 a.m. He reported that ten

minutes after we left him one of the old birds flew into the alcove and watched the young for a few minutes, but did not go to the nest. At nightfall three young men with a little white dog appeared, and, standing by the tent, had discussed how to get at the birds, but when about to put their plans into execution had been much startled by Selous entering into conversation with them. They silently glided away. He said the old roosted away from the nest, and did not come on to it all the morning, although the young were pitifully crying for food. They went down to the shepherds, and, procuring some hard boiled eggs, gave the young one each. Owing to the scared condition of the birds it was decided to keep away from the nest, and watch over their safety from a distance. Selous, watching from the opposite side of the valley, saw the old feed the young by regurgitation. I cannot help thinking that their scared condition is in part due to Selous relying too much on the diurnal habits of the bird, and that coming out of the tent and burning an acetylene lamp inside may have had something to do with it.

In the evening we had an animated discussion about the raid. As usual, the landowner's and shooting tenant's interests are in opposition. Earl was very much against a complaint being made, as it would arouse the gamekeeper's enmity, but Selous and I held that, as the landowner was anxious that the birds should be protected, and as our permission came from him, it was clearly our duty to warn his agent, as we had nothing to do with the shooting tenant. So I wrote, and after that the fat was in the fire. The police easily traced the men owing to their little white dog. They were miners intent on getting ten shillings each for the young birds. The gamekeeper was very angry, but we afterwards placated him by photographing himself, his dogs, and his tame Raven.

10th.—Selous started after breakfast to watch the nest from opposite side of valley. Earl and I followed later, as the sun did not reach nest until midday. Owing to scared condition of the birds we did not think it wise to start operations near nest, but to take a few photographs from the tent. Earl left me at 1.55 p.m. At 2.10 p.m., after a gentle croaking in the air, I saw the shadow of the old bird pass across the sunlit cliff. Immediately the two young birds stood up, shouting and showing their crimson

gapes. Presently the shadow swept across again lower down, and the old bird sailed noiselessly on to the deserted chasm nest. She stood there anxiously peering down at the young, looking as glossy as black satin, and as she peered down the grey third eyelid kept flashing across her eye. I think it must be darker than that of the Hooded Crow, as it does not seem as marked a feature. After a time she sailed down on to a burnt-looking patch of grass almost on a level with the nest, and after some hesitation glided on to the nest, and amid a tumult of flapping wings and half-choked cries she fed both the young by regurgitation, flying off a few seconds later with a piece of white excrement in her beak. The young kept up a continual clamour until she had made five or six visits in fifteen minutes, each time carrying excrement away when she left them.

I have been surprised since my return from this expedition at the number of times I have been asked if the Raven's nest was very foul. As a matter of fact, the Raven, like the Hoodie, keeps the nest scrupulously clean, and the young are quite free from vermin. The myth to which this idea can be traced is mentioned by Isaac Walton, and is quaintly put as follows:—“For a certain annotator saith that the young Ravens while as yet they are unfledged do appear of whiteness, and therefore are neglected of their parents, as if they were bastards, seeing that they resemble not their colour. At which time Divine Providence, who nowhere sleepeth, doth feed them that call upon Himself. For he causeth certain vermicles [small worms] to be bred in the little nest, by eating of which they are sustained, until at length on the ninth day, the feathers beginning to grow, they resemble the colour of their parents, and so come to be nourished by them” (Louis of Grenada). As Reg. B. Lodge points out, the foul nest with “vermicles” was probably that of the Kite. The male also fed the young, but not as frequently as the female. Selous agreed in identifying female by one of the secondary feathers being missing from her left wing. Although the male did not often feed, he frequently watched from the alcove site. The young were fed nine times between 2.10 and 4.30 p.m. At 4.50 one of the old birds, which had been standing preening itself in the chasm site, flew away uneasily, and a few minutes later Earl and Selous relieved me.

Before leaving we wrapped some heather up in a mackintosh, making a bundle about the size of a camera, and fixed it with tripod about twelve feet from nest to act as a dummy camera, covering all with heather.

11th. — Heard Raven's croak through open window in early morning. Walked to nest after breakfast. In crossing moor found Grouse-feathers where there had evidently been a kill (?) Peregrine. Got into hiding-tent at 12.30, raining and blowing hard.

At 12.45 female flew into alcove; this is a recess about six feet wide, with an arched top, and filled with old dead heather-stems. She shook herself, and then crouched in the recess. Presently she hopped and walked to the edge, where she stood whilst the wind ruffled up her neck- and breast-feathers so as to show the bare skin. After looking down anxiously many times, as if in painful uncertainty, she hopped and walked along the ledge towards the nest, the wind from behind often nearly taking her off her feet. After more anxious peering and hesitation she launched out on her sable pinions, and with her primaries stretched out like fingers she slowly floated down on the wind, balancing herself with straightened legs and outstretched toes. With little side tilts and turns she floated down past the nest, right down to the foot of the cliff. Just as she seemed about to alight, she floated right up to the top of the cliff, coming down again slowly along its face with one wing nearly grazing it. Then, just as her outspread toes seemed about to touch the ground, she soared away into the valley out of sight. In a few minutes she appeared again in the alcove, and the performance was repeated. This time she did alight at the foot of the cliff, and her actions were explained when I saw both the young rise up from the grass, crying and showing their crimson gapes. After feeding one bird with some crimson stuff which we afterwards identified with sheep's placenta, she floated up into the air and soared away. Within a couple of minutes she returned, and then the male joined her, both sailing up and down the cliff as if drawn up and down on invisible wires. Often one was coming down as the other was going up; the male looked like a gigantic Chough, his beak all gory with what he carried. Within ten minutes

each of the young had been fed four or five times, until they could hold no more.

When Earl and Selous came shortly after 1 p.m., as it was very evident that the dummy camera had frightened the old birds and so led to the young climbing out of the nest to be fed, we made it less bulky, and, after putting the young back into the nest, built up the edge more securely. There was no lack of building material, as all along the foot of the cliff was a layer of dead heather-stems, in some places six inches deep.

Earl left me about 2 p.m. Fifteen minutes later the female settled in the alcove. She croaked several times, as if calling the male, then soared round and flew away. Presently she was back again in the alcove, and was joined by the male. He had something in his beak, and she crouched facing him, and, opening her beak, passed the lump, which looked like carrion fat. She pouched it, and, flying down to the nest, fed the young.

12th.—Selous watched the nest from dawn. Earl and I went to nest midday. Blowing a gale and raining. Found that the heather had blown off the dummy camera. Substituted camera.

13th.—Gale still blowing. Camera shifted.

14th.—Still blowing. Camera torn off tripod—all exposed to view, and rain; yet young in nest, and did not seem hungry. On way home saw Herring-Gull chase Grouse. Found on developing negatives that camera is not light-tight.

15th.—Found one of the young off nest; put it back, and took camera home for repairs. Looked in at the shepherd's on way home. They have three Geese sitting on eggs in kitchen; each is in a box about two feet square, and twice a day they are lifted out and allowed to go outside. In a few minutes they come back again, and are lifted back into their boxes. Also called at keeper's, and saw tame Raven; it is thirteen years old, and has one claw missing. Keeper says they often when young lose a claw through strangulation by wool in nest.

16th.—Stayed at home and repaired camera. Rain stopped in afternoon. Went for a ride. Never saw so many Curlews; counted eighteen feeding in a small meadow.

17th.—Rained nearly all day. Walked over to nest in after-

noon. Both young in nest; water running through it. Saw a Buzzard on the moor.

18th.—Bright, with occasional clouds; strong wind. Went to gamekeeper's, and wasted an hour trying to take a photograph of "Raaf," the tame Raven. It behaved like a semi-domesticated devil. In one of the cloudy intervals he walked past, surrounded by three black retrievers, snarling at him, whilst he was erect and watchful. Put camera up by nest. Earl left me at 2.20 p.m. At 2.30 female came to alcove site, but soared away again. Settled there again in fifteen minutes, hopped and walked along edge. Sharpened her beak on edge, flew to chasm site, and after peering anxiously at young soared away. She did this nine or ten times, gradually getting nearer the nest. Once when in chasm site she disgorged some lumps of placenta, and after thoughtfully turning them over swallowed them again. At last, at 4 p.m., she sailed on to the nest, and I took her feeding the young. She returned and fed them again at 4.8, 4.10, 4.12, and 4.18, each time flying straight on to burnt patch of grass before sailing on to nest. She does not put her beak so far into theirs now, and it is easy to see the lumps of placenta being passed. After the last feed she never came near the nest again before Earl relieved me at 6.30. Occasionally one of the young stood up at the edge of the nest and flapped its wings, as if trying them. Earl reported that when not at nest female generally took up a position on the opposite fell, near where Selous used to sit to watch the nest, and he several times saw the male transfer food to her there. He seems to do most of the foraging. I have not seen him go to nest since 11th.

19th.—Arrived at nest at 12.50. Whilst putting double back in, the wooden wedge to which camera is fixed came out of cliff, and whole thing had to be dismantled and put up again. Whether it was due to all this disturbance or not, the female only once came to alcove fifteen minutes after Earl left at 3 p.m. Left at five, as sky was clouded over. Rained all night.

20th.—Typical April-day showers and sunshine. Earl left early to keep old birds off nest, as it seems to us that they try to get feeding done when we are not there. I arrived at 12.15. Earl left me in tent at 12.30. At 12.35 Raven pitched in

alcove, walked about, turned round with difficulty owing to high wind. Went on to nest from burnt patch. At 12.43, as sun was shining, took her feeding young. Fed again at 12.47, 12.49, 1.9, and 1.15 p.m. Earl relieved me at 2 p.m. Changed plate, but Raven did not return before we left at 5.30. Saw male transferring food to female on opposite fell about 4 p.m. No bird on negative taken. What had happened was that when she fed them they were quite in the dark recess behind nest, and the tent being below level of nest, I could not see this.

21st.—Earl departed early, and stuffed recess with turf and heather to keep the young to the front. I followed later. Earl left me at 12.20. At 12.30 Raven flew on to chasm nest and peered down; young crying all the time. Then she soared away. Repeated this two or three times, and the last time got as far as the burnt patch. Twice she flew away from this. Once whilst standing there she momentarily regurgitated a piece of placenta, which showed red between her mandibles. Then three or four times she flew from the patch to the nest, and when just about to alight flew away. At last, at 12.45, she flew on to the nest, and I took her, and was sorry, as she had alighted quite close to camera and was out of focus. She walked on to the nest, and after feeding young croaked at the heather and flew away. It certainly does not take much to scare her. The male was close by, although I could not see him; both croaked loudly, as if annoyed. At 12.53 she flew on to nest, and apparently only fed larger of the two young. At 1 p.m. Earl returned, and I changed the plate, and he left me at 1.10 to return at 2 p.m. Female pitched on chasm nest at 1.15 and peered down. The young were apparently asleep as they made no outcry. She then flew away, and did not return till 1.50, when I heard her croak, and found her in the alcove. She looked towards nest and croaked, but young did not reply. She picked up dead heather-stems and dropped them over edge, and seemed annoyed. Then she suddenly cried out and flew away. Earl was within a few yards of tent. She had never let him get so near before. He says both birds made a great outcry this morning when he was blocking the recess, female flying about quite close. Once when he had to shift one of the young, and it cried out, she flew within eight feet of him, as if about to

attack. She then alighted on top of cliff and scolded him. He kept within range of nest to prevent her feeding them. As the sun was obscured and not likely to clear we went home.

22nd.—Spent most of morning trying to photograph “Raaf” and the dogs. Keeper says that our birds are old male and last year’s female. The original female was trapped last year. He also mentioned that when the old birds drive the young away in January, they pursue them for miles, and the outcry is considerable. Made friends with “Raff” by means of raisins and sweets. Seemed to pouch everything, and then hide it. Joined Earl at nest at 12. Earl left me at 12.20. Old bird in alcove at 12.30. Got as far as chasm and burnt patch, but not on to nest. Earl came at 1 p.m., the idea being to interrupt feeding if it took place, and enable me to change plates, as if once fed there is not much chance during rest of day. He noticed that the larger youngster had climbed on to top of heather, and against my advice tried to get it down into nest. He climbed up to dislodge it, when the smaller bird sailed off the nest down the hill, turning summersault and squawking at end. Earl went after it, and there was a great hubbub. Both old birds flew to its rescue, the mother flying round Earl a few yards from his head, but the male well in the background. By the time he got the youngster into nest the other had climbed down. Earl left me at 2 p.m.; immediately afterwards the female appeared on top of cliff, croaking loudly, but, although she spent some time at chasm, I was not surprised that she did not visit nest. Gave up at 4.30, as light was bad.

23rd.—Rained in morning, cleared up midday. Earl left me in tent at 2 p.m. At 2.10 young began to cry. Female made three or four false starts from alcove to chasm and burnt patch, but finally went on to nest about 2.13, and then flew off without feeding. Then between 2.15 and 2.30 fed young seven times. Took her in what ought to be good position. On Earl’s return at 2.30 found shutter had not gone off; leak in tube. As probably they would not be fed for some time, took some photographs of young. Then, as light was good and young seemed to be getting hungry, Earl left me at 4.45 p.m. Old bird back on chasm nest in a few minutes, and then fed young five times in twenty minutes, after which she cleared off alto-

gether. Took her feeding young. During day, when not engaged in preening, young have been exercising their wings. Each in turn backs on to edge of nest, and flaps its wings vigorously for some minutes. Only some of secondaries and tail-feathers show any quill. Third eyelid filmy, and not as white as old bird's. Saw one deliberately evacuate into nest to-day; as a rule they back to its edge. Female has not lately carried excreta away. She seems to feed the bigger one first, and keeps on bringing food as long as they cry. Saw female turn summersaults in air to-day and yesterday. Whilst flying round she closed left wing, and made complete turn sideways. Every afternoon lately a pair of Kestrels have come up the valley at the same hour. As they come past the nest the Ravens attack them, but, although they make terrific stoops, the Kestrels easily steer clear of each attack.

24th.—Rained all day.

25th.—Cleared up midday. Earl had gone early, and put up a large piece of white tape over nest to scare old birds off till we were ready. Earl left me in tent at 2.15. Old bird back in a few minutes. Very timid about going on to nest, although young crying loudly. When at last she fed them at 2.30 the sun had just become obscured. Earl came at 3 p.m. to see progress, but although I waited till 5.30 there was no more feeding. Although it hailed and rained at intervals during afternoon, the young did not seem to notice it, but went on with their preening and wing exercises. They do not sleep as much now. Saw some more nuptial antics to-day. Both old birds were on the opposite fell most of the afternoon. Once the male, after feeding the female, did a sort of ungainly dance before her; flapped his wings whilst facing her, and jumped up into the air three or four times; jumped up two or three feet. On another occasion they walked after one another, retreating and advancing until I did not know which was which. Then they stood facing one another with their beaks touching. They stood motionless like this for over five minutes. Selous, before he left us, said we might see nuptial antics towards the end of sojourn, as in those that have two broods the antics begin again towards end of first brooding; so antics may show at same time in these birds, although they have no second brood.

26th.—Cloudy. Sun came out at 11.30. Earl left me at 12.30. Beyond coming occasionally to assure herself that young were all right, the female did nothing all the afternoon. As it was clouding over I gave up at 4 p.m., but as there seemed prospect of more sun, I returned and got into tent. Shepherd on his afternoon round joined us, and had a look at young. Found one off nest. Earl put it back, and against my advice tried to get the other to come down off the heather at back. He and shepherd left me at 4.30. Both old continued to fly round, making great clamour, and female paid several hurried visits to chasm nest, peering down and flying off again. Earl returned at 5.30 to say that in trying to shift bird it flew out unperceived by me, was caught by wind, and blown up on to top of cliff. He says shepherd thinks that if we want any more photos we had better clip the young. He left it at top of cliff and walked with shepherd, to let things quieten down a little. On his return he tried to catch the young bird, but it soared out and flew down the valley, with one old bird on either side of it. So he came down and told me. We then sat down at a little distance, and watched the old birds. They visited a spot on a precipitous scree about a quarter of a mile down the valley, and at last, through the glasses, we thought we saw the young bird. So we went down to the spot and searched high and low, but could not find it. We then returned and took three inches off one wing of bird in nest, and then resumed our watch. Finally we came to the conclusion, from frequent visits of old birds, that youngster must be in a patch of heather on side of fell. Had nearly given up search when looking up I saw it in a small birch tree. Earl tried to get it, whilst I went to a point giving good outlook. Earl failed to get it, and it soared right across valley, and began to hop and walk up the fell. I stayed same side whilst Earl went after it. After a long time Earl headed it off, when it flew again to my side. Guided by signs from Earl, I got to it, and managed to throw my coat over it. Clipped one of its wings and put it back into nest. On way home saw male hunting round for youngster near where we caught it. Looked in at shepherd's. He was very surprised to hear we had caught young. Said some years ago the Duke gave a farmer permission to take a young bird. He turned up early one morning on

horseback, and just as he had made up his mind which of the four he would take they all soared out into the valley. Although no further advanced than ours, it was only at 7 p.m. that he looked in at shepherd's on his way home to say that it was only when he and the horse were nearly dead-beat that he managed to secure it about ten miles from the nest; so our three hours' job was easy in comparison. At Earl's suggestion the shepherd is to put a scare up by nest each morning on his way past at 5 a.m. to prevent young being fed before our arrival.

27th.—Earl left me in tent at 1 p.m., after we had taken down shepherd's scare, which consists of a kite's tail. Female, very shy of coming on to nest, stood on burnt patch with beak full of food, slobbered a lot of saliva. Young did not shout much. Twice saw them yawn during afternoon. Not fed.

28th.—Windy and cold; sun only at intervals. Snowstorm in afternoon. Earl took refuge with me in tent. Only fed once. Left at 4 p.m. Light bad. Fells all covered with snow.

29th.—Took down scare at 1 p.m. Old bird back in fifteen minutes. Fed young twice in three minutes. Sun obscured. As Earl was not due till 2 p.m., I thought I had better come out in case they got filled up. Couldn't find Earl, so went back into tent. She evidently does not mind me, as she was back in ten minutes. Unfortunately she hesitated long enough on the burnt patch for sun to go in. She came again, but after a long interval, and no sun. Thundered; went home in a snowstorm, with the largest flakes I have ever seen, all about the size of half a crown; going down a rough road with first one and then the other eye blocked was quite exciting.

30th.—Very cold, cloudy, but with fairly long intervals of sunshine. We have for some time thought that the female must keep a store of food near the nest, as the intervals would not allow of her going to male for it. This must be so, as Earl says that during last few days he could always tell when young were being fed, as on such occasions the male accompanies him wherever he goes, scolding him all the time. Female fed young at 2 p.m., and again in a few minutes; so I came out and changed plates, and, as she returned again in a few minutes, I took her again just as she stood still looking at them after she had fed them. This turned out to be the only decent negative

of the lot. After the second photograph Earl came round, and after I had changed plates he stayed in vicinity, because a snowstorm was coming up. Very cold inside tent, and by Earl's appearance not much better outside. When sun showed signs of coming out Earl went off. Although the sun shone for two hours, and the young shouted for food, neither of the old birds returned. Just before Earl left one of the youngsters flew out, and there was a great commotion whilst he caught it. When he came back he said that both the Ravens had pursued him across the moor for over a mile, both swearing at him, and the female at one time walking on the ground behind him not more than twenty feet away, cursing him volubly. The difference in size of the young is, I think, a sexual difference. The smaller has the higher pitched voice. Although voices of old vary according to excitement, being low-pitched when quiet, yet I think the male has the higher pitched voice of the two.

May 1st.—Before starting proceedings intended to photograph the young. Their beaks, which at first were flesh-coloured, are now nearly quite black; the pigmentation spreads towards middle from both tip and base; the base has strong bristles pointing towards tip. They are as large as the old birds, and only a few tail-feathers show quills. At no time have they quarrelled in the nest. Just when about to make the first exposure first one and then the other sailed off the nest, and flew up the valley, with the old ones accompanying them; so bringing our task to an end. The shepherd says that it is only for the first day or two that the old bird mothers them. He also states that he has known them to have six young, and that this would give us best opportunities, as they take quite a fortnight longer to reach maturity.

Before leaving us Selous pointed out that it would be interesting to get some explanation of the fact that in nearly all references to the Raven, either in the Bible or in fairy stories, it figures as an unnatural bird which does not feed its young. I think that, considering the difficulties we experienced, it may be concluded that the ancients, being without field-glasses or hiding-tents, found it hopeless to watch the old birds feed the young, as being both timid and wary they would not approach nest whilst conscious of being watched. The annual driving

away of the young could not fail to arrest attention, and would only confirm the impression of the old being unnatural parents. I think the annual driving away may explain how if one bird is killed it soon finds a mate. All those birds that have been reared there will probably look upon it as a desirable site, and will join if wanted. As to where the new bird comes from, there is no knowing how many unpaired birds there may be in the neighbourhood, for if a solitary Raven is seen some miles from the nest, the natural conclusion is that it is one of the breeding pair, but it might not be so.

As regards nuptial antics, I forgot to mention that a few days after the male's dance before the female I saw her do the same thing when alone.

Some weeks after leaving I heard from the keeper that our two young flew over nearly every day and joined "Raff" on the fell, making a great noise, which he did not seem to like.

I should very much like to mention the locality of this nest, as the alcove site could not be beaten as regards opportunities of watching, and the young could by means of a ladder be easily placed there. But so long as ornithology is infested by a number of born stamp-collectors who have missed their vocation, and who do ornithology more harm than any other of the bird's enemies, it is not wise to do so.

I may say for the benefit of those who wish to help in preventing the extinction of our rarer birds, that by scribbling all over an egg with a blue marking-ink pencil marks are made which cannot be washed off without obliterating the natural blotches of the egg. I recommend this as a slight measure of protection against those who have not outgrown the childish state in which the desired object to give any pleasure must be grasped, even if the grasping entails destruction.

I have often wondered why the Raven should breed so early, and cannot help thinking that the hatching of the young in the lambing-time is more than a coincidence.

After all I have seen and written, I yet think that the best description of the Raven's habits in a few words is, after all: "He giveth to the beast his food, and to the young Ravens which cry. For that their mother's heart is hardened, fearing a snare, she hasteth not; she will not be taken."

MISCELLANEOUS NOTES ON ZOOLOGICAL INSTITUTIONS RECENTLY VISITED IN EUROPE.

BY CAPT. STANLEY S. FLOWER, F.L.S.

(Continued from p. 295.)

7. LYONS, FRANCE.

(i) *Zoological Gardens.*

THE Zoological Gardens of Lyons form part of the beautiful Parc de la Tête d'Or, on the left bank of the Rhone, at the north end of the city. This park covers an area of just over 281 acres (114 hectares), and was laid out in 1857 by the landscape-gardener, M. Buhler. It may be divided into two parts: first, the lake of 42 acres (17 hectares), woods, lawns, and drives; and, secondly, the scientific side, containing the botanical garden, the palm-house (which is said to be 23 metres or 75½ ft. in height), the hothouses (including the *Victoria regia* house), the alpine garden, and the menagerie, which is grouped round the Observatory building near the centre of the park.

The whole institution belongs to the Municipality, and is open free to the public. M. P. Didier is the Director of the Zoological Gardens.

In comparison with most other gardens, the chief features of the Lyons menagerie that impressed me in the three visits I made to it in October and November, 1908, were, first, the large size of the paddocks for Ungulates; secondly, the large amount of running water; and, thirdly, that there was a label for every species of animal exhibited, giving the scientific and French names of the animal, and, where required, the name of the donor of the exhibit.

The menagerie contained about one hundred and fifty-five mammals, representing thirty-seven species (but this includes no fewer than sixty-eight individual Fallow Deer, *Cervus dama*), representatives of fifty-seven species of birds, two large Missis-

sippi Alligators, and a few small land Tortoises. The most interesting exhibits were a very fine and remarkable Syrian Bear, presented by Mr. Lortet, a Rhone Beaver, and three very handsome black Humped Cattle from Madagascar, presented by Mr. Grammont.

Of inanimate exhibits in this park attention may be called to the Erratic Blocks brought by prehistoric glaciers from the Alps or Jura Mountains to the neighbourhood of Lyons, and to the also prehistoric dug-out canoe, about 32 ft. (say, 10 metres) in length, found by M. Gobin in 1862 on the banks of the Rhone.

(ii) *Bidel's Menagerie.*

In October, 1908, I saw Bidel's Menagerie (which is said to have been founded in 1830) in the Cours du Midi, at Lyons. The collection consisted of nineteen Lions, two Tigers, four Leopards, three Pumas, two Wolves, one Polar Bear, one Black Bear, and a few Monkeys. The animals appeared very healthy and well cared for, and I found their trainer was the old Sudan traveller, Mr. Salvator.

8. MARSEILLES, FRANCE.

Zoological Gardens.

During 1908, 1909, and 1910 I visited these charming gardens on six or seven different occasions. Representatives of about fifty-eight species of mammals and ninety-four species of birds were usually to be seen. Of particular interest were a young Sooty Mangabey (*Cercocebus fuliginosus*), born here in 1908; a very handsome male Leopard from Yunnan (*Felis pardus fontanieri*); a pair of Water Buffaloes (*Bos bubalis*, var. dom.), with magnificent horns, which were led about the gardens by a keeper; three very remarkable Long-eared Goats from Mount Carmel, presented by Mr. Grandval; and specimens of the Seychellian Pigeon (*Alectroenas pulcherrima*).

9. MUNICH, BAVARIA.

Zoological Gardens.

The new Zoological Garden "Verein" of Munich, has its offices in the Kaufinger Strasse, 23 II., and 54 acres (22 hectares) of land on a sixty-year, rent free, lease from the city, on the

right bank of the Isar, just south of the Talkirchen Bridge over that river.

In May, 1910, Herr Ober. Lieut. Herman Manz, the President of the Society, kindly took me over this site, showing me the plans of the proposed buildings, enclosures, &c., which had been drawn up with the assistance of Prof. L. Heck and Dr. G. Brandes, and had been approved by the municipal authorities. The site appears to be an admirable one for the purpose. To the west is the Isar, "rolling rapidly," and double banks (with low ground between them to take water if necessary) have been made to prevent flooding the gardens when the river is swollen by the melted snow from the mountains. To the east is high ground dropping steeply into the gardens. This hill shelters the whole site from east winds, and a thick belt of trees along the river side shelters the site from west and south winds, and proposed buildings at the north end of the site will eventually also shelter the gardens from north winds. The centre of the grounds is meadow land, with a canal flowing through it from south to north.

Besides the fifty-four acres already appropriated for the Zoological Gardens, another piece of ground to the north is available for future extension, and it is proposed to use it for the establishment of an exhibition of domestic cattle.

The features of the site of the new Munich Zoological Gardens are:—

1st. Its picturesque position by the river, with fine views up the valley, ending in glimpses of distant snow-crowned mountains.

2nd. Its existing trees: well-grown old trees of many kinds. In planning the proposed buildings and enclosures great care has been taken to avoid in any way damaging these trees.

3rd. Its dells and woodland ponds, which will be utilized as enclosures for waterfowl, &c.

4th. The steep hillside on the east, with natural outcrops of rock, which is to be transformed into an alpine flower garden, with enclosures for Chamois, &c.

5th. The sheltered position of the central meadow land, where good paddocks can be made for Antelopes, &c.

6th. The abundant water supply. It is proposed to have large ponds for various aquatic mammals, as well as for birds.

7th. The fact that, owing to the configuration of the ground, and also to adjacent property belonging to the Municipality, the gardens cannot get "built in," or their appearance spoilt by houses being built overlooking them, as at Antwerp, Berlin, &c.

The site is inhabited by many wild birds, and the Society is putting up nesting-boxes, and doing what it can to protect and encourage the birds.

The proposed scope of these new Zoological Gardens is very ambitious; it includes houses for all wild animals usually kept in captivity, and also an aquarium.

10. NAPLES, ITALY.

The Aquarium.

I do not intend here to give any description of the world-famous Zoological Station of Naples (its imposing buildings beautifully situated in the park by the sea "Villa Nazionale," its library, rows of large and sumptuously fitted workrooms, its cosmopolitan workers and the large sums of money spent on it are all well known), but to confine my remarks to that part of it, the Aquarium, which is open to the public.

The chief interest of this Aquarium is that the animals and plants exhibited in it are local, being all from the Gulf of Naples. From the point of view of the casual visitor it differs from other aquariums in that he has to pay more to see it, the entrance price being two francs per person. The exhibits are not labelled, but extremely well written and profusely illustrated guide-books, in several languages, can be purchased.

In July, 1910, the collection of live animals I saw in the Naples Aquarium consisted of:—

REPTILES.—One Loggerhead Turtle (*Thalassochelys caretta*).

FISHES.—Representatives of forty to forty-six species: One or two *Anguillidæ*, one *Murænidæ*, one *Centriscidæ* (several individuals of the quaint red Trumpet Fish, *Centriscus scolopax*), two *Syngnathidæ*, one *Mugilidæ*, one *Gadidæ*, five *Serranidæ* (including many individuals of the Marine Gold Fish, *Apogon rexmullorum*, which are bright red with conspicuous black eyes), one or two *Sciænidæ*, nine or ten *Sparidæ*, one *Mullidæ*, one *Caproidæ* (several individuals of the red Boar Fish, *Capros aper*), three to five *Labridæ*, two *Pleuronectidæ*, one *Gobiidæ*, one

Scorpenidæ (very many individuals of *Scorpena porcus*), two *Triglidæ*, one *Trachinidæ*, one *Uranoscopidæ*, one *Blennidæ*, one *Balistidæ*, one *Scyllidæ*, one (?) *Carchariidæ*, one *Rauidæ*, and one *Trygonidæ*.

Special attention may be called to the families *Sparidæ* and *Balistidæ*: among the *Sparidæ* to some large specimens of the Gilt-head (*Pagrus auratus*) and of the Pandora (*Pagellus erythrinus*) in Tank No. 5, and to the fact that a Sea Bream (*Cantharus vulgaris*) has lived five years in captivity here (see 'Guide pour l' Aquarium,' Naples, 1908, page 101).

I saw five individuals of the File Fish (*Balistes capriscus*) in Tank No. 8; these formed a most interesting exhibit, and, speaking personally, I considered that even if there had been nothing else to see in Naples it was well worth while to have gone there only to have seen these curious and attractive fish alive and in, apparently, good health, but I was sorry to learn that they do not live long in captivity. The 'Official Guide' (edition of 1908, page 101), says of the File Fish:—"C'est un poisson vif, curieux et bon camarade; il ne jouit de toutes ses facultés qu'en été, parce qu'il est très sensible au froid et meurt généralement au commencement de l'hiver. Sa nourriture consiste en mollusques et en crustacés; il les broie de ses dents puissantes; on peut entendre le bruit de ce travail à travers les vitres du réservoir."

I am very glad to hear now (March, 1911) from a worker of the Naples Zoological Station who is visiting our Nile Aquarium at Gezira, that they are proposing to heat the tanks in the Naples Aquarium; so that such interesting forms of life as *Balistes* may have longer careers in captivity there.

CEPHALOCHORDATES.—Specimens of the Lancelet or Amphioxus (*Branchiostoma lanceolatum*).

TUNICATES—Five species of Ascidians, including *Phallusia mammillata*, the red *Cynthia papillosa*, and very many individuals of the white, translucent *Ciona intestinalis*.

INVERTEBRATES.—The Naples Aquarium is particularly rich in invertebrate animals, and of the very many interesting live things to be seen there I will only mention those I particularly noted at the time of my last visit.

Among the Arthropods there were two fair-sized individuals

of the King-Crab (*Limulus*) (surely not from the Gulf of Naples!), several Thornback Spider-Crabs (*Maia squinado*), the curious Box Crab (*Calappa granulata*), and an olive-brown Cicada-Prawn (*Scyllarus latus*).

The Echinodermata were represented by at least seven species of Star-fishes (*Asteroidea* and *Ophiuroidea*), four of Sea-Urchins (*Echinoidea*), and two of Sea-Cucumbers (*Holothuroidea*).

The Cephalopoda exhibited comprised six specimens of the Octopus (*Octopus vulgaris*), eleven of the Squid (*Loligo vulgaris*), and two of the Cuttlefish (*Sepia officinalis*).

Of the Gastropoda attention may be called to the specimens of *Doris*, to the large black Sea-Hare (*Aplysia limacina*), and to the War-trumpet Shell (*Triton nodiferus*).

The Ctenophora were represented by two species of *Beroë*, and the Anthozoa by a large series of Sea Anemones and Corals.

11. PARIS, FRANCE.

(i) *Jardin des Plantes*.

To properly appreciate this wonderful place, the cradle of zoological science, the Mecca of zoologists, the visitor, if he has not been brought up to a knowledge of it from childhood, should first read some of the literature bearing on its history.*

This history is so full of the names of famous men that at every epoch it is of absorbing interest, but by dividing it into four periods, as suggested below, it will be easier for the visitor to trace out the varied fortunes of the institution and the evolution of the grounds and buildings.

I. The Brosse period, 1626–1643.—The physician, Guy de la Brosse, appears to be the founder of the *Jardin des Plantes*, and was its first Intendant. In 1626 Louis XIII. approved the acquisition, in the Faubourg St. Victor, of a house and twenty-four acres of land for the purpose of what may be called a

* (i) 'History and Description of the Royal Museum of Natural History,' translated from the French of M. Deleuze, Paris, 1823. (ii) 'Guide des Etrangers dans le Muséum d'histoire naturelle,' Paris, 1855. (iii) 'Guide à la Ménagerie des Reptiles,' Léon Vaillant, Paris, 1897. (iv) 'The Royal Menagerie of France,' E. T. Hamy, Smithsonian Publication No. 1155, Washington, 1898.

Medical-Botanical Garden and Museum. The work commenced in 1635, and in 1640 a garden, ten acres in extent, was opened. De la Brosse laid out the grounds, under the superintendentship of the King's First Physician Bouvard, and assisted by the botanist Vespasian Robin. Vespasian's father, John Robin, the Royal Botanist, helped to provide the new garden with plants. De la Brosse died, in the garden he was creating, in 1643, and was there buried.

II. The Fagon period, 1671–1718.—Fagon, great-nephew of Guy de la Brosse, was born and brought up in the Jardin des Plantes. In 1671, on the death of Denys Jonquet (who had succeeded Vespasian Robin), Fagon was given the chair of Botany, and later he became both Superintendent and Intendant of the Institution. In 1715 he resigned his official duties, but continued to live in the garden, and there died in 1718.

It was under Fagon that the famous botanists, Joseph de Tournefort and Antoine de Jussieu (uncle of Antoine Laurent de Jussieu, 1748–1836) were appointed to the staff of the Jardin des Plantes.

III. The Buffon period, 1739–1788.—Buffon was only thirty-two years old when he was appointed Intendant in 1739. While he held office he accomplished a marvellous amount of progressive administrative work, not only in the matter of gardens, museums, and publications, but also in opening the collections to the public. He wished to form a zoological garden in the grounds, but died in 1788 without seeing the realization of this plan.

Among the men that Buffon appointed to help him in these works were :—

(i) Louis J. M. Daubenton, who, at the age of twenty-nine, became Buffon's zoological assistant in 1745, and remained in the Jardin des Plantes till he died there on the last day of 1799, and was buried on the hill of the Labyrinth.

(ii) The younger Daubenton, who assisted the elder, his cousin, and retired on account of ill-health four years before the death of Buffon.

(iii) J. A. Thouin, Head-gardener from 1745 till his death in 1768.

(iv) Andrew Thouin, son of J. A. Thouin, born in the

gardens, 1747, succeeded his father and was later made Professor of Agriculture.

(v) John Thouin, son of J. A. Thouin, born in the gardens, 1756; became Chief Gardener.

(vi) James Thouin, born 1751, became Secretary and Cashier.

(vii) John Francis Lucas, born in the gardens, 1747, became Keeper of the Galleries of Natural History.

IV. The New Organization Period, 1793 and onwards.

Among the buildings in the Jardin des Plantes the visitor should particularly note :—

(i) The Rotunda, designed by M. Molinos in 1802; commenced 1804, finished 1812.

(ii) The Lion House; commenced 1818, finished 1821.

(iii) The Reptile House, opened in 1874.

(iv) The Grand Volière, or Great "Flying Cage," certainly the best and most handsome construction of its kind that I have hitherto seen in Europe. I was told that it cost 10,000 francs (£400) to build.

Among the more interesting mammals that I saw alive in the Jardin des Plantes in October, 1908, may be mentioned :—

Four Chimpanzees.

The great Mandril, presented by Monsieur Lesieur in 1897.

A male Gelada Baboon (*Theropithecus gelada*), recently deposited by M. Maurice Rothschild. This Baboon has the extraordinary habit of reverting the upper lip, so as to hide its nose.

An Aye-aye (*Chiromys madagascariensis*), recently acquired.

A hybrid Zebra, bred from a male *Equus burchelli chapmani* and a female *Equus zebra*.

The nice little herd of five specimens of the rare North African Hartebeest (*Bubalis buselaphus*).

A young male Addax Antelope (*Addax nasomaculatus*), from Goudnam (? Goridam) in the French Sudan, presented in 1908 by Monsieur Girard, Sergeant Télégraphiste.

A male Gazelle (*Gazella dorcas isabella*) (?) which came from the French Sudan with the Addax.

A female *Gazella mohr*, a very large animal, in fine condition, presented by M. Girard in 1906.

A young male Giraffe from Timbuctoo.

The Alligators (*Alligator mississippiensis*) of the Jardin des Plantes are famous. Prof. Léon Vaillant, writing in July, 1897 ('Guide à la Ménagerie des Reptiles,' pages 2 and 3), mentions—"plusieurs individus existent au Muséum depuis 1852, ils pouvaient à cette époque mesurer 70 cent. à 80 cent. et peser de 3 kilg. à 4 kilg., aujourd'hui leur taille dépasse 3 mètres et leur poids est de plus de 82 kilg.; à l'état de liberté la croissance doit se faire sans doute plus rapidement."

It may be of interest to note here that a male *Alligator mississippiensis* in the Giza Zoological Gardens, on September 20th, 1899, was in total length 2 ft. 6½ in. (.77 metres), died on March 28th, 1911, and was then found to measure in total length 8 ft. 9 in. (2.66 metres) and to weigh 309 lb. (140 kilos.).

Early in 1910 the Menagerie went through a most trying time; the Paris correspondent of the London 'Daily Telegraph,' January 29th, 1910, wrote of the Jardin des Plantes:—"Now in the direst plight, the heating apparatus being submerged, and there are no means of warming the houses of the Monkeys and Reptiles, which are encompassed by water. A platform has been erected for the Giraffe, but the Elephants and Hippopotami are still wallowing in icy slush. The Gardens are meanwhile closed to the public."

(ii) *Jardin d'Acclimatation.*

I visited the Jardin Zoologique d'Acclimatation in the Bois de Boulogne on October 27th, 28th, and 29th, 1908. As on former visits in 1896, 1899, and 1907, I found that the chief feature of the menagerie was the large series of domesticated or semi-domesticated animals.

But the collection is not limited to these; among the mammals that I saw in 1908 may be mentioned:—Sixty-two Monkeys, representing eleven species, including three small Mandrils, and two very fine grey-cloaked Sacred Baboons (*Papio hamadryas*); ten Lemurs of seven species and subspecies, two or three Sea-Lions, two Seals, two Kinkajous (*Potos flavus*), Porcupines of three genera, two Indian Elephants, two American Tapirs, two Chapman's Zebras, one Grant's Zebra, at least twenty-nine Antelopes representing six species, two very fine male Spanish Wild Goats, "*Capra agrimia*," one Reindeer, a

male Sudan Giraffe, a Collared Peccary, and an Afriver River-Pig.

The most remarkable birds on exhibition were two Sun-Bitterns (*Eurypyga helias*), which displayed beautifully one afternoon. The display of the Sun-Bittern is, I think, one of the most marvellous sights that any human being can be privileged to see. Their keeper told me that these two Sun-Bitterns have lived here for eleven years.

A group of twenty-three Penguins (*Spheniscus demersus*), and an Ostrich, harnessed into a cart, should also be mentioned.

The Aquarium contained only Axolotls and six species of freshwater fish.

The tameness of the wild Hooded Crows (*Corvus cornix*) in this garden appeared to me noteworthy. In England I have found this species most shy and evasive, but in Paris it appeared to be familiar and aggressive, almost but not quite so much so as the resident Hooded Crows of Egypt.

12. SOUTHAMPTON, ENGLAND.

Museum.

I visited the Hartley University College Museum at Southampton on October 4th and 6th, 1909. The Institute to which it is attached was founded by bequest of Henry Robinson Hartley, who died in 1850. The building was opened in 1862. The Museum is open free to visitors daily (except on Tuesdays, when I understand that sixpence is charged per person).

This Museum consists of a large hall with two galleries running round it, all lighted by skylights in the roof. The lower gallery is ornamented with fifteen shields painted with the arms of Hampshire towns. The upper gallery is ornamented with pairs of horns, one of African Buffalo, one of Indian Buffalo, one of Gayal, three of long-horned Domestic Oxen, and one of Kudu. The skin of a large Python from Zululand is also hung from the lower gallery, and two trunks of New Zealand tree-ferns extend from the lower to the upper gallery.

The collection on the ground floor consists of zoological, palæontological, and geological specimens, and also of local antiquities; noticeable are remains of *Bos* "*primigenius*" found in 1887 when excavating new docks at Southampton, a very

large skull of a recent marine Turtle, a model of an Eel (*Anguis vulgaris*) (modelled by Frank T. Buckland, born 1826, died 1880), which was caught in the Test, Hampshire, and weighed 7 lb. (3·17 kilos.), and the head of a $23\frac{1}{2}$ lb. (10·66 kilos.) Pike (*Esox lucius*) caught in the Itchen, Hampshire, in 1877.

The two galleries are mainly occupied by books, with small mineralogical specimens in the cases on the railing of the lower gallery.

The most noteworthy (to my particular fancy) specimen in this Museum is the skull of a large Crocodile, labelled:—
“Skull. Old World Crocodile, probably Indian.” It measures—

Length, without lower jaw, about 2 ft. $4\frac{1}{2}$ in. = 723 mm.

„ with „ „ „ 2 „ $9\frac{1}{4}$ „ = 844 mm.

It is a remarkably rugged skull. There are no bony ridges in front of the eyes (as in *Crocodylus porosus*), but there is a large flattened median boss of bone about a quarter to a third of the distance from the eyes to the nostrils.

(To be continued.)

NOTES AND QUERIES.

AVES.

White-tailed Eagle no longer breeding in Ireland.—It is with great regret that I have to state that the last pair of White-tailed Eagles breeding in Ireland have disappeared from their old breeding haunts on the North Mayo cliffs. The last stronghold and refuge of the *Haliaeetus albicilla* in Ireland, where they have regularly bred from time immemorial, after a long struggle for existence, have now fallen by the traps and poison of the keepers of adjacent grouse-shootings, by whom they had long been doomed to destruction, and the marvel is that they had so long escaped the keeper's vengeance. It is sad to think that for the future neither naturalist nor tourist will enjoy the sight of these noble birds in their haunts on the magnificent cliffs of the Mayo coast, rising from the water to a height of seven to eight hundred feet. Now that the birds have disappeared there is nothing left to remember them by except the old nests, still visible in several places along the cliffs, and resembling cartloads of dead and rotten sticks—the withered stems of heather. There is one on the great cliff of Loughmuriga, two or three miles from Belderig, another on Alt More, and three to be seen on the great cliff of Alt Redmond, and the one last used on Spinks; these five last-named are situated on the range between Porturlin and Portacloy. I remember when two pairs bred on these great cliffs, and in winter one or two of the immature birds used to take up their abode on the sandhills of Bartragh Island, Killala Bay, where they subsisted on the rabbits and any dead fish thrown upon the shore. These annual visits took place regularly every season until 1856, when they ceased, and since then only a very occasional visit has been noticed, evidently showing that the war of extermination had then begun. When I first visited the North Mayo coast, July 1st, 1892, specially to ascertain whether Eagles still bred there, I was fortunate in my quest, for on inquiry I was told that a pair still bred there, and had a nest with young on Spinks Cliff, situated between Porturlin and Portacloy; so, driving round to Porturlin, I engaged a boy to show me where the nest was, but after leaving the village and

reaching the top of the cliffs, my guide, seeing his comrades going out mackerel-fishing, left me and joined them, but first giving me some very vague directions as to the position of Spinks. However, I walked on for an hour, seeing no sign of Eagles, when I thought of returning, as it was getting late, and I had before me a drive of fifteen miles to my lodgings in Belderig. I had not walked more than a couple of hundred yards on my return when I heard the angry cries of a Peregrine, and, the sound coming nearer, I looked round over the great bog, and then perceived the cause of the Peregrine's anger—a splendid Eagle, slowly flying in from the bog, with the angry Peregrine close after him in full cry; the Eagle, taking no notice, kept straight on, passing right over me within easy gunshot, and carrying a large hare dangling from his talons, held by the head and forequarters. He passed slowly on, disappearing over the cliffs to where it was evident the nest and young were situated. As I had no idea as to the exact position of the nest, I continued on my return, not reaching Belderig until after nine o'clock, very tired, but highly pleased at the very unusual sight, to me, of an Eagle carrying a hare to its young.

The following year I again visited the cliffs with a young friend, but, although we saw no sign of Eagles, were told they were about the cliffs as usual, but could get no account of a nest to be seen. Two years after I again went to the cliffs, and heard the same story, but no one had seen a nest. After that I did not visit North Mayo until May, 1898, when, in company of my old friend, Mr. R. J. Ussher, of Cappagh House, Co. Waterford, and my old and lamented friend, the late Howard Saunders, of London, we heard from the men that Eagles were about the cliffs that season, but no one saw a nest. However, as we walked along the cliffs, we had evidence of the truth of their statement, for when passing Spinks we picked up an Eagle's feather, and the clean-picked skeleton of a hare that must have been killed within a week or two at farthest. This was the last authentic evidence I have had of the Eagles in their old haunts; any stories since then of Eagles living about the cliffs are unreliable, as I found out when visiting that coast along with my friend, R. M. Barrington, the 2nd of the present month (August). We went by steamer from Sligo to Portacloy, and had a most enjoyable run along the Sligo coast, across Killala Bay, and the Mayo coast to our destination, Portacloy. On the morning of our arrival we walked over the hill to Spinks cliff, but saw no appearance of Eagles at the old haunt. Next morning we engaged a four-oared curragh, and rowed along the

base of the cliffs as far as Porturlin, in order to have a closer view from the sea of the face of the cliffs, especially those haunted by the Eagles, but saw no trace of them; then, when questioning the boatmen, who were constantly in their currachs fishing all along that part of the coast, they all agreed that it was some years since any Eagles were observed in their old haunts, good evidence of their final disappearance. Thus has ended the race of Irish White-tailed Eagles. I may further add that there are only two breeding haunts in Ireland of the Golden Eagle, but how much longer the birds will escape their destroyers is hard to say, though one nesting-site is carefully preserved by the owner of the estate. — ROBERT WARREN (Ardnaree, Monkstown, Co. Cork).

P.S.—I mentioned in the foregoing notes that there were only two breeding haunts of Eagles now in Ireland. I regret that I was mistaken, for I now hear from my friend, R. J. Ussher, that on his last visit a few weeks ago to Muilrea he found that the Eagles were extinct, where in 1898, in company with the late Howard Saunders, of London, they had the pleasure of seeing a pair of Golden Eagles soaring round that great mountain, on which their nest was situated. Mr. Ussher, with James Bourke, who lived at the foot of the mountain, ascended within sight of the Eagle's cliff, but on inquiry found that the last Eagle was destroyed in the spring of 1910, the manager of the property saying that, as the Eagles killed lambs, they should be destroyed, and the result of his orders being that they are now exterminated, all being poisoned. So now there is only one remaining breeding haunt of Eagles in Ireland, and although that is strictly preserved by the owner of the estate, yet I fear their destruction in a few years will follow.—R. W.

Variety of the Gannet.—Referring to the supposed brown variety of a Gannet, which was seen by at least four persons at the Bass Rock in July, 1910, of which a figure kindly communicated by Mr. R. Fortune appeared in 'The Zoologist' (*ante*, p. 73), I now learn that no more has been seen of this anomalous bird. A close watch has been kept for it at the Bass Rock all this summer by Mr. J. M. Campbell, principal of the lighthouse, who is himself an ornithologist, but to no purpose. That the bird was an artificially coloured one there can be little, if any, doubt, as was long ago surmised by Mr. William Evans, of Edinburgh, and others. The nest on which it was photographed was this year occupied by two normally coloured Gannets, one of which may have been the individual in question returned to its proper ledge. Among the many curious varieties of birds which

have been placed on record in 'The Zoologist' and other journals, there does not appear to be an instance of a bird, by nature permanently white, turning brown. Ptarmigan have their well-known seasonal change, it is true, but that is not a case in point. No species of which the adult plumage is white, or nearly so—such as a Gannet, a Swan, a Stork, a Snowy Owl, or a Gull—has ever been known to assume a brown colour. I think I am right in supposing that such a *lusus naturæ* as this is unknown to ornithologists in any country. Brown and black birds become white not very infrequently, of which the Thrush and Blackbird are common examples, but that is in accordance with the ordinary law of albinism, to which every species is liable, and is easily explained by an absence of pigment in the feathers. Melanism, on the other hand, is produced by a superabundance of it, and is always much rarer than albinism.—J. H. GURNEY (Keswick Hall, Norwich).

Great Black-backed Gull breeding on an Inland Lake.—A young friend of mine, Mr. H. Scroope, Jun., of Ballina, when visiting that fine sheet of water in North Mayo—Lough Corm—discovered a pair of these Gulls having a nest on a grassy island frequented by hundreds of Black-headed Gulls. The destruction of eggs by these great Gulls was enormous, for on a corner of the island where the Gulls carried the eggs to eat, he says he saw as many egg-shells of the Black-headed Gulls as would have filled a basket. However, in order to prove the identity of the Gulls, he brought away their three eggs, the size of which beyond all doubt proved their species. He was careful in this, because a pair of Lesser Black-backed Gulls frequented the lake for some years, and their young, fledged, were seen accompanying their parents. This is the first instance that I have known of this large Gull breeding on an inland fresh-water lake in Ireland, which is situated at least nine or ten miles from the sea, and is twelve or fourteen miles from Downpatrick Head, the nearest breeding haunt of the Great Black-backed Gull on this coast.—ROBERT WARREN (Ardnaree, Monkstown, Co. Cork).

Most important provisions affecting animals are contained in the Protection of Animals Act (introduced by Mr. G. Greenwood, M.P.), which is about to receive the Royal Assent. The maximum punishment for cruelty has been increased from three to six months, and a fine of £25, while the period in which proceedings can be taken has been increased to two months. Power is given to a private

person to give another person into custody, on condition that the person so doing carries out the prosecution. In addition to providing for the destruction of animals which have been cruelly treated, a very important principle has been established by a clause inserted during the passage of the Bill through the House of Lords by Lord Leigh, on behalf of the National Canine Defence League, embodying the provisions of the Bill promoted some time ago by that Society, the object of which was to prevent dogs or other animals being subjected to revengeful treatment after conviction of the owner, and also to provide a deterrent to cruel treatment of performing or other valuable animals, the loss of which would mean a greater penalty than would the imposition of a simple fine. Under this clause an order can be made depriving the owner of the possession of the animal which was the subject of the charge, if there is reason to believe that it would be the victim of further cruelty if left with its owner. In the case of an order being made for the forfeiture of dogs, the Canine Defence League is offering to find good homes for the animals, and to bear all expenses connected therewith.

The new Act also provides for the inspection of spring traps every twelve hours, and imposes penalties on those who sell poisoned grain or seed, or place poison without taking reasonable precautions against access thereto by dogs, cats, fowls, or other domestic animals.

BRITISH ASSOCIATION FOR THE ADVANCEMENT OF
SCIENCE, PORTSMOUTH, 1911.

ADDRESS TO THE ZOOLOGICAL SECTION.

By Professor D'ARCY WENTWORTH THOMPSON, C.B., *President of the Section.*

MAGNALIA NATURÆ; OR, THE GREATER PROBLEMS OF BIOLOGY.

THE science of Zoology, all the more the incorporate science of Biology, is no simple affair, and from its earliest beginnings it has been a great and complex and many-sided thing. We can scarce get a broader view of it than from Aristotle, for no man has ever looked upon our science with a more far-seeing and comprehending eye. Aristotle was all things that we mean by "naturalist" or "biologist." He was a student of the ways and doings of beast and bird and creeping thing; he was morphologist and embryologist; he had the keenest insight into physiological problems, though lacking that knowledge of the physical sciences without which physiology can go but a little way: he was the first and is the greatest of psychologists; and in the light of his genius biology merged in a great philosophy.

I do not for a moment suppose that the vast multitude of facts which Aristotle records were all, or even mostly, the fruit of his own immediate and independent observation. Before him were the Hippocratic and other schools of physicians and anatomists. Before him there were nameless and forgotten Fabres, Roesels, Réaumurs, and Hubers, who observed the habits, the diet, and the habitations of the sand-wasp or the mason-bee: who traced out the little lives, and discerned the vocal organs, of grasshopper and cicada; and who, together with generations of bee-keeping peasants, gathered up the lore and wisdom of the bee. There were fishermen skilled in all the cunning of their craft, who discussed the wanderings of tunny and mackerel, sword-fish or anchovy; who argued over the ages, the breeding-places and the food of this fish or that; who knew how the smooth dogfish breeds two thousand years before Johannes Müller; who saw how the male pipe-fish carries its young before Cavolini; and who had found the nest of the nest-building rock-fishes before Gerbe re-discovered it almost in our own day. There were curious students of the cuttle-fish (I sometimes imagine they may have been priests of that sea-born goddess to whom the creatures were sacred) who had diagnosed the species, recorded the habits and dissected the anatomy of the group, even to the discovery of that strange hectocotylus arm that baffled Della Chiaje, Cuvier, and Koelliker, and that Verany and Heinrich Müller re-explained.

All this varied learning Aristotle gathered up and wove into his great web. But every here and there, in words that are unmistakably

the master's own, we hear him speak of what are still the great problems and even the hidden mysteries of our science; of such things as the nature of variation, of the struggle for existence, of specific and generic differentiation of form, of the origin of the tissues, the problems of heredity, the mystery of sex, of the phenomena of reproduction and growth, the characteristics of habit, instinct, and intelligence, and of the very meaning of Life itself. Amid all the maze of concrete facts that century after century keeps adding to our store, these, and such as these, remain the great mysteries of natural science—the *Magnalia naturæ*, to borrow a great word from Bacon, who in his turn had borrowed it from St. Paul.

Not that these are the only great problems for the biologist, nor that there is even but a single class of great problems in Biology. For Bacon himself speaks of the *magnalia naturæ, quoad usus humanos*, the study of which has for its objects "the prolongation of life or the retardation of age, the curing of diseases counted incurable, the mitigation of pain, the making of new species and transplanting of one species into another," and so on through many more. Assuredly I have no need to remind you that a great feature of this generation of ours has been the way in which Biology has been justified of her children, in the work of those who have studied the *magnalia naturæ, quoad usus humanos*.

But so far are biologists from being nowadays engrossed in practical questions, in applied and technical Zoology, to the neglect of its more recondite problems, that there never was a time when men thought more deeply or laboured with greater zeal over the fundamental phenomena of living things; never a time when they reflected in a broader spirit over such questions as purposive adaptation, the harmonious working of the fabric of the body in relation to environment, and the interplay of all the creatures that people the earth; over the problems of heredity and variation; over the mysteries of sex, and the phenomena of generation and reproduction, by which phenomena, as the wise woman told, or reminded, Socrates, and as Harvey said again (and for that matter, as Coleridge said, and Weismann, but not quite so well)—by which, as the wise old woman said, we gain our glimpse of insight into eternity and immortality. These, then, together with the problem of the Origin of Species, are indeed *magnalia naturæ*; and I take it that inquiry into these, deep and wide research specially directed to the solution of these, is characteristic of the spirit of our time, and is the pass-word of the younger generation of biologists.

No small number of theories or hypotheses, that seemed for a time to have been established on ground as firm as that on which we tread, have been reopened in our day. The adequacy of natural selection to explain the whole of organic evolution has been assailed on many sides; the old fundamental subject of embryological debate between the evolutionists or preformationists (of the school of Malpighi, Haller, and Bonnet) and the advocates of epigenesis (the followers of

Aristotle, of Harvey, of Caspar F. Wolff, and of Von Baer) is now discussed again, in altered language, but as a pressing question of the hour; the very foundations of the cell-theory have been scrutinized to decide (for instance) whether the segmented ovum, or even the complete organism, be a colony of quasi-independent cells, or a living unit in which cell differentiation is little more than a superficial phenomenon; the whole meaning, bearing, and philosophy of evolution has been discussed by Bergson, on a plane to which neither Darwin nor Spencer ever attained; and the hypothesis of a Vital Principle, or vital element, that had lain in the background for near a hundred years, has come into men's mouths as a very real and urgent question, the greatest question for the biologist of all.

With all the growth of knowledge, with all the help of all the sciences impinging on our own, it is yet manifest, I think, that the biologists of to-day are in no self-satisfied and exultant mood. The reasons and the reasoning that contented a past generation call for re-inquiry, and out of the old solutions new questions emerge; and the ultimate problems are as inscrutable as of old. That which, above all things, we would explain baffles explanation; and that the living organism is a living organism tends to reassert itself as the biologist's fundamental conception and fact. Nor will even this concept serve us and suffice us when we approach the problems of consciousness and intelligence and the mystery of the reasoning soul; for these things are not for the biologist at all, but constitute the psychologist's scientific domain.

In Wonderment, says Aristotle, does philosophy begin,* and more than once he rings the changes on the theme. Now, as in the beginning, wonderment and admiration are the portion of the biologist, as of all those who contemplate the heavens and the earth, the sea, and all that in them is.

And if Wonderment springs, as again Aristotle tells us, from ignorance of the causes of things, it does not cease when we have traced and discovered the proximate causes, the physical causes, the Efficient Causes of our phenomena. For beyond and remote from physical causation lies the End, the Final Cause of the philosopher, the reason Why, in the which are hidden the problems of organic harmony and autonomy and the mysteries of apparent purpose, adaptation, fitness, and design. Here, in the region of teleology, the plain rationalism that guided us through the physical facts and causes begins to disappoint us, and Intuition, which is of close kin to Faith, begins to make herself heard.

And so it is that, as in Wonderment does all philosophy begin, so in Amazement does Plato tell us that all our philosophy comes to an end.† Ever and anon, in presence of the *magnalia naturæ*, we feel incline to say with the poet:

οὐ γάρ τι εἶν γε κἀχθίς, ἀλλ' ἀεὶ ποτε
ζῆ ταῦτα, κούδιες οἶδεν ἐξ ὅτου 'φάνη.

* Met. i. 2, 982b, 12, &c.

† Cf. Coleridge, Biogr. Lit.

“These things are not of to-day nor yesterday, but evermore, and no man knoweth whence they came.”

I will not quote the noblest words of all that come into my mind; but only the lesser language of another of the greatest of the Greeks:—“The ways of His thoughts are as paths in a wood thick with leaves, and one seeth through them but a little way.”

A CASE OF A REMARKABLE EGG OF *FALCO TINNUNCULUS* LAID UNDER REMARKABLE CIRCUMSTANCES.

By C. J. PATTEN, M.A., M.D., Sc.D.

On Sunday, June 11 last, my tame Kestrel, which I have had for eight years, appeared to be in remarkably lively mood. When let out of her wire enclosure she indulged in her usual trick of pouncing on my shoe and biting at the leather repeatedly. When I shook her off she followed me across the yard, and on presenting my gloved hand she dashed at it, at the same time dropping her wings like a curtain, as though she were shielding her favourite mouse. Many other tricks which I have frequently found her indulging in were particularly well performed that morning. I was therefore exceedingly pleased that after my absence from home for the greater part of the preceding week I returned to find her so well and lively. However, in the afternoon a remarkable change came over her. She retired to a corner, and, assuming an almost horizontal position, so that her head, back, and tail were almost parallel with the ground, she became so apathetic that I suspected poisoning from some of the food (a young rat caught in a trap) she had lately partaken of. Unable to rouse her, I carried her into my study, where she again crept into a corner and behaved similarly. She remained in this condition until 6.30 p.m., at which time I left her alone. On my return at 10.30 p.m. she still appeared to be in the same condition. I tried to rouse her by pretending to attack her with my hand and by splashing her with cold water, but it was of no avail. I then left her in the corner while I wrote letters. She now began to utter a few faint squeaks at intervals. At 11.45 p.m. she gave a rather painful cry, and on going over to see what was the matter I found she had laid an egg. Almost immediately she began to get lively, and so I had to exercise care lest she might break the egg. Fortunately I succeeded in getting possession of the latter safely. Remarkable as this case of ovulation may be, the egg itself is none the less remarkable. Although the usual brownish-red egg (so profusely pigmented that no trace of white is visible) may sometimes be represented by one richly mottled on a yellowish-white or pinkish ground-colour, I may say I have never before seen a Kestrel's egg such as the one my bird laid. This egg

is milky-white in colour, almost unspotted except at its larger end. This part is spotted and blotched with rich purplish-brown intermixed with light greyish-purple, the whole pigmentation forming a broken zonular band. The egg might be compared to an enlarged model of a Greenfinch's egg in which the ground-colour has lost its faint greenish hue. The texture of the shell is fine and thin, but sufficiently strong to allow of the contents being extruded by means of the blow-pipe. The egg is less rounded at the smaller end than usual, and resembles in shape an ordinary domestic fowl's egg. In size it is perfectly normal, *viz.*, length, 3.9 cm.; breadth, 3 cm.; the average measurements given for the Kestrel's egg by Saunders being, length, 4 cm.; breadth, 3.1 cm. That is to say, my Kestrel's egg is 1 mm. less than the normal in length and in breadth. It seems impossible to offer an explanation for this strange case of ovulation. But I may perhaps be allowed to refer to one point in connection with the bird's diet just before it laid the egg. During my absence from home, which lasted four days, the bird was supplied with sufficient food for that time, but it was all given on the first day. When I returned the greater part was untouched, the reason being that the warm weather had affected the food sufficiently to render it adverse to the bird's palate. Hence the hawk fasted for three days. On my return I gave her a plentiful supply of fresh ox-spleen and liver, which she gorged herself with, and this highly nutritious hearty meal, coming after a fast and in a warm change of weather, may have toned her to such a physiological state that her ovaries became sufficiently active to induce ovulation. Such an explanation is vague and theoretical, and I give it only for what it is worth.

NOTICES OF NEW BOOKS.

The Grouse in Health and in Disease ; being the Final Report of the Committee of Inquiry on Grouse Disease. Two vols. Smith, Elder & Co.

THESE two quarto volumes constitute the most exhaustive monograph on the Grouse that has yet appeared, and one that is a model for future investigators to follow ; the contributors are accepted authorities, and the illustrations are a no inconsiderable feature in a well-designed publication.

The work commences with "The Systematic Position of the Grouse," by A. H. Evans, followed by a very full life-history of the bird, by A. S. Leslie, which will be read with interest by both the sportsman and the ornithologist. "The Changes of Plumage in the Red Grouse in Health and in Disease," by Edward A. Wilson, deals with some controverted points on the subject, and is fully and excellently illustrated ; it is a subject requiring ample treatment, and has received it. The food of the bird is described by Messrs. Wilson, Leslie, and Grimshaw, and its causes of mortality are shown to be numerous, but its powers of survival very considerable. Birds which had lost a wing, "cut off clean at the shoulder," have not only survived, but succeeded in subsequently rearing a healthy brood. Barbed wire is undoubtedly a danger ; in South Africa we have even seen a locust in flight impale itself. But Grouse disease in its "epidemic" or "epizootic" form is the real subject of investigation, and one that principally concerned the inquiry of the Committee. It has been dealt with as exhaustively as possible. The names of Drs. Shipley, Fantham, Leiper, Seligmann, Cobbett, Sambon, Hammond Smith, and others are sufficient to prove the value of this, the chief work of the research. As Lord Lovat subsequently remarks :—"After examining nearly two thousand cases of death from other than natural causes, and the facts and surrounding circumstances of over two hundred separate outbreaks of disease, the Committee have arrived at the conclusion

that the Strongyle worm, and the Strongyle worm alone, is the immediate *causa causans* of adult 'Grouse Disease.'**

The Freshwater Fishes of the British Isles. By C. TATE REGAN, M.A. Methuen & Co., Ltd.

THE angler frequently knows more about the bionomics of his familiar fishes than does the technical ichthyologist; on the other hand, he is not versed in the discrimination of species, as may be seen in many records, where Roach are confused with Rudd and small Chub with Dace. This book is well entitled to its foreword: "One for the angler, and for all who wish for reliable information as to our fresh-water fishes, their specific characters, geographical distribution, and life-history."

The Char, on which the author is an authority and can write with first-hand confidence, receives ample treatment, and provides one of the most valuable contributions to the volume—in fact, we must go to this book for a practical digest of the differences and distribution of these fishes. Mr. Regan, against the old myth of the friendship of the Pike and Tench, writes: "In some localities a small Tench is said to be a very good bait for a Pike." This is a common opinion among anglers on the Mole, where the writer of this notice has even known a small Perch to serve the same useful purpose. As regards the weight of big Pike, an illustration is given of the "great Pike of Whittlesea Mere," which may be regarded as the record English specimen of that fish, and was stated to weigh 52 lb.; it was taken when the Mere was drained in 1851. Of the Bream, Mr. Regan rightly distinguishes but two species, though among some anglers there is an erroneous disposition to consider there are three. We also read that "on warm summer days a number of these fish may sometimes be seen lying motionless near the surface of the water." This description is not an absolute one, for on some parts of the Mole—a Bream home—these fish can generally be seen on warm summer days in considerable numbers

* Prof. J. Arthur Thomson, in the Murtle Lecture, delivered in Aberdeen University, 1909, remarked that "wild animals in nature have parasites, but no diseases." Can we absolutely accept this opinion after a perusal of the above report on Grouse disease?

close to the surface, and not motionless, but patrolling the surface of the stretch they frequent.

The illustrations are excellent, and drawn by Mr. Regan himself, with the result that the real specific differences and general facies receive a prominence not always found when the eye of the artist and not that of the ichthyologist is a more dominant agent.

Guide to the Exhibition of Animals, Plants, and Minerals mentioned in the Bible. Printed by Order of the Trustees of the British Museum.

“It was thought by the Trustees of the British Museum that an Exhibition of Animals, Plants, and Minerals mentioned in the Bible would form an interesting supplement to the literary and historical Biblical Exhibition which has been arranged at Bloomsbury for the Tercentenary of the Authorized Version, and instructions were given for its preparation.” The result is the Collection now placed in one of the bays of the Central Hall of the Natural History Museum, and also the publication of this Guide-book, which is, however, by its value in literary research, considerably more than its title implies. The Animals and Minerals respectively have been selected, arranged, and labelled by Mr. R. Lydekker and Dr. G. F. Herbert Smith, and the Plants by Dr. A. B. Rendle.

The principal English works on the subject hitherto have been Dr. Tristram's ‘Natural History of the Bible,’ and a more popular publication by the late J. G. Wood, entitled ‘Bible Animals,’ but there was every room and demand for the concise statements to be found in this small but excellent ‘Guide.’ Of course, as regards the animals, the non-mythical are alone referred to, the mythical being entirely in the domain and knowledge of the students of comparative theologies.

But the strength of this publication will be found in Dr. Fletcher's essay, “showing how modern interpretations of the ancient names of Biblical minerals have been deduced.” This, though somewhat out of the purview of ‘The Zoologist,’ will not only interest naturalists, but make this ‘Guide’ indispensable to Biblical students, and provide one of those out-of-

the-way treasures prized by literary men. It is well to be reminded that St. John, the seer of Patmos, was a contemporary of Pliny, the naturalist, and Dr. Fletcher remarks: "Pliny's great work on Natural History, published in 77 A.D., only two years before his death, tells us what was known about minerals by naturalists at the time when St. John himself was living." While of Theophrastus, whose Greek work on Stones, which, "though brief is very useful," we read: "The author lived about 370-287 B.C., and therefore, though his book was probably completed before the Septuagint translation was begun (270 or 280 B.C.); he must have been a contemporary of the translators themselves." These are truly links of the past, and they help us to rightly understand it. May other naturalists who are also scholars follow Dr. Fletcher's lead.

EDITORIAL GLEANINGS.

WHITTLESEA MERE SINKS OVER TEN FEET IN SIXTY YEARS.—The drought has had an extraordinary effect on the bed of the once famous Whittlesea Mere, the greatest of the Cambridgeshire Fens. Ever since the mere was drained in 1851 the land has gradually shrunk. During the previous few years no perceptible difference has taken place, but this year there has been a further shrinkage, and probably the bed of the mere is now as low as it can possibly get. After the mere was drained in 1851 an iron post was driven firmly through the peat into the underlying bed of gault. The gault was unshrinkable and as firm as a rock. The post was driven in until the top was level with the spongy land, and then a large square iron plate bearing the date was fixed. Deprived of the water of the mere the peaty fenland has shrunk to a marked degree this year, and now the iron pillar stands over ten feet out of the ground. The pillar has not risen; it is immovable.—*Daily Chronicle*, Sept. 13th.

This is an interesting record in connection with a reference to the Mere on a previous page (*cf.* notice of Mr. Regan's book, *ante*, p. 357).

ONE of the greatest attractions of the Zoo at present to those who like to see foreign birds exercising their natural activities consists of a pair of the common pink-and-grey Cockatoos, well known to Australians as "Galahs," which are enjoying their freedom in the Gardens. They divide their time between the society of the Marmots and Squirrels in the Squirrels' enclosure, and that of their caged fellows in the Parrot Aviary at the opposite side of the Gardens. Just about tea-time they are most in evidence; after taking a meal *à la carte* with the rodents, they enjoy themselves by nibbling the bark of an old dead willow in the neighbouring waterfowls' enclosure or the turf on the Fellows' Lawn. These amusements are varied by alarums and excursions on the wing. Yelling at the top of their voices, the two Cockatoos start on a fly round, showing incidentally a power of flight which no one would suspect from seeing them in the Parrot Aviary. There they seem nearly as heavy on the wing as Ducks; but the free birds show a wonderful command of wing, flapping, when once well up in the air, with the slow, easy stroke of a Sea-Gull, shifting like Swallows, and swooping like Hawks. No bird that I have ever seen flying at large shows such a pure joy in flight for its own sake, or has such a splendid appearance in showing it. As the Cockatoo turns, its lovely rose-pink breast is presented to the eye, and stands out like a great flower when it alights on a tree. The installation of these free Cockatoos at the Gardens was quite accidental. The cock bird turned up one day as a "stray" in the Squirrels' enclosure, and speedily made it clear that he had come to stay. Of his associates, he plainly despised the wild Wood Pigeons, and ignored the Squirrels; the Marmots he seemed to regard as kindred spirits, and used to play with them, stroking their faces or clutching their tails playfully with his foot. At other times he would tumble about with a dry crust of bread as if juggling, and altogether lived the life of a jovial bachelor until a mate was put out for him in a cage. When it was seen that the solitary Adam appreciated this companion, his Eve was liberated, and the two have lived happy ever since.—FRANK FINN (*Pall Mall Gazette*, Sept. 13th).

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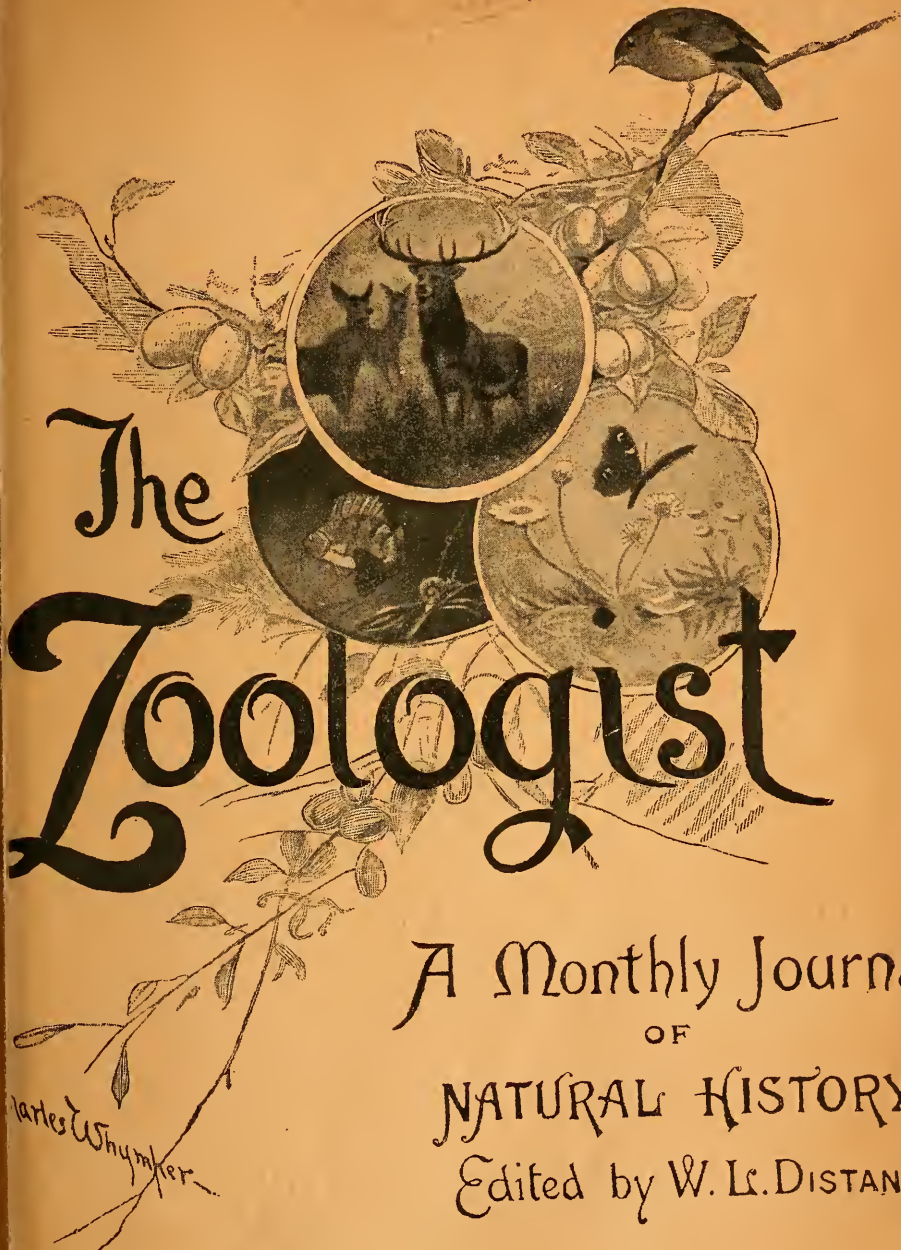
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THE ZOOLOGIST

No. 844.—October, 1911.

OBSERVATIONS ON THE NOCTURNAL HABITS OF THE REDWING.

BY FREDK. J. STUBBS.

THE Redwing (*Turdus iliacus*) has a curious habit of roaming about at night, and, although this is not unknown, it has yet to become part of ornithological literature, and the present notes may perhaps focus the attention of observers on the phenomenon. The movements have been referred to by several writers, all of whom have described them as migratory; but the evidence that I have been able to gather certainly does not justify us in being so confident on this point.

From the time of the bird's arrival in autumn to the end of December, and afterwards at irregular intervals until April, a large number of Redwings are on the wing each night, and frequently make journeys of at least several and probably many miles. We never see them, and only know of the passing of the birds by their voices. The note used is the peculiar piercing monosyllable so familiar to every field student of birds, but this is after all such a needle point of sound that it always passes unnoticed unless the observer has had his attention drawn to it, and is interested in the phenomenon. The call does not suggest any of the noisy migrants that lend so great an interest to our autumn nights, and, although coming with startling suddenness from the dark air, it is not associated with any special bird—it is sometimes attributed to a Bat—and slips from the memory in the way of most other isolated sense impressions, and is forgotten before the next call is heard. The

trained ear recognizes the note instantly, but usually it is recorded as that of a commonplace bird, an obvious migrant, engaged in its normal journeyings.

Redwings roost in company, generally in association with Starlings, and the note is commonly heard as the birds come in for the night. It is a shrill "seep," audible from a great distance, but perhaps the call most often heard through the day is a soft "chup" or "yup" that has no sibilant quality. I think the latter note is confined to the female, but here my observations are not so numerous as I should wish. After many hours spent in watching the birds I am in no position to interpret either the "seep" or the "chup," and do not know their meanings; they may be notes of alarm, or signals, or perhaps exclamations of no import whatever. Occasionally the Redwing uses a harsh chuckle that is almost as loud as the well-known alarm of the Blackbird; this appears to be a true alarm-note. I might add that the Redwing sings regularly and frequently during its stay in England. I hear the song often, for it is a conspicuous sound of fine days in autumn and spring (*cf.* 'Lancashire Naturalist,' ii. pp. 39-41).

During the night the "seep" alone is used. In the fields there is no part of the twenty-four hours when we may not hear the call, but in places where the Redwing is never seen, as in the heart of London and other large towns, or over wide peat-moors or over the sea, the sound is confined to the hours of darkness. It is most frequently heard on fine still dark nights, but I have remarked it in bright moonlight, fog, drizzling and heavy rain, snow, and hard frost. We do not often hear it in boisterous weather, and perhaps the Redwing does not fly on such nights.

Three years ago Mr. H. B. Booth described ('Naturalist,' 1908, pp. 17-18; and also 1909, p. 78) an "Extraordinary Immigration of Redwings" in Yorkshire. The note is both valuable and interesting, but if I read the facts aright the movement should not be termed *extraordinary*, for it is a normal phenomenon, and one that we have been observing for many years in Lancashire (*cf.* 'Report Oldham Micros. Soc. and Field Club,' 1903-4, p. 25). Mr. Booth does not give his reasons for believing the movement to be migratory. (I trust the reader will

not view this as a mere quibble of criticism on my part; really it is a necessary discussion of the subject.) The birds are also described as being in one continuous flock, and here again there is a strong probability that a mistake has been made. When we hear a succession of separate calls we are more likely to attribute them to a passing flock than to a single bird flying around one's head. For instance, on the night of Nov. 4th, 1909, in the heart of London, I heard the call repeated hundreds of times. At 10, when I noticed the first one, the sky was cloudy, with little or no wind; at 11.15 a slight rift appeared in the south-east, and by 12.30 the sky was entirely clear. There was three-quarters of a moon, rising about 8.30. From 10.15 to midnight there was a constant succession of calls, sometimes with five-seconds intervals, occasionally a minute or even more apart. The birds were evidently low down, and some were certainly within fifty feet of my ears, and it was very strange to stand in what is perhaps the busiest street in England and listen to the mysterious birds piping above the heads of the oblivious crowd below. Yet it was not easy to imagine that big flocks were passing, for the cries were always separate, and I did not hear one except after an interval of some seconds. When a flock of birds passes us in daylight, or even by night (Terns or Curlews on migration, for instance), their voices come in bursts or gusts; but, although I have heard the nocturnal call of the Redwing thousands of times, I cannot recollect a single occasion on which the birds were calling in unison.

My personal observations on the Redwing by night have been made in many parts of Great Britain, from Fifeshire to Kent, and from Norfolk to Anglesea, and my knowledge has been enriched by the notes contributed by many of my friends. Perhaps there are parts of the country where the bird is never known, and a knowledge of these localities might be useful. I have heard them constantly over the largest towns: one cannot stand for long in a quiet London street after dark on a close October or November night without hearing the ear-piercing note. We cannot be sure that lights attract them, for I have frequently noticed the voice of the bird over miles-wide Pennine moorlands or bare Welsh hills far from any house. This has been my experience when I have walked out over a wide stretch

of sand at low tide, or when standing at the extremity of a long pier or breakwater, or on a headland jutting into the sea.

Of course, I have often been out on a favourable night and never heard the note, or perhaps paid no attention to it, for the most fascinating of subjects is stale at times. Very often the footfall must drown the sound, for it is of but the briefest duration; yet, nevertheless, I rarely go to the trouble of standing to hear the call without being rewarded, for certain nights never fail to suggest the passing of the Redwings. In this connection the following quotation from Dr. Buckland ("Curiosities of Natural History," ser. ii. 285-6, *cf.* Henderson, 'Folklore of the Northern Counties,' p. 99) is worth notice:—

"A rushing rustling sound is heard in the English Channel on the still dark nights of winter, and is called the Herring Spear, or Herring Piece, by the fishermen of Dover. It is caused by the flight of . . . Redwings as they cross the Channel to warm regions. The fishermen listen to the sound with awe, yet regard it as an omen of good success with their nets." The passage is not the most lucid, and a fresh investigation of the superstition would be welcome; yet it is easy to understand how the presence of Herrings near the surface of the sea on a fine night would be associated with the passing Redwings in the minds of the fishermen.

Considering the maze of telegraph- and telephone-wires above our towns, we might expect to have great numbers of "wired" Redwings; yet I cannot remember seeing even one, although I have handled a good many Song-Thrushes that have been killed in this manner. It is curious to find Mr. Barrington (in his great work on Migration in Ireland) recording a striking preponderance of Song-Thrushes over Redwings at the Irish lighthouses (from 1881 to 1899 he received one hundred and eighteen against sixty-one, but in some years—1891, for example—the proportions were eighteen and three); perhaps the Redwing has specially keen senses that enable it to steer its course with little danger in the dark of the night, or the disparity in numbers may be due to the Song-Thrush being the more abundant bird in Ireland.

For a migrant the Redwing is strangely averse to leaving its favourite fields. Thrushes and Fieldfares soon desert a district

when continual frosts or snow make the task of securing food a matter of difficulty, but most of us know that the Redwing will remain until it succumbs of starvation. We must, therefore, view it as a very sedentary bird, and not as a gipsy migrant continually wandering about the country. This is the point on which the student will make his most interesting and also his most puzzling observations.

Speaking in a general way, we rarely indeed notice the voices of any other Passerine birds after nightfall, and there is no doubt that in many parts of England the calls of the Redwing outnumber those of all other birds together. The Redwing alone amongst its kindred passes the nights in mysterious wanderings. The habit is not well known to the present-day ornithologist, but I think it was more familiar in England in olden times, and that it has some connection with the name "Swinepipe" still used for the Redwing in various parts of England. This word has, or had, many variants, some of which are "Windpipe," "Winnard," "Windle," "Wheenerd," "Wingthrush," and "Windthrush" (*cf.* Swainson, 'Provincial Names'; Newton, 'Dictionary of Birds,' &c.). Dr. Charleton told Willughby (*bk. ii. p. 189*) that they were called "Wind Thrushes" because "about the beginning of winter, when strong winds blow, by which perchance they are assisted in their passage, they come to us from the sea." But Willughby thought the name might be from the German "Wyn Trostel" [the equivalent to the modern *Weindrossel*], "or Vineyard Thrush, because . . . they feed upon grapes, . . . so that by mistake they are called Wind Thrushes, their true name being Wine Thrushes." It rather appears to me that all these old English names are more likely to have the root "Whine Thrush," but the change must have taken place long ago, for in 1548, in Cooper's 'Thesaurum Linguæ,' it is "Wing Thrush." Newton derives the word "Swinepipe" from the "pipe used by swineherds," which resembled the shrill voice of the bird, but there is no evidence to support it; and it must be remarked that Slaney appears to connect the word with the "chup" note. The connection between the German name and the vine seems to be not proven.

I hope that this brief introductory note will succeed in attracting more attention to the Redwing, for it is really one of

the most mysterious of our birds. There is no doubt that it passes a large proportion of the hours of darkness on the wing, but for my part I can see no evidence strong enough to enable us to look upon *all* these movements as migratory. And even if we are ever able to prove that the calling birds are on migration, we are faced with another problem in our knowledge that the other Passerine birds do *not* migrate in this way.

Up to now I can only imagine two possible explanations, other than the unsatisfactory one of migration. The first is that the note is not confined to the Redwing, but is the common property of many other Passerine birds when on migration. I wish only to mention this, and do not hold the view.

The remaining suggestion is that these noisy journeys constitute a form of song. We have already in the Waterhen a bird whose only "song" consists of wild flights high in the dark air above town and country, but so far as I know this song-period is confined to spring and summer, and I have never observed it before the first week in March or after the first week in July. In January and February, when food is scarce, the nocturnal calls of the Redwing are rarely heard, but in the fine weather of autumn and spring, when the birds are singing by day in the tree-tops, we expect to hear their notes by night. I have elsewhere ('British Birds,' iii. pp. 155-56) expressed my opinion that bird song has no direct connection with sexual affairs, and shown why it must be regarded as nothing but the ebullition of superabundant energy; and there would be nothing unexpected in the discovery that the male Redwing lets off his superfluous vitality by wandering about in the dark skies of autumn. Probably the final solution will be based on observations made in the breeding haunts of the birds, when they are perfectly sedentary, for in this country the actual migratory movements are certain to obscure the subject. We often read that Redwings migrate in hard weather, and read also that they die of starvation at such times: it is just then that we rarely hear their nocturnal voices! And I know no better justification for my notes than the easily ascertained fact that the majority of ornithological writers have little or even no knowledge of these noctivagations of the Redwing.

THE DISTRIBUTION OF BRITISH ANNELIDS.

BY THE REV. HILDERIC FRIEND, F.L.S., Fellow Royal
Microscopical Society.

(Continued from p. 191.)

11. DEVONSHIRE.—The naturalists of this county have in past years given some attention to the Oligochæts. Allusion is made to them in Bellamy's 'Natural History of South Devon,' and the invaluable 'Transactions' of the Devonshire Association may also be consulted. But we are not aware that anything of value has been published since the days when the study was placed on a new and scientific basis. My records are founded on personal observations, and on a series of specimens collected for me some years ago by my sister, Nurse Hetty Friend. I have previously published a brief article on Devonshire Earthworms in the 'Field Club.' The only worm recorded by Johnston ('Catalogue,' p. 61) which is indisputable is (1) *Allurus tetradrus*, Sav., and this has been confirmed by Beddard, who received it from Bickleigh, near Plymouth. The so-called *Lumbricus minor* may include three or four different species, but I may here regard it as equivalent to (2) *L. castaneus*, Sav., which occurs under droppings in pastures. To these we may add (3) *L. terrestris*, L., and (4) *L. rubellus*, Hoffm. I have no record for the other two species of *Lumbricus* found in the British Isles. (5) *Allolobophora longa*, Ude, and (6) *A. caliginosa*, Sav. (perhaps the form *turgida*, Eisen), also occur. The Brandling (7) *Eisenia fetida*, Sav., is abundant at Bovey Tracey and elsewhere. My specimens from this county are smaller and darker than those found further north—a subject of interest upon which further observations are desirable (see 'Westminster Gazette,' June 10th, 1911). (8) *Aporrectodea chlorotica*, Sav., is likewise widely distributed, as well as (9) *Eisenia rosea*, Sav. (= *mucosa*, Eisen), and (10) *Dendrobæna subrubicunda*, Eisen. In April, 1906, I received some worms from Wookey Hole, through Mr. W. Evans,

F.R.S.E., of Edinburgh, and was hoping they would prove to be an addition to our list, but they turned out to be merely a duplication of the last record. The only other record is in need of confirmation. I received from my sister two specimens of a small worm whose girdle extended from segments 31 to 36. This I have recorded as (11) *D. mammalis*, Sav. (= *D. celtica*, Rosa). Much evidently remains to be done in this delightful county. Total, 11.

12. DORSET.—Though I believe several worms are known, I have reliable records for two only. Yet it was from Dorset that I got my inspiration. The Rev. O. Pickard Cambridge gave much attention to (1) *Allurus tetrædrus*, Sav., which he found at Hyde, near Wareham, in July, 1888. Dr. Benham wrote to Cambridge for specimens, and said the species was new to Britain. This, however, was a mistake, as it was already recorded for Devonshire by Johnston (see *supra*). Benham wrote about it in 'Nature,' and Beddard in 'Proc. Roy. Phy. Soc. Edin.' x. 209. Mr. Cambridge also found a second worm in the same locality, which was said to be *Allolobophora bæckii*, but which, I think, must be provisionally entered as (2) *Dendrobæna subrubicunda*, Eisen.

13. DURHAM.—My son, J. Newton Friend, D.Sc., Ph.D., has sent me specimens of nine different kinds of earthworms from this county as follows:—Darlington, September, 1909: (1) *Allolobophora longa*, Ude; (2) *Lumbricus terrestris*, L.; (3) *L. rubellus*, Hoffm., and (4) *L. castaneus*, Sav.; (5) *A. caliginosa*, Sav. (*turgida*, Eisen); (6) *Aporrectodea chlorotica*, Sav.; (7) *Eisenia rosea*, Sav.; and (8) *Dendrobæna subrubicunda*, Eisen. In August, 1911 (9) *Eisenia fetida*, Sav., from clayey garden soil.

14. ESSEX.—I have published information on Essex Earthworms from time to time in the 'Essex Naturalist' and elsewhere. In the early nineties I had a most excellent correspondent and collector in the person of Mr. Wm. Allen, of Canning Town. Mr. Wm. Cole, F.L.S., and Mr. George Day, F.R.M.S., also assisted me in my endeavours to make the county list complete. Mr. Allen sent me from Plaistow Marsh (1) *Bimastus eiseni*, Levinsen, and an allied form, which I named var. *gracilis*, but which I am now disposed to think may have been a different species. (2) *Dendrobæna arborea*, Eisen, is

found in Epping Forest, as well as (3) *D. subrubicunda*, Eisen. Mr. Day sent me; also from Epping Forest and elsewhere, the three common species of *Lumbricus*, viz. (4) *L. terrestris*, L.; (5) *L. rubellus*, Hoffm.; and (6) *L. castaneus*, Sav. On April 6th, 1892, I received a series of worms from Epping Forest, which contained, in addition to some of the foregoing, specimens of (7) *Allolobophora longa*, Ude, and some very curious examples of (8) *A. caliginosa*, Sav. Some of these were typical *turgida*, Eisen, but one specimen was remarkable in that it had a continuous band (*tubercula pubertatis*) on one side extending over four segments, with discontinuous pores on the other side. From Plaistow Marshes Mr. Allen sent me about the same time the three species of *Lumbricus*, together with fine types of (9) *Eisenia fœtida*, Sav., or the Brandling, and the Gilt-tail recorded above (3), with (10) *Aporrectodea chlorotica*, Sav., and var. *pallescens*, Friend. In May I had from the same indefatigable worker, from Rainham, in addition to Nos. 4, 6, 8, 10, the Square-tail (11) *Allurus tetrædrus*, Sav. Further consignments confirmed many of the foregoing, and added (12) *A. caliginosa*, form *trapezoides*, and a species of *Dendrobæna* which I was not able to identify. I fear the specimens are now lost, but, as the Essex gleanings were rich in curious forms, possibly it was a rare or unknown species. Oerley, a Hungarian authority, who worked for a time in England, examined the worms around Woolwich, and recorded one or two (notably *Octolasion rubidum*, Oerley), which have not been found again either here or elsewhere. Having had large numbers of types from the same localities, I do not record Oerley's species, as I think they would have been met with again had his records been correct. A species received from the Old Forest through Mr. Day in June, 1902, resembled No. 3 in certain particulars, but may have been a different form. (13) *Eisenia rosea*, Sav. (= *Allolobophora mucosa*, Eisen) reached me from various localities, and (14) *Octolasion lacteum*, Oerley, came from Mr. Allen's garden in Canning Town, as well as from Epping Forest (recorded as *Allolobophora profuga*, Rosa). Total, 14.

15. GLOUCESTERSHIRE.—While Mr. Allen and others were working so assiduously in Essex, Mr. Watkins, of Painswick, was emulating them in his efforts to make the list for this

county as complete as possible. The three species of *Lumbricus* were early in the field: (1) *L. terrestris*, L.; (2) *L. rubellus*, Hoffm.; and (3) *L. castaneus*, Sav.; also (4) *Allolobophora longa*, Ude; (5) *Dendrobæna subrubicunda*, Eisen; (6) *Aporrectodea chlorotica*, Sav., and (7) *Bimastus eiseni*, Levinsen; (8) *Dendrobæna mammalis*, Sav. (= *A. celtica*, Rosa) was in good form. I received the same worm also from Avonmouth through my friend Mr. Huddart, who also added (May 24th, 1892) two new species to the list. The first (9) *Lumbricus festivus*, Sav. (= *L. rubescens*, Friend), had never before been received from any correspondent, all the specimens I had seen having been collected by myself. The second was (10) *Octolasion lacteum*, Oerley (= *A. profuga*, Rosa). The two forms of *caliginosa* (11) *Allolobophora turgida*, Eisen, and (12) *A. trapezoides*, Dugès, also occur, and (13) *Eisenia rosea*, Sav. The list closes with (14) *Allurus tetrædrus*, Sav. Total, 14.

16. HAMPSHIRE.—This county, rendered famous by White's 'Natural History,' is still sadly neglected so far as the earth-worms are concerned. We have so far not a single trustworthy record.

17. HEREFORD.—During the past three years I have been able personally to work a portion of this county with good results. My visits have chiefly been to the district between Malvern and Ledbury, including Colwall, Bosbury, and Eastnor. The four species of *Lumbricus* all occur, viz. (1) *L. terrestris*, L.; (2) *L. festivus*, Sav. (= *L. rubescens*, Friend); (3) *L. rubellus*, Hoffm.; and (4) *L. castaneus*, Sav.; also (5) *Allolobophora longa*, Ude, and (6) *A. caliginosa* forma *turgida*, Eisen, as well as (7) forma *trapezoides*, Dugès. (8) *Octolasion lacteum*, Oerley (= *A. profuga*, Rosa), is of frequent occurrence in the gardens, as well as its related form (9) *O. cyaneum*, Sav. (= *Allolobophora studiosa*, Rosa). The Brandling (10) *Eisenia fætida*, Sav., and (11) *E. rosea*, Sav., are very plentiful. (12) *Aporrectodea chlorotica*, Sav., occurs everywhere, and the watercourses can hardly be searched in vain for (13) *Allurus tetrædrus*, Sav. (14) *Dendrobæna subrubicunda*, Eisen, and its small ally, the true Treeworm (15) *D. arborea*, Eisen, may be found in dead stumps and old leaf-mould. (16) *Bimastus eiseni*, Levinsen, occurs in the same situations at West Malvern. Two other worms remain to be mentioned. I found

(17) *Helodrilus oculatus*, Hoffm., last Easter in a ditch near Eastnor—an interesting record; while (18) *Eisenia veneta*, Rosa (= *Allolobophora hibernica*, Friend), has at West Malvern yielded two very sharply defined varieties, which I have named respectively *robusta* and *dendroidea* (see 'Gardeners' Chronicle,' October 9th, 1909). The county record stands at total 18.

18. HERTFORDSHIRE.—I am chiefly indebted to the Rev. Theodore Wood for my knowledge of the Annelids of this county, and published an account of eight species so long ago as December, 1891, in the 'Field Club.' They were collected at Baldock, and in the following year the list rose to a total of fifteen species, as follows: (1) *Lumbricus terrestris*, L.; (2) *L. rubellus*, Hoffm.; (3) *L. castaneus*, Sav. (= *purpureus*, Eisen); (4) *Allolobophora longa*, Ude; (5) *A. turgida*, Eisen; (6) *A. trapezoides*, Dugès (these two being forms of *A. caliginosa*, Sav.); (7) *Octolasion lacteum*, Oerley (= *A. profuga*, Rosa); (8) *Bimastus eiseni*, Lev.; (9) *Eisenia foetida*, Sav., or the Brandling, and (10) *E. rosea*, Sav. (= *A. mucosa*, Eisen); (11) *Aporrectodea chlorotica*, Sav., and (12) *A. cambrica*, Friend; (13) *Dendrobæna subrubicunda*, Eisen, and (14) *D. arborea*, Eisen; with (15) *Allurus tetrædrus*, Sav. One of the specimens of *Allurus* had the male pores on the twelfth instead of the thirteenth segment.

19. HUNTINGDONSHIRE.—Nothing known.

20. ISLE OF MAN.—We owe our knowledge of the Manx Annelids to Mr. Southern, B.Sc., and those interested in the subject should consult his "Contributions towards a Monograph of the British and Irish Oligochæta" in Proc. Royal Irish Acad. xxvii., Section B, No. 8 (1909). In addition to several Enchytræids, which will be recorded later, we find: (1) *Lumbricus rubellus*, Hoffm.; (2) *L. castaneus*, Sav.; (3) *Allurus* (= *Eiseniella*) *tetrædrus*, Sav.; (4) *Aporrectodea* (*Allolobophora*) *chlorotica*, Sav.; (5) *Dendrobæna subrubicunda*, Eisen; (6) *D. arborea*, Eisen; (7) *Bimastus eiseni*, Lev.; (8) *B. constrictus*, Rosa; and (9) *Octolasion lacteum*, Oerley (= *A. profuga*, Rosa).

21. ISLE OF WIGHT.—No records to hand.

22. KENT.—I wrote on the Earthworms of Kent some years ago in the 'Field Club,' recording six species received from "Abbey Wood, Kent, in light sandy soil," through the kindness of the editor, Rev. Theodore Wood. I give the corrected list in

the order in which I then described them: (1) *Eisenia fætida*, Sav., or the Brandling, and its ally, the Gilt-tail; (2) *Dendrobæna subrubicunda*, Eisen; (3) *Allolobophora turgida*, Eisen; (4) *Allurus tetrædrus*, Sav.; (5) *Lumbricus rubellus*, Hoffm.; and (6) *L. castaneus*, Sav. Though Darwin lived and worked in Kent, he does not help us to a knowledge of the species of worms found there. I was at Tunbridge Wells, March 26th, 1892, and found (7) *Lumbricus terrestris*, L., and (8) *L. festivus*, Sav., with the other two species of *Lumbricus*; also (9) *Allolobophora longa*, Ude, and (10) *Dendrobæna mammalis*, Sav. In July of the same year Mr. Wood sent me from Thanet several of the foregoing, besides (11) *Aporrectodea chlorotica*, Sav.; (12) *Octolasiium cyaneum*, Oerley (= *A. studiosa*, Rosa); and (13) *Eisenia rosea*, Sav. (= *A. mucosa*, Eisen). I regret that during my residence in Sheppey and my visits to the South of England I rarely had opportunities for more extended researches, or the number would certainly exceed the present total, 13.

23. KEW GARDENS.—Naturally we find many Annelids in Kew Gardens which are not indigenous. I omit from this list all foreign genera, and retain only those species which are either known to be British by the fact that they are found elsewhere within our area, or are so nearly allied to known species that there is a possibility of their being natives. It is many years since I first visited Kew for the purposes of this study, and I have had every assistance from the officials and gardeners down till the present time. The Kew 'Bulletins' and Beddard's 'Monograph' should be consulted by those who wish for fuller information. In March, 1897, I received from the late Mr. G. Nicholson (1) *Lumbricus terrestris*, L.; (2) *L. rubellus*, Hoffm.; and a variety of (3) *Aporrectodea chlorotica*, Sav.; besides *Branchiura* and other forms. Mr. S. T. Dunn, B.A., also sent me somewhat later some interesting species, which will be recorded under another head. The systematic study of the Annelids, however, may be said to have been begun in 1909, and it is still progressing. During this time we have added (4) *Allolobophora turgida*, Eisen, and (5) *A. trapezoides*, Dugès. These two forms are sometimes very distinct at Kew. (6) *Eisenia fætida*, Sav., is very variable, probably because specimens are often introduced from other parts of the world. (7)

Dendrobæna subrubicunda, Eisen, and (8) *D. arborea*, Eisen, are frequent. Here I place also (9) *D. submontana*, Vej., concerning which I wrote fully in the 'Gardeners' Chronicle,' January 29th, 1910. A new species of *Aporrectodea* was also found in 1910—(10) *A. similis*, Friend—and I see no reason why it should not be frequently met with elsewhere. The type and varieties of (11) *Eisenia veneta*, Rosa, have often occurred; also (12) *E. rosea*, Sav. (= *Allolobophora mucosa*, Eisen); (13) *Lumbricus castaneus*, Sav.; and (14) *Octolasion cyaneum*, Oerley (= *Allolobophora studiosa*, Rosa); and in September, 1909, I found (15) *Dendrobæna octædra*, Sav. (= *bœckii*, Eisen), which is one of our rarest worms; also (16) *Allolobophora longa*, Ude, and (17) *Bimastus constrictus*, Rosa. Some well-known species will yet be found, without doubt, when the survey is complete. Total, 17.

24. LANCASHIRE.—It is twenty years since I began my personal researches here. On June 5th, 1891, I recorded from the neighbourhood of Colne (1) *Lumbricus rubellus*, Hoffm.; (2) *L. castaneus*, Sav.; (3) *L. terrestris*, L.; (4) *Allolobophora trapezoides*, Dugès; (5) *Dendrobæna subrubicunda*, Eisen; (6) *Eisenia rosea*, Sav.; (7) *Aporrectodea chlorotica*, Sav.; and (8) *Allurus tetrædrus*, Sav. On Easter Monday, April 18th, 1892, I was at Morecambe, and found all the foregoing, together with (9) *Dendrobæna mammalis*, Sav. (= *Allolobophora celtica*, Rosa), and (10) *Allolobophora turgida*, Eisen. Meanwhile, I had received from Mr. Nuttall, of Rochdale (September 26th, 1891), (11) *A. longa*, Ude, and Nos. 1, 3, 6, as given above. In 1899 I found some of the foregoing at Stockport, and added a new Enchytræid. My later visits have been occupied chiefly with the estuarine forms and Enchytræids, which will be dealt with later. Mr. Southern has recently added two or three interesting species to this list. He records in the 'Contributions' (see Bibliography, p. 184), Nos. 1, 3, 5, 6, 7, 8, 10, 11, and adds (12) *Dendrobæna arborea*, Eisen (= *rubidus*, Sav.); (13) *Eisenia fœtida*, Sav.; and *Octolasion cyaneum*, Oerley. The phosphorescent worm referred to by Johnston ('Catalogue,' p. 62) remains in doubt. Total, 13.

25. LEICESTERSHIRE.—In June, 1892, I received from Mr. Elliott, of Belgrave, Leicester, two batches of earthworms. They were all of the ordinary species, numbering eight, as follows:

Three species of *Lumbricus*—(1) *L. terrestris*, L.; (2) *L. rubellus*, Hoffm., and (3) *L. castaneus*, Sav.; (4) *Allolobophora longa*, Ude; (5) *Eisenia fœtida*, Sav., and (6) *E. rosea*, Sav.; (7) *Aporrectodea chlorotica*, Sav.; and (8) *Dendrobæna subrubicunda*, Eisen. I have so far been able to add only one species to list, viz. (9) *Allurus tetrædrus*, Sav., near Ashby.

26. LINCOLNSHIRE.—Though there are many able naturalists in this county, and much good work has been done in other directions, our knowledge of the Annelids is terribly in arrears. Unless I have mislaid my records, there are at present only two species which have been duly authenticated. In April, 1893, I received from Mablethorpe, through Mr. Walter F. Baker, of Leeds, (1) *Lumbricus rubellus*, Hoffm., and (2) *L. castaneus*, Sav.

(To be continued.)

THE BIRDS OF THAT PORTION OF THE NORTH-EAST COAST BETWEEN TYNEMOUTH AND SEATON SLUICE, NORTHUMBERLAND.

BY J. M. CHARLTON.

(Continued from p. 313.)

BARN-OWL (*Strix flammea*).—In January, 1911, two of these birds were shot at Delaval Hall by Mr. Dixon, of Seaton. They had not been previously observed there, so very possibly were on migration. I have every reason to think that they would have remained and bred there, as others have probably done before.

LONG-EARED OWL (*Asio otus*).—A fairly regular autumn visitant. All the occurrences I know of were in the vicinity of Holywell Dene, among the trees there. This species makes straight for woods on its arrival.

SHORT-EARED OWL (*A. accipitrinus*).—A regular winter visitant; numbers have been shot on the coast. Unlike the preceding species, it has not such a strict partiality for trees, but after its arrival is found along the sand-banks and fields near the shore. As many as ten have been flushed in a flock at once.

TAWNY OWL (*Syrnium aluco*).—In autumn a few arrive on the coast and pass inland, and return in spring to depart for the Continent. They have been shot on the rocks by St. Mary's Island. On May 4th, 1904, when in company with A. King, Esq., I observed one of these birds at Briar Dene, which flew in the direction of Whitley, mobbed by Rooks and small birds. On our return to Cullercoats, the first object which caught our eye, passing St. George's Church, was a Tawny Owl, evidently the same bird, sitting beneath a small arch in the steeple, and surrounded by twittering Sparrows.

[MARSH-HARRIER (*Circus æruginosus*).]—A bird of this species was stuffed, very badly, and placed in the windows of a shop at Tynemouth, where it was for many years. On making enquiries, I learnt that it had been shot off Tynemouth in about 1820.

As I have my doubts as to this, I have made but a passing mention of it.

COMMON BUZZARD (*Buteo vulgaris*).—A rare visitant. Two birds were observed by several people in Holywell Dene early in May, 1904, and one of them was shot. A male of the dark form was shot in Holywell Dene in December, 1907, by Mr. Richardson. It is now in my possession.

ROUGH-LEGGED BUZZARD (*B. lagopus*).—This species has only once occurred within the district. A very fine specimen (immature male) was shot on Nov. 15th, 1910, by R. Dixon, of Seaton Delaval. He had observed it for a fortnight flying about among the trees near Delaval Hall. Several local gunners were, of course, out after it. He could always tell where it was by the commotion caused among the Rooks. When shot it was flying from a large beech-tree, among others, forming a small copse near the Hall. It is a very fine darkly-marked bird ('British Birds,' December, 1910).

WHITE-TAILED EAGLE (*Haliaëtus albicilla*).—A very rare winter visitant; the first example procured here was shot about 1874 by a Mr. John Armstrong off the rocks near the point to the north of Cullercoats Bay. This specimen was only "winged," and was kept in confinement at the 'Huddleston Arms Hotel' at Cullercoats for some weeks. A second example was shot in Holywell Dene on Nov. 25th, 1903. The latter was at first thought to be a Golden Eagle, as is often the case, and was inserted in the local papers as such, but when sent to be stuffed it was identified as a Sea-Eagle. Mr. Siddle, of Holywell, who shot it, tells me that on the first occasion that he had ever handled a gun he walked into the Dene, and was told that there was an Eagle there. Going on, he came upon two men, and saw them creeping up to a gate on which sat the bird itself. At about thirty yards' range steady aim was taken by one—"bang!" The Eagle launched itself into the air. Another report, then two more in quick succession, and still the bird flew on! It flew some distance towards Mr. Siddle, and settled in a tree close by him. He fired, and it fell to earth with a dull thud. It was set up by R. Duncan, who informs me that it had numbers of shot in it, which had evidently been in several days, and had caused festering wounds. It was a very large

specimen, an immature female in the fourth year, three inches above the average length. Its measurements were: Length, 39 in.; extent of wings, 92 in.; weight, 11 lb. It would be halting on migration south, very probably having been shot at and wounded on its passage. The confusion in its identity arose from the fact that it had not assumed the white tail.

SPARROW-HAWK (*Accipiter nisus*).—A rare visitant on migration in autumn. The only records are: an immature female, shot at St. Mary's Island in January, 1892, by Herbert Coxon, Esq., and now in his collection; another, shot at Cullercoats about Jan. 10th, 1911; one which passed through Mr. Richardson's hands in 1907; another, shot at Cullercoats in December, 1910; and on April 9th, 1911, my brother and myself observed one from our house, flying north against a heavy wind, and evidently on migration. It flew close above the cliffs at Cullercoats.

HONEY-BUZZARD (*Pernis apivorus*).—In his catalogue of the 'Birds of Northumberland and Durham,' John Hancock mentions a mature bird that was picked up, drowned, on Whitley Sands on Aug. 27th, 1835, when he was on the beach.

PEREGRINE FALCON (*Falco peregrinus*).—A very rare autumn visitant. A female in the first plumage was shot at Hartley Bates on Sept. 22nd, 1852, and is now in the Hancock Museum. In his 'Scraps about Birds,' C. M. Adamson says:—"On the 8th October, 1858, I saw a young Peregrine Falcon which a fisherman at Cullercoats had shot early in the morning whilst feeding on a Woodcock, which it had probably caught before having actually alighted." Another specimen was shot by Mr. Ewen on St. Mary's Island on Oct. 1st, 1889; it had the whole leg of a Partridge in its crop. It is in Mr. Ewen's possession, and was stuffed by Mr. R. Duncan, being one of the best examples of his skill.

HOBBY (*F. subbuteo*).—The only record of this species is that of an adult female, shot at Cullercoats on June 2nd, 1863, and mentioned by J. Hancock in his catalogue, who states that it was at the time of his writing in the possession of Mr. M. C. Woods, of Holleyn Hall. This bird was on passage from the south.

MERLIN (*F. aesalon*).—An occasional visitant in autumn and winter. The first record I have is of a female shot at St. Mary's
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Island by J. Duncan on Nov. 16th, 1892, which is now in the collection of H. Coxon, Esq. In 1904 two specimens (immature) were shot, now in Mr. Richardson's possession.

KESTREL (*F. tinnunculus*).—A not uncommon visitor to the fields in autumn and winter when on migration; numbers appear to arrive on the coast in autumn. Nearly all the occurrences are of immature and female birds, adult males being very rare.

OSPREY (*Pandion haliaëtus*).—A rare visitant on migration. Selby mentions one shot near Hartley, which must have been a few years prior to 1831. I am indebted to Mr. R. Duncan for the following trustworthy and interesting information concerning this species:—"The first specimen I saw obtained was one shot by a pitman of Hartley. It was feeding on the carcass of a horse which lay in the passage between the island and the mainland. This was about the year 1850. The second was seen by myself at Tynemouth about 1860, where it was afterwards shot. A third specimen was shot at Hartley about 1872. A fourth was seen on the flagstaff at the rifle-range near St. Mary's Island. A pitman fired three shots at it, missing it completely; but the bird was so exhausted that it could not stir from its perch. Eventually it was shot when the man approached within closer range. This would be about 1876. The last bird was one which, although it had several shots fired at it, escaped out to sea, flying close to the water with heavy wing beats. This was in 1881. As far as I can remember, all the above birds were seen or procured in September." The last was procured in the year in which the remarkable number of ten specimens were recorded on the east coast of England.

CORMORANT (*Phalacrocorax carbo*).—Occasionally passes along the coast; it is observed going north in spring and south in winter in small flocks. "Gormer" or "Gourmet" are the local names for the Cormorant. On several occasions during the winter of 1910 a Cormorant took its stand on the Black Midden Rocks at the mouth of the Tyne, and remained sitting within thirty yards of the shore on a half-submerged rock. The children assembled once and pelted it with stones, but the only notice it took of the missiles was to occasionally move its head out of the line of flight of one if it came too near. On Dec. 14th,

1910, I observed one of the white-breasted variety of the Cormorant off St. Mary's Island. I was shooting from a coble, and the bird rose up from the water facing the wind, and with its breast to me, the whole of which, together with the belly, appeared dull white. This form is described in the 'Field' for Nov. 6th, 1909, and also in 'British Birds.' The bird I saw had not any white on the throat or neck. William Turner, in his Commentary on the Birds of Pliny and Aristotle (1544), says: ". . . . I have seen Mergi [Cormorants] nesting on sea cliffs about the mouth of the Tyne river. . . ." Some of the cliffs here referred to are doubtless those of Tynemouth. While touching on the subject it would perhaps not be inappropriate to give a short sketch of the geological features of the district. These have for many years been a source of trouble to geologists. The strata of the rocks along the coast have been so broken up that in some cases it is difficult to define them. This peculiar action is believed to be due to a great thrust from the north, which has probably originated in the elevation of the Cheviot range in a former geological age. The coast-line is composed for the most part of coal-measure rocks, but there are blocks of magnesium limestone (Permian) let into the cliffs by faults at three points, *viz.* Tynemouth (Cullercoats), Whitley, and Seaton Sluice. The outcrop of this limestone at Tynemouth is very large, and forms the whole of the cliff on which the castle stands; that at Whitley and Cullercoats is also of considerable size. A large quantity of limestone occurs at Whitley Dene, and it was formerly quarried, thereby forming the depression for the reservoir. The lime was extracted in kilns, which still remain, and form ample nesting-sites for Sparrows and Starlings. Marl slate is in evidence at Cullercoats, forming the base of the magnesium limestone, and seams of pulverized coal occur along the face of the cliffs on the south of George's Point, and also on the cliffs near St. Mary's Island. This latter is sometimes broken off and strewn in large quantities on the foreshore by the waves. There is an outcrop of yellow sandstone at the extremity of George's Point, Cullercoats, and again at the base of Cullercoats Bay, several large caves having been bored in it by the action of the tide. These sandstone cliffs have been proved by the nature of the particles of sand to be of

desert formation, and they are much favoured by flocks of domestic Pigeons as well as Sparrows, which obtain the grit from them. Quantities of shale occur just here.

SHAG (*P. graculus*).—An uncommon winter visitant. I have very few records, and all of immature specimens: one shot off the beacon point in front of our house at Cullercoats on Jan. 17th, 1904; two in the possession of Mr. Elliott, Whitley Bay, shot at Whitley, 1905; one shot by myself from a coble on Dec. 14th, 1910; and in January, 1911, I several times observed a bird of this species swimming about and diving in Cullercoats Bay. At a distance it was distinguishable from a Diver by the apparently greater effort it made in diving.

GANNET (*Sula bassana*).—Formerly not uncommon, when, my father informs me, several were often to be seen in summer fishing off the North Pier, Tynemouth, being visitors from the Bass Rock. Now the Gannet is but seldom seen. Mr. R. Duncan informs me that one day many years ago, while passing along at the island, he came upon one of these birds on the sand. It was entirely unable to rise, and on his approach disgorged a large quantity of fish, evidently partly in fear and partly to lighten itself so as to escape.

COMMON HERON (*Ardea cinerea*).—An occasional visitor in winter. One or more are observed on the coast every year. On Aug. 3rd, 1903, I observed a Heron come directly over the sea from the east, and on reaching the coast turn due south and pass out of sight. Occasionally a bird of this species visits the disused reservoir at Whitley, and remains a few days.

BITTERN (*Botaurus stellaris*).—A bird of this species was caught alive in a public lavatory at Cullercoats in February, 1905. This was the time that as many as six specimens occurred in the north of England, but this bird was not then recorded. Mr. Joseph Taylor, who caught the bird, kept it for several days, but it pined away and died. It was examined at the Hancock Museum, and set up by Mr. Taylor, who gave it to a Mr. Watson, of Wallsend. When in confinement Mr. Taylor informs me that it attacked him fiercely with its beak, and was handled with a considerable amount of danger.

(To be continued.)

L'AGE DES PERDRIX.

I.—LA PERDRIX GRISE.

PAR LE DR. LOUIS BUREAU.

(Directeur du Muséum d'Histoire Naturelle de Nantes.)

LES phénomènes de la mue, qui jouent un si grand rôle dans la biologie des oiseaux, ont attiré spécialement mon attention. Déjà, mon ami M. Harting a présenté aux lecteurs du 'Zoologist' une analyse de mon mémoire : ' De la mue du bec du Macareux arctique (*Fratercula arctica*) après la saison des amours.'

C'est encore l'étude de la mue des oiseaux qui m'a fourni les éléments d'un récent mémoire intitulé ' L'âge des Perdrix,'* qui est de nature à intéresser les ornithologistes et les chasseurs.

A la suite d'observations générales sur la mue, je suis arrivé à constater qu'il était parfois possible de déterminer, avec une étonnante précision, l'âge d'un oiseau tué à l'état sauvage. Et, parmi la gent emplumée, ce sont les Perdrix qui donnent les résultats les plus intéressants, les plus utiles, et les plus faciles à vérifier.

La Perdrix grise, surtout, se présente dans des conditions très favorables à l'étude.

La détermination de l'âge d'un Perdreau est basée sur la mue qui, débutant avant la fin du premier mois, se continue jusqu'à l'âge de quatre mois, généralement jusqu'à mi ou fin octobre, novembre pour les compagnies arriérées.

Après cette époque, jusqu'à octobre de l'année suivante, on peut encore reconnaître si une Perdrix est née au dernier printemps ou âgée de plus d'un an.

Cette étude de l'âge des Perdreaux offre non seulement un intérêt biologique, mais aussi un intérêt d'applications pratiques, surtout sur un terrain de chasse où on ne fait pas d'élevage.

Le chasseur possédant des notions précises sur le développement des Perdreaux se trouve, sur un terrain de chasse, dans la situation d'un voyageur qui, descendant pour la première fois dans une petite localité, se ferait fort de déterminer l'âge de la plupart des habitants et de reconstituer les familles.

Pendant les premiers mois de la chasse—fin d'août, septembre, octobre et parfois commencement de novembre—un Perdreau d'origine sauvage peut être daté avec précision.

* LOUIS BUREAU: 'L'âge des Perdrix.'—I. La Perdrix grise. In 8°, 124 pp., 35 figures. Nantes: Vié libraire, 28, Passage Pommeraye.—Williams & Norgate, 14, Henrietta Street, Covent Garden, London, W.C.

Tout chasseur peut se convaincre de la régularité avec laquelle se fait la mue d'un Perdreau :

Tuez un Perdreau gris pendant les mois que je viens de citer. Examinez ses ailes, surtout les 10 rémiges primaires, vous constaterez qu'elles sont dans le même état de développement : si l'une de ces rémiges vient de tomber à l'aile droite, vous verrez qu'il en est ainsi de celle qui lui correspond à l'aile gauche.

Si une des rémiges de remplacement, c'est-à-dire de deuxième plumage, a atteint, à l'aile droite, une longueur déterminée, même développement sera constaté à l'aile gauche.

La régularité de la mue des rémiges primaires apparaît ainsi nettement et des observations répétées ne font que la confirmer.

Tuez, à un départ, plusieurs Perdreaux d'une même compagnie, comparez leurs ailes, comme vous venez de le faire pour le précédent, vous constaterez une identité presque complète.

Voilà une constatation que tout chasseur peut faire chaque fois qu'il abat un ou deux Perdreaux. Elle est bien de nature à attirer l'attention.

Maintenant, comment se fait cette mue des rémiges primaires ?

Elle se fait suivant un ordre régulier, qui est toujours le même :

Numérotez les rémiges primaires, en allant de l'extrémité de l'aile vers le corps de l'oiseau :

1, 2, 3, 4, 5, 6, 7, 8, 9, et 10.

La 10^e rémige primaire du premier plumage tombera la première, avant la fin du premier mois, et, lorsque la plume de remplacement (deuxième plumage) aura atteint, en moyenne, 15 millimètres, en 3 jours, la 9^e du premier plumage tombera pour être remplacée aussitôt par une nouvelle rémige.

Ensuite tombent successivement, à *des intervalles de temps de plus en plus longs*, les 8^e, 7^e, 6^e, 5^e, 4^e, et 3^e auxquelles succèdent immédiatement des rémiges de remplacement *dont la rapidité de développement en 24 heures décroît suivant le même ordre.*

Les rémiges 2 et 1 ne tombent pas à la première mue. Elles persistent jusqu'à la fin de la seconde mue, septembre ou octobre de l'année suivante, ce qui permet de reconnaître pendant quinze ou seize mois si une Perdrix est jeune ou vieille : l'extrémité de la 1^{re} rémige est *pointue* chez le Perdreau jusqu'à l'âge de 15 ou 16 mois ; elle est *arrondie* chez la Perdrix plus âgée.

Ensuite on ne peut plus reconnaître l'âge d'une Perdrix.

De cette symétrie et de cette régularité dans la chute des rémiges primaires, à la première mue—*phénomène qui n'est sujet à aucune exception*—il est aisé d'entrevoir la possibilité de dresser un Tableau chronométrique de l'âge des Perdreaux.

C'est à quoi je suis arrivé, à la suite de onze années d'observations méthodiques, précédées d'années préparatoires.

Voici comment j'ai procédé :

J'ai fait quelques élevages, qui m'ont été utiles, tout en ne demandant des données certaines qu'aux Perdreaux nés et vivant en liberté.

Cependant, dans l'impossibilité où je me suis trouvé, pendant les dix premières années, de tuer des Perdreaux dont le jour de naissance, à l'état sauvage, m'était connu, j'ai dû acquérir, par l'élevage, des notions sur le développement de ces oiseaux pendant les premières semaines. J'ai fait usage des Perdreaux qui se développaient le mieux et qui, par leur maximum de développement ne paraissaient pas avoir souffert de l'élevage.

Connaissant le beau Perdreau d'élevage, il m'a été possible de prélever, à l'état sauvage, sur des compagnies de 2^e et 3^e couvées, un premier Perdreau que j'ai identifié avec des Perdreaux d'élevage dont j'avais conservé les dépouilles, déterminant ainsi son âge avec une précision qui ne laisse guère à désirer.

Après cela, j'ai prélevé, dans ces compagnies et dans d'autres mises en observation, des Perdreaux à des intervalles divers, qui m'ont permis de suivre les progrès de la mue, à un moment précis et pendant un temps déterminé.

Ces observations, souvent renouvelées, m'ont permis de dresser un Tableau chronométrique donnant, jour par jour, le développement *moyen* des Perdreaux, pendant toute la durée de la première mue, c'est-à-dire, pendant les mois d'août, septembre, octobre, et parfois commencement de novembre, chez les compagnies arriérées.

Au 1^{er} novembre, 1909, ce tableau me paraissait avoir atteint toute la précision désirable. Il restait à le *mettre au point*, à l'aide d'un Perdreau d'éclosion datée, né et vivant à l'état sauvage, et de lui faire subir ensuite un *contrôle* avec des Perdreaux de différents âges également datés.

N'étant pas encore parvenu, à cette époque, à suivre une compagnie dont le jour d'éclosion avait été constaté, le *zéro*, autrement dit le *jour d'éclosion* et celui de la chute de la 10^e *rémyge primaire* ne m'étaient connus que chez des Perdreaux d'élevage.

C'est alors qu'à la date du 20 mai, 1910, dans la crainte de ne pas encore réussir à constater le jour d'éclosion de compagnies de Perdrix, à l'état sauvage, je fis paraître une *Note préliminaire sur l'âge des Perdrix*, dans laquelle j'exposai la méthode employée dans mes recherches et sollicitai le concours de propriétaires ayant des goûts cynégétiques.

Il s'agissait de découvrir la date d'éclosion d'une ou plusieurs compagnies de Perdrix et d'y prélever, à partir du 30^e jour seulement, pendant les mois d'août, septembre et octobre, plusieurs individus pour les confronter au Tableau chronométrique.

Cet appel a été entendu et le contrôle a été fait avec toute la précision désirable pendant les premiers mois de la chasse de 1910.

Par un simple examen des ailes, un Perdreau nous avoue son âge, et on peut présumer s'il est en retard, normal, ou en avance dans son développement sur la moyenne atteinte par les individus de même âge. On conçoit le profit que les éleveurs peuvent tirer de cet intéressant résultat.

Si un Perdreau d'éclosion datée, confronté au Tableau, accuse deux ou trois jours de moins ou de plus qu'il n'a en réalité, *ce n'est pas le Tableau qui est en défaut, c'est l'oiseau qui est en retard ou en avance dans son développement sur la moyenne atteinte par les individus de son âge.*

A défaut de Perdreaux d'éclosion datée, tout chasseur peut soumettre à l'épreuve le Tableau chronométrique, à l'aide de Perdreaux tués à des intervalles de temps divers dans une même compagnie.

L'erreur à prévoir est, du reste, très limitée; dans les cas examinés elle n'excède pas trois jours, et ces cas sont rares.

Quelque fois même l'occasion s'offre au chasseur de déterminer exactement, à distance, l'âge d'une compagnie :

"Peut-être, avez-vous vu, parfois, au départ d'une compagnie, une plume se détacher sous l'influence des battements d'ailes précipités et tomber à terre. Le moment de la chute de cette rémige était arrivé, le départ en a été la cause déterminante.

"Remarquez l'endroit où tombe cette plume, prenez-la en main, et, si c'est une rémige primaire, ce que vous reconnaîtrez aisément, déterminez son numéro d'ordre, à l'aide des figures ci-jointes, qui donnent l'état des rémiges primaires du premier plumage parvenues à leur complet développement, telle qu'elles sont au moment de leur chute.

"Le Tableau chronométrique donnant l'âge auquel a lieu la chute de chaque rémige primaire vous fera connaître l'âge du Perdreau aussi exactement que si vous l'aviez en main."

Dans le mémoire dont je viens de donner un aperçu, il ne s'agit pas seulement de l'âge des Perdrix. Toute la biologie de la Perdrix grise est décrite d'après des observations sur nature. L'accouplement, l'époque de la ponte, le nombre des œufs, l'époque de l'éclosion, le développement du Perdreau gris jusqu'au moment où il est devenu Perdrix sont l'objet de chapitres spéciaux, accompagnés de figures en similitravure et d'autres au trait donnant soit les principaux plumages, soit l'état des ailes à la chute de chaque rémige primaire, base du Tableau chronométrique.

L'étude de *l'âge de la Perdrix rouge* fera prochainement l'objet d'un mémoire spécial, dans lequel le développement des deux espèces sera comparé.

NOTES AND QUERIES.

AVES.

White Wagtails at Co. Mayo.—For the first time since these birds have been observed visiting Bartragh regularly every spring, a pair were seen the last week in August (by Captain Kirkwood) visiting the island on their autumn migration. It is strange how none have been observed previously, although a sharp look-out has been kept for them in autumn as in spring. — ROBERT WARREN (Ardnaree, Monkstown, Co. Cork).

Abnormal Eggs of the Spotted Flycatcher.—A pair of Spotted Flycatchers built a nest in half a coconut-shell in this garden, and on May 31st last had five eggs. They were all unmarked, and all misshapen, and resembled one another in the latter respect almost exactly. I took one egg, and did not expect that any of the others would be hatched. But one of them was hatched, and the young bird became nearly full-feathered, when it died in the nest. Probably a cat killed the parents, or one of them, for they disappeared. The Flycatcher has been scarce here for the last three or four years, and this season—like some other summer birds—has been perhaps rarer than ever. It is impossible to preserve birds in village gardens so long as the villagers keep an unlimited number of cats, and the law relating to cats remains as it is. These beasts—the only so-called domestic ones allowed to roam at will on land that does not belong to their (nominal) owners—seldom fed, and constantly tormented by children, seek a quite refuge in people's gardens, and then destroy a large proportion of the nests of birds which do not breed in inaccessible holes, as well as of the old birds and young ones of all species just out of the nest.—O. V. APLIN (Bloxham, Oxon).

Starling and Bullock.—On one of the hottest days of the past summer I was standing close to some young bullocks which were sorely tormented by flies. One of them was closely attended by a young Starling, which was busily engaged in pecking these insects off his nose and eyes. As the bullock kept his head more or less close to the ground, his nose was within easy reach of the bird's beak, but in order to get at the flies clustering thickly about his eyes the

Starling had to make repeated jumps, exerting just enough force to reach and neatly take off its prey without touching the sensitive skin surrounding those organs. This was accomplished apparently with such dexterity and precision that the animal seemed to have no objection whatever, neither finching nor showing any other sign of annoyance or inconvenience.—G. T. ROPE (Blaxhall, Suffolk).

Nutcracker in Bucks.—It is probably worthy of record that on October 7th last I had a male Nutcracker (*Nucifraga caryocatactes*) brought to me in the flesh. It was killed in a horse-chestnut tree at the village of Whitechurch, about four miles from here. It was in good condition (quite fat). I fancy this is the first recorded instance of its occurrence in Bucks. It will be mounted for this museum. I may also state that on October 1st I received a young female Grouse from Dunkeld, Perthshire, which is white, with the exception of two or three dozen feathers. — EDWIN HOLLIS (The Museum, Church Street, Aylesbury).

The Variety of the Gannet at the Bass Rock.—Mr. J. H. Gurney's surmises and deductions with respect to this bird (*ante*, p. 348) are interesting, but nevertheless, I consider, quite wrong. I am not prepared to say what was the cause of the markings, or whether the bird has moulted out to a normal type, but I say most distinctly and emphatically that it was not a painted bird. It passes my comprehension how anyone who has carefully examined the photograph can imagine for one moment that it is. The birds on the Bass Rock marked for identification purposes were merely daubed with red oxide. The colour on this particular bird was even and delicate, and the markings symmetrical. Red oxide, no matter how worn or washed by the sea-water, never assumes the shade of colour worn by this Gannet. Atkinson and I paid a visit to the Bass Rock last August, and made a careful search for the bird; we did not see it, but we did see some with the remains of red oxide upon them, and if any further confirmation was needed to convince us that we had not made a mistake, we obtained it. Mr. Campbell admitted to us in the fullest manner that our bird was not one marked by him. We have also found two other gentlemen, fellow members of the Zoological Photo Club, Messrs. Stewart and Ferguson, who have seen the bird. Mr. Stewart writes me as follows:—"My friend Ferguson and myself were staying on the Rock last year from the 14th to the 18th July. The day we arrived we did not see the bird, but the next morning we both saw it on the West Cliff. It was standing with its mate beside a young one. The head was much browner than usual, and this colour

extended down the neck and was lost on the back, and the same shade of brown formed V-shaped markings on the back; this was most marked nearest the tail, which was, however, pure white, showing that it must have been an adult bird. The bill, I thought, was lighter in colour than normal, but the eyes and feet were to all appearances normal. On telling Campbell, he said it was one he had painted to see whether both birds took part in incubation. I was inclined to believe this, but the regular V markings and the non-patchy look about the colour made it more like a variety than a marked bird. I saw one of his marked birds the next day, and it was quite easy to tell the difference between the two. I certainly think that the bird was a distinct variety, as the painted birds soon lose their colour, and they are irregularly marked." Atkinson and I spent quite an hour watching the bird one day, both with field-glasses and otherwise. It was, however, quite near enough for us to examine all details without the glasses, so there was no possibility of mistake. I may say here that I have not been observing birds for nearly thirty years without being able to tell the difference between a painted bird and one coloured by nature. The fact therefore remains that the only four people who have seen the bird are perfectly certain that it was not a painted specimen, therefore other surmises, to my mind, are of no value against this evidence. It seems nowadays to be perfectly useless recording any occurrence rare or differing from the normal unless one is prepared to exhibit the specimen "in the flesh," and, although this course may be considered correct by "scientific" naturalists, to me, as a "field" observer pure and simple, it does not appeal. Otherwise it would have been an easy matter to have secured the bird.—R. FORTUNE (5, Grosvenor Terrace, East Parade, Harrogate).

Former Occurrence of Black Grouse in Wyre Forest, Shropshire, and Worcestershire.—In 'Berrow's Worcester Journal,' August 14th, 1817, appears an advertisement of property for sale, of which the following is an extract:—"Upwards 1100 acres of land, Brand Wood, Wimper Hill, Lower Longdon, Upper Longdon, Withy Bed, and Great Chamberlaine. All in the parish of Stottesdon, generally known as Vallet Woods, Bewdley Forest. Abounding with Grouse and Pheasants." From these particulars we can gather that Black Grouse were at least fairly abundant in that particular part of Wyre Forest. When I first visited this district in 1888 I found Black Game still here, but evidently in very reduced numbers to those of former times. I should think their numbers would not have exceeded

a score of birds altogether, and these verged rapidly on extinction. The last notes I have of Black Grouse being seen were a greyhen on June 10th, 1893, flushed on the Shropshire portion, and a male bird March 11th, 1894, on the Worcestershire part of the Forest, both not far distant from Dowles Brook.—J. STEELE ELLIOTT (Dowles Manor, Salop).

Willow-Grouse in Northamptonshire.—A Willow-Grouse was shot in the grazing country in South Northamptonshire on Sept. 1st, and was brought to me for identification in the flesh. It was in summer plumage, but was moulting into what is, I suppose, an autumn dress. From the amount of bright bay feathers about the fore parts, I think it must have been a male. It was in excellent condition. From this occurrence it is evident that some misguided person has been introducing the Willow-Grouse into this country, and thus running a risk of contaminating the blood of our own Red Grouse—the pride of every Briton who takes an interest in live things. The example in question may have wandered for a long distance, for the nearest moorlands (where alone an introduction is likely to be tried) are in Derbyshire, Staffordshire, and Shropshire. But wherever it came from, it evidently had had no difficulty in picking up a good living. At all events, it is a good thing the bird was killed, and it is to be hoped that all who have the interest of our native avifauna at heart will lose no opportunity of destroying any Willow-Grouse that they may meet with at large in this country.—O. V. APLIN (Bloxham, Oxon).

Great Black-backed Gull nesting inland in Ireland.—Three localities have come under my personal observation where this Gull was nesting inland. I have seen their nests on the islands of Lough Aderry and Lough Derryduff, which are situated between Ardara and Naran, in Donegal, and at least in one year on Lough Doon. On one small island of the former some three pairs had eggs at one time in 1891. This species was still there when I revisited this lough a few years ago. There also I found a pair of Herring-Gulls with eggs on the large island in Lough Kiltorris, some few miles distant.—J. STEELE ELLIOTT (Dowles Manor, Salop).

White and other Varieties of Birds.—A curious Jackdaw was shot at Wroxton on Dec. 16th, 1910. Both wings are bright cinnamon-brown, and the tail is slightly tinged with brown; otherwise the plumage is normal, and the sharp contrast of the blue-black of the mantle and the light brown of the wings is very striking. It is, I think, an old bird. In the same winter a very pale-coloured Green

Woodpecker was shot at Tusmore; the crown of the head is a dull crimson with no scarlet tinge, and the tail is tinged with a rusty tint. A pure white albino Jackdaw was shot at Drayton (the adjoining parish to Wroxton) on July 17th, 1911, and an albino Rook, of a dirty or smoky white, near Shennington, on June 3rd, in the same year. Both these are birds of the year, and had the irides, beak, and legs pale pinkish white. A pale-coloured Starling (moulted into autumn dress) with partly white quill-feathers was killed at Adderbury at the end of August. A neighbour of mine about the end of February last shot a cream-coloured Snipe in a furze cover at Milcomb. It was unfortunately very much knocked about, and was not preserved.—O. V. APLIN (Bloxham, Oxon).

Notes from Yorkshire.—On April 26th last a male Pied Flycatcher (*Muscicapa atricapilla*) visited Bingley Wood, and remained for the most part of a week. From what one knows of its habits, the spot is an ideal nesting-place, and it is not unreasonable to suppose that, if a female could have been found, it would have remained to breed. It is a somewhat singular thing that only the male of this species, except on rare occasions, visits the Aire Valley on migration in spring, while in a neighbouring valley, where the physical conditions would appear to be identical, it is a fairly common nesting species. Why this is so would be difficult to say, but it does not appear to be merely a question of food supply. The migration route of the females may be different to some extent from the males—at least, this would appear to be the case in Mid Airedale—and this fact may account, at least to some extent, for the species being so local in its habits. A few years ago I saw a Woodcock indulging in its characteristic love-flight in Bingley Woods, at a season of the year when it must have been nesting, but, although a careful search was made, the nest could not be discovered. Ever since I have kept asking the gamekeeper to look out for its nest, and this year he has informed me of an undoubted instance of its nesting in Bingley Woods, and was fortunate in bringing off its young. A Redshank has also nested within a short distance of this place for the first time this year, and brought off its young. Whilst searching for its nest three nests of the Snipe were found. Both the Woodcock and Redshank have extended their nesting range in Yorkshire within recent years. I have also to record the visit of the Lesser Whitethroat to this district—a male in May, but it did not remain to breed. It is a scarce breeding species in Upper Airedale. I have seen the Hawfinch twice this season, but not found its nest; once in this locality a few weeks ago, whilst sitting down,

one flew past within a few yards of where I was resting, and in June a pair were seen flying across a meadow into Bolton Woods, in Wharfedale. In July, whilst travelling along a highway close to this village, a Lesser Redpoll rose from a bank close to the roadside, and I naturally thought it was feeding on some kind of seed, and took no further notice, but on going a few days later I again saw the bird near the same place, and on going near the spot from which it arose I found the nest with two eggs, built in a quickset hedge not more than eighteen inches from the ground, and, although people were frequently passing to and fro, the old birds brought off their young in safety. I have never before found the nest of this species so near the ground; the next nearest the ground I once found in a hazel-bush, but it must have been a yard or more from the ground. Whilst walking out with a friend in May last, he called my attention to a nest partially built at the foot of a rose-bush which he had been poking with his walking-stick, and which I certainly thought was a Grasshopper-Warbler's, but owing to the nest having been disturbed it had been forsaken. Several nests are said to have been found this year in the Bradford district; it is, however, a rare species in Airedale. It is said to have bred near Thornton. I have not found all this season a nest containing a Cuckoo's egg, although the bird has been plentiful. Since this species must lay on an average ten or a dozen eggs in a season, one would expect to find them much more frequently than experience warrants. A friend of mine tells me that a Cuckoo's egg has been found in a Robin's nest near Halifax this season. Late in this season I visited a young plantation, and found a good many nests, chiefly Thristle's, all of which contained dead young ones. At first I attributed this to the intense heat, but on second thoughts I came to the conclusion that the cause must have been some disease, as they all appeared to be about the same age—perhaps six or seven days old. To find nest after nest containing dead young is one of the saddest sights witnessed this season. Corn-Crakes have been commoner than for a good many years, and so has the Redstart. I have never before seen so many young Redstarts in September, whilst the Wheatear has been remarkably scarce. The Black-headed Gull is founding breeding colonies near a good many of our reservoirs in Yorkshire; one I visited in April last, where there appeared above a hundred, nearly all of which remained to breed; another, which only had about four pairs three or four years ago, this season must have had over one hundred and fifty pairs breeding.

In the July number of 'The Zoologist' (*ante*, p. 277), Mr. Walter

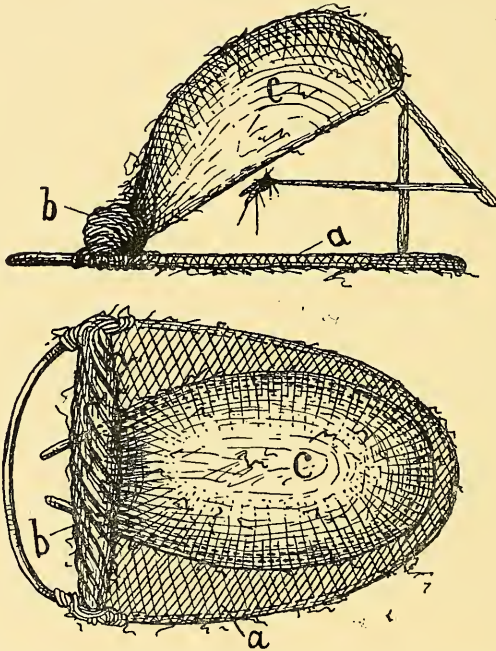
Greaves, under the head of "Nidification of the Whitethroat," remarks that it would "require a great amount of observation to definitely decide whether one sex only in this or any other species is concerned with nest building." My own observations favour the view that the female is chiefly concerned in nest building—in some species I should say the nest is built exclusively by the female; as to which sex determines the nesting site, it would be difficult to decide, but from my own limited observation, I think the female. male

This summer three eggs were brought to me which had been taken out of three different nests as the eggs of the Linnet, but I found they were from the nests of the Twite. On making enquiries I found that about a dozen nests had been found within a very limited area. In this district there seems to be a local race of this species, which builds its nest on the ground amongst mat-grass (*Nardus*) and bracken (*Pteris*), and is much more social in its habits than the one which builds in the heather. A pair of House-Martins here commenced to build their nest on June 1st last, and fledged on July 23rd—fifty-three days—and at present (Sept. 11th) have a second brood, which in all probability will leave the nest in a day or two, thus covering another period of fifty-three days. I think it must have been over a month ago since the first brood left this neighbourhood, presumably on migration. It might here be remarked that this species incurs great risk in having a second brood in this upland district. In some years it must tax the resources of the parents to provide the means of subsistence for their second brood, and occasionally, it is to be feared, the young must be starved to death. It is somewhat singular that the House-Martin is more habitually double-brooded than many of our resident species, but this is an undoubted fact.—E. P. BUTTERFIELD (Bank House, Wilsden, Bradford).

One of the Causes of our Rare Birds disappearing.—I have just received a post-card from Leeds, asking if I had any duplicate eggs to dispose of by exchange or sale, the writer stating he was ready to deal either way, as he had a large stock of eggs of nearly all the British List; among other rare specimens, he had *ten* eggs of Golden Eagles and *fifty* of Ospreys, thus showing plainly why the Golden Eagles and Ospreys of Scotland are so steadily vanishing. If these dealers were not so well paid by silly collectors who pose as naturalists, our rarer birds would be allowed to rear their young in peace and safety, but while this craze for egg-collecting, and especially the demand for full clutches, exists, our poor birds will eventually disappear. I replied

to this writer that I would have no dealings with him or others in a similar business. — ROBERT WARREN (Ardnaree, Monkstown, Co. Cork).

Chinese Bird-Trap.—This primitive trap is used very successfully by Chinese up the West River, in Kwangsi Province, and no doubt in other parts of China. It seems to be much employed for catching the so-called Pekin Robin (*Copsychus saularis*), a small black-and-white bird much sought after as a songster, and often seen in cages. The trap is constructed entirely (including the spring) of

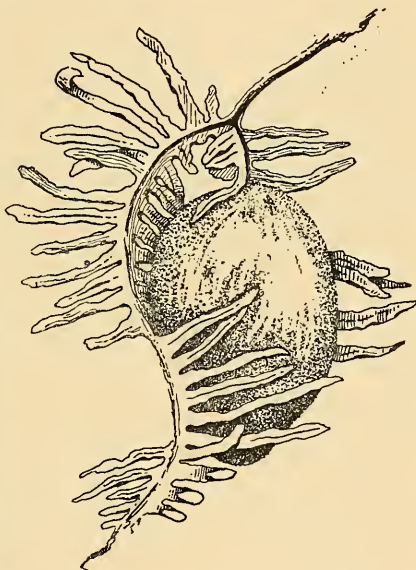


vegetable material which grows everywhere in the country. The platform (a) is made of a slender bamboo bent into an oval, the hinder part serving as a handle by which to carry the trap, whilst the larger anterior part is covered with plaited straw or sedge to form the platform. The spring (b) is a thick roll of twisted creeper or vine-stem, through which are thrust the two ends of the bamboo bent to form the frame on which is plaited the cover (c) of straw or sedges; the ends of the spring are firmly lashed to the bamboo around the edge of the platform. The catch arrangement is the ordinary figure 4, and on it is stuck a bait in the shape of a live grasshopper. The traps we examined had very good springs, and

shut with quite an unexpected snap. So it would appear that some of the patent spring mouse-traps were long ago anticipated by the Chinese, the only difference being in the material of which it is constructed.—J. C. KERSHAW.

AMPHIBIA.

Eggs of a Tree-Frog.—The egg-masses of a Chinese Tree-Frog (*Rhacophorus leucomystax*) are found in great numbers on bushes overhanging pools and ponds in the beginning of the wet or hot season, as the eggs are often hung above temporary water which is only there at that time of year. The egg-masses are also attached to reeds growing in the water and other similar situations. Some are much larger and more irregular in shape than the one figured. Some are placed but a few inches above the water, and others as much as six feet. The colour is pale yellow-ochre; the texture to sight and touch is much like the spongy oothecæ of certain *Mantidæ*, but on a large scale, resembling burnt, frothy glue: the mucus secretion from the



Egg-mass of *Rhacophorus leucomystax* in front of fern (two-thirds of nat. size).

ovarian glands of the female. The egg-masses are, however (like the Mantis ootheca), quite dry and firm as regards the exterior. The numerous eggs are scattered in the substance of the interior. When the eggs mature the whole mass collapses and elongates greatly, the interior deliquesces, and the tadpoles fall into the water beneath in a stream of dirty brownish liquid. The firmer texture of the exterior or "skin" of the egg-mass remains for a few days, but finally dries and shrivels up. The tadpoles acquire hind legs in about two months, and fore legs in about three months. These Tree-Frogs are wonderful quick-change artists, turning from pea-green—their normal colour—through various shades of yellow to pale cream-colour or almost white. At other times, under certain conditions, they become very dark

brown or nearly black—in fact, they rival or surpass the Chamæleon in cryptic coloration in accordance with their surroundings.—J. C. KERSHAW.

O B I T U A R Y.

GEORGE HENRY VERRALL.

By the death of George Henry Verrall on the 16th of last month, British entomology has suffered a loss of which it is as yet too soon to speak. As many readers of this notice are doubtless aware, Verrall from his youth up had devoted himself to the study of that much neglected though most important order of insects known as Diptera, or two-winged flies, of the British representatives of which he possessed at the time of his death an unique knowledge, being recognized abroad as well as at home as the leading English authority on the subject. Verrall's career as an entomologist commenced some five and forty years ago, when, as a boy of eighteen, he began to collect flies in the garden of his father's house at Denmark Hill. The specimens thus obtained were steadily added to as opportunity offered, mainly as the result of collecting holidays spent in various parts of Great Britain; material contributions were also received from time to time from entomological friends, until to-day the cabinets in the late naturalist's home at Newmarket contain by far the finest and most complete collection of British Diptera ever brought together. It is gratifying to learn that a large part of this series of specimens has generously been bequeathed to the Trustees of the British Museum, and will shortly be added to the National Collection at South Kensington.

Realizing the importance of having reliably named Continental specimens at hand for comparison, Verrall, although confining his studies to *British* Diptera, many years ago acquired the extensive collection formed in Austria-Hungary by Herr Ferdinand Kowarz. In 1893 he also purchased the exotic flies amassed by the late Mons. J. M. F. Bigot, and thus became possessed of the types of the greater part of the species connected with the name of that well-known dipterist, as well as of a certain number of those described by his compatriot and predecessor Macquart.

As a contributor to scientific journals, Verrall was by no means prolific, and his published memoirs probably number less than thirty, a total which would doubtless have been considerably augmented, however, had it not been for the great work shortly to be referred to, which of late years left little leisure for other tasks.

His first paper, contributed to the pages of the 'Entomologist's Monthly Magazine' at the age of twenty, appeared in June, 1868, and was followed at longer or shorter intervals by other articles from his pen, the last of his writings to be published making its appearance in April of the present year. Conservative by nature as well as in politics, the subject of this appreciation was rightly opposed to unnecessary changes in nomenclature, and never failed to deprecate anything in the shape of hasty or ill-considered work, while carelessness and incompetence found in him a somewhat un-sparing critic.

Leaving to the entomological journals the task of enumerating in detail Verrall's contributions to the literature of Diptera, some reference must now be made to his more important publications. 'A List of British Diptera' (1888), of which a second edition, revised and expanded, appeared in 1901, proved a boon to many a student, and for the first time provided those entomologists who devote themselves to the study of our three thousand odd species of British flies with a reliable basis for their investigations.

It was not until almost the last decade of his life that Verrall commenced to produce his monumental work on 'British Flies,' which, as planned by its author, was intended to consist of fourteen volumes. The first of these to be published made its appearance on January 1st, 1901, and at the present time its only successor is a volume issued exactly eight years later (on January 1st, 1909). It is on these two books—each of large octavo size, consisting of some eight hundred pages, admirably illustrated with text-figures by the author's nephew, Mr. J. E. Collin, and, in the case of the later of the two, largely in small type—that Verrall's reputation as an entomologist will rest. As to the verdict of posterity there need be no apprehension. *Thoroughness* was the leading characteristic of all of Verrall's work, and the "capacity for taking pains," which was his in a marked degree, prevented him from publishing anything hasty or unreliable. Such a production as this naturally has the defects of its qualities. The two volumes that Verrall has left behind him, which deal chiefly with some of our larger and more conspicuous flies, are works of reference, whose very weight and bulk would prevent their use anywhere but in the study; and the ordinary British collector, who is not much interested in the details of synonymy, might possibly have preferred a handbook containing nothing but synoptic tables for the determination of species, and including the whole Order. To those who wish to verify the designations of their captures for themselves, however, the published volumes of 'British

Flies' are invaluable; and, since British ideas as regards the nomenclature of Diptera are not invariably the same as those current on the Continent of Europe, the books should prove indispensable also to Continental dipterists.

E. E. AUSTEN.

In addition to what has been so well said by Mr. Austen (*supra*) as to the scientific status of our late friend, something may still be recorded as to his very human personality.

He was born on the 7th February, 1848, and passed away at his Newmarket residence on September 16th last, being thus in his sixty-fourth year of age. George Verrall was entomologist, sportsman, and politician, and it was in one of these capacities that most of his friends knew him best. Entomology was the charm of his life; probably everything else gave way to it, and I well remember a good many years ago when, being with him in the weighing-room at Yarmouth races, he suddenly seized a fly from the window and told me it was a good specimen of a rare species. He had long studied the British Diptera, and joined our mutual friend Edward Waterhouse at Rannoch in 1870, when he collected so successfully that "it took Verrall years to clear up all his captures on that journey." It was also about this time that my same informant has often told me of a favourite black and white rat "that always sat on the table by George's side and took tea with him." This rodent also frequently journeyed with him in his pocket. Verrall was President of the Entomological Society in 1899 and 1900, but where he was really king was at the Entomological Club. His yearly supper-party at the Holborn Restaurant was the Mecca of "insect men," and his only greed I ever noticed was that in hospitality, for he was always disappointed when his guests were numbered in less than three figures. Those yearly gatherings, continued so long, will make many of us remember him best as we knew the kindly president in that club chair.

As a sportsman he was a great authority in racing matters, and was a turfite in the real and best sense of that word; but here the sportsman ended, he did not to my knowledge angle or shoot; a day's entomologizing was always to him real recreation, and he enjoyed his billiards.

In politics he was a true but broad-minded Conservative, worked hard and well for his cause and was an ardent Tariff Reformer. He represented the Newmarket Division for one of the recent short sessions. It was, however, because he was so truly human that he was generally loved, and it is that which makes so many of us feel his loss.

W. L. D.

NOTICES OF NEW BOOKS.

A Vertebrate Fauna of Scotland: The Tweed Area, including the Farne Islands. By A. H. EVANS, M.A., F.Z.S. Edinburgh: David Douglas.

THIS forms the eleventh volume of what may well be called Harvie-Brown's History of the Vertebrate Fauna of Scotland. It is written by Mr. A. H. Evans, the well-known ornithologist and author of the volume on Birds in the "Cambridge Natural History." The Tweed area, as treated in this volume, "is almost co-extensive with the shires of Berwick, Roxburgh, Selkirk, and Peebles, while it penetrates East Lothian and Midlothian to a very small extent, and includes a considerably greater portion of Northumberland." The Mammals, Birds, and Reptilia are described; the ichthyology of the district is so closely connected with that of the "Forth" area that it has been decided to leave the Fishes to be treated in a forthcoming volume on the latter from the pen of Mr. William Evans.

The introduction contains some most interesting and useful biographical details of well-known Border naturalists, most of whose names are now well known to all of us over a far wider area. The work itself is a record of both personal observation and wide, and, what is more, judicious compilation. To read, to assimilate, and to sift the more and more prolific records found under the titles of an ever-increasing bibliography requires, especially in the ornithological writer, many of the qualifications of the accomplished historian. By mistaken observations, honestly recorded, much heresy has crept within the lists of our British faunal districts, and the conscientious naturalist who undertakes a work of this dimension must needs walk warily. The names of both Editor and Author of this volume are sufficient to satisfy the most exacting that all that knowledge and caution can do has been done. This volume is not of the nature of a Border foray, but exhibits a more steady and complete conquest of the vertebrate fauna of the Tweed area.

The illustrations are beautiful and well chosen. They represent well-known scenes, familiar to many of us, and to some who scarcely expect to visit them again. We must all in time become more or less members of the well-derided cult of "arm-chair naturalists"; to such these pictures have a reminiscent charm.

The Life of Crustacea. By W. T. CALMAN, D.Sc.
Methuen & Co., Ltd.

IN these pages (1909, p. 238) a notice appeared of Dr. Calman's volume on Crustacea in Sir Ray Lankester's series entitled "A Treatise on Zoology." In that notice a pious wish was expressed that the author might in another publication fully describe the Crustacea "from the taxonomical, bionomical, and distributional standpoint." We scarcely suspected that such a volume was already in view when those remarks were made, and now we possess the very publication desired. In fact, it is so complete an introduction to a great division of the Arthropoda, and is written in so comprehensive a manner in relation to current biological conclusions and suggestions, that it is a work that might be made a standard for a new departure in zoological education. In all good schools where science is taught as a polite accessory and not as the main subject, zoology receives harsh and more or less inadequate treatment. Some general text-book is used to cover the whole animal kingdom, usually of so technical a nature as to be bewildering and repellent to students to whom that science is not considered the one thing needful, a method which almost seems designed to warn an average youth from the zoological field. We are not referring to a scientific curriculum, but to an ordinary general education. If this book of Dr. Calman's could be made a compulsory study for at least the first twelve months in the subjects of a necessary education, and though the study for the time be thus reduced to the Crustacea alone, such a grasp would be obtained in zoological method as would supply a key to other orders, and incite observation and research. But it must be thoroughly assimilated, and a Lobster, easily obtained, can be made the main subject for preliminary dissection.

We have no wish to puff this volume, but we would be glad to think that an educational use should be made of it. Dr. Calman, having written his two books on the subject, must now undertake the third—a complete history of the British Crustacea. We have many books on British birds and insects; the British crustaceans await their more up-to-date description, especially from their bionomical standpoint.

The Life of the Common Gull; told in Photographs. By
C. RUBOW. Witherby & Co.

THIS is one of the well-illustrated booklets issued by Messrs. Witherby & Co., and is translated from the Danish. We give one extract as representative:—"A mysterious incident sometimes occurs at the breeding-place: a gull is sentenced to death and executed by its comrades. What wrong has it done? Who prosecutes? How is it sentenced? Such a scene as the following may be witnessed:—The weather is dead calm, and the sun burns on the sand, the heavy heat has brought the colony to an uncommon degree of silence, parents and youngsters are sitting together half-sleeping. Suddenly fifty to one hundred gulls fly up in the air and collect together. Then one swoops down on to one of the gulls sitting on the sand, and strikes him hard in the back of the neck. A second, a third, and many more, one after the other, quickly follow the first. The ill-fated bird attempts to defend itself—to fly away, but in vain. It is struck down; again and again the blows fall on the same spot in its neck. Soon it becomes exhausted, and with outstretched wings lies on the ground, crying angrily and furiously no more, but wailing like a sick child. Flapping along, it tries with its last strength to reach a hiding-place, but its enemies are constantly overhead. Finally it succeeds in dragging itself into shelter under a shrub, but its fate is sealed, and a few minutes afterwards it is dead. There is only one wound upon it, but that is a deadly one in the back of the neck, and penetrates right into the vertebræ."

EDITORIAL GLEANINGS.

HEDGEHOGS SUCKING COWS?—Mr. Claude Morley, in the 'East Anglian Daily Times' of Sept. 30th last, writes:—"Mr. John Cockaday, of the Queen's Head Hotel, at Stradbroke, is the first person known to me to confirm the accuracy of this habit. Everyone has heard someone else say that such is true, but no confirmation was forthcoming till Mr. Cockaday kindly wrote that he 'has on several occasions seen a hedgehog sucking a cow, when farming on Mr. Eustace Gurney's Sproston Hall Estate, in Norfolk.' To-day he gave me the interesting details of one of these cases:—Five years ago he noticed a cow lying down, and on approaching noticed that a hedgehog (very common in that neighbourhood) was sucking. This was distinctly visible at fifteen or twenty yards, and the contraction of the cheeks in the act of suction also was evident. The important point noticed was that only the extremity of the mouth touched the teat, and the teeth were not in contact at all, which obviates the theory advanced by many naturalists that their conformation precluded the possibility of such a sucking habit. In this case, after a short time, the teeth would appear to have actually come into play, for the cow jumped to her feet in a fright and kicked vigorously at the hedgehog, which Mr. Cockaday's dog promptly slew."

Mr. Millais, in his 'Mammals of Great Britain and Ireland' (vol. i., p. 118), remarks on this matter: "Cows in full lactation often have drops of milk clinging to the udders, and a hedgehog snouting round for insects might well come across this unexpected delicacy and lick it off. A hedgehog tastes most things that come in its way." Major Barrett-Hamilton, in his 'History of British Mammals' now in course of publication, writes (Part vii., p. 69):—"But careful naturalists, remembering amongst other things, the small size of the hedgehog's mouth, will probably await further evidence before they place the sucking of cows amongst the habitual accomplishments of the animal; and I am inclined to think that the story may be classed with the many other mythical narratives which make the work of the older naturalists more picturesque than trustworthy."

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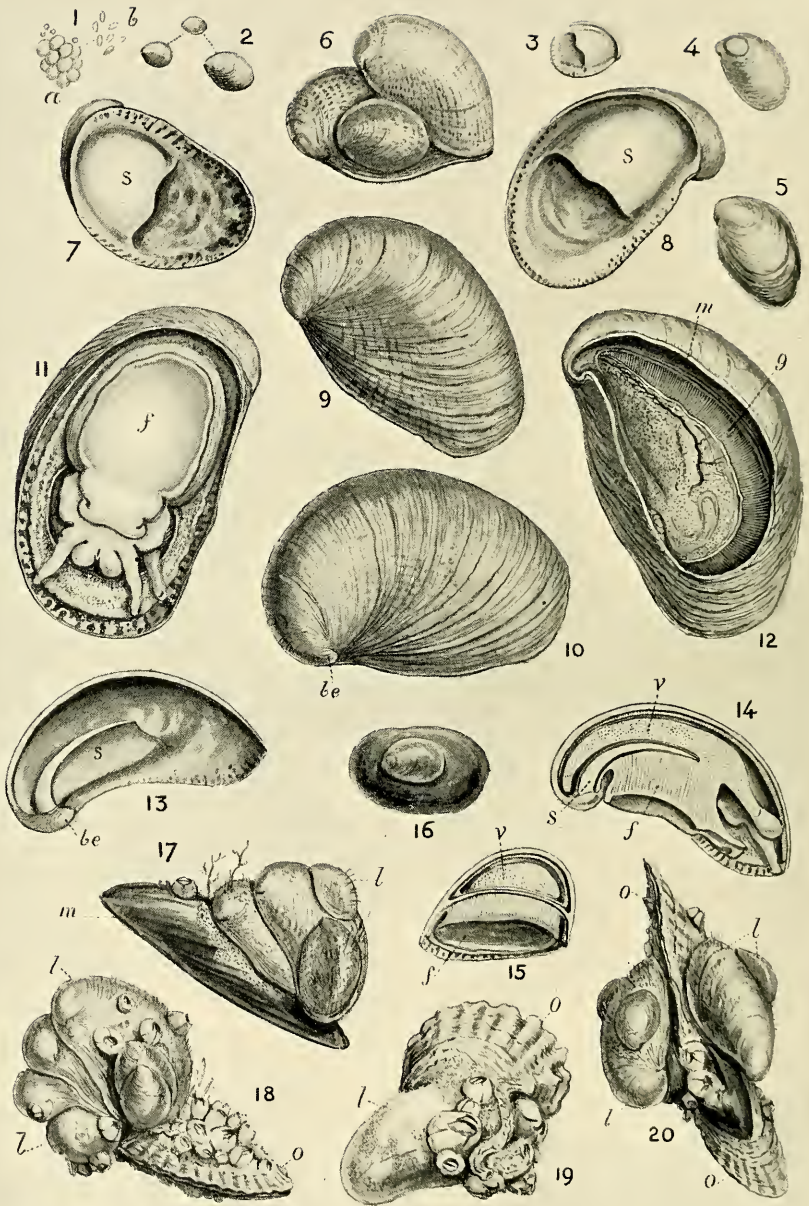
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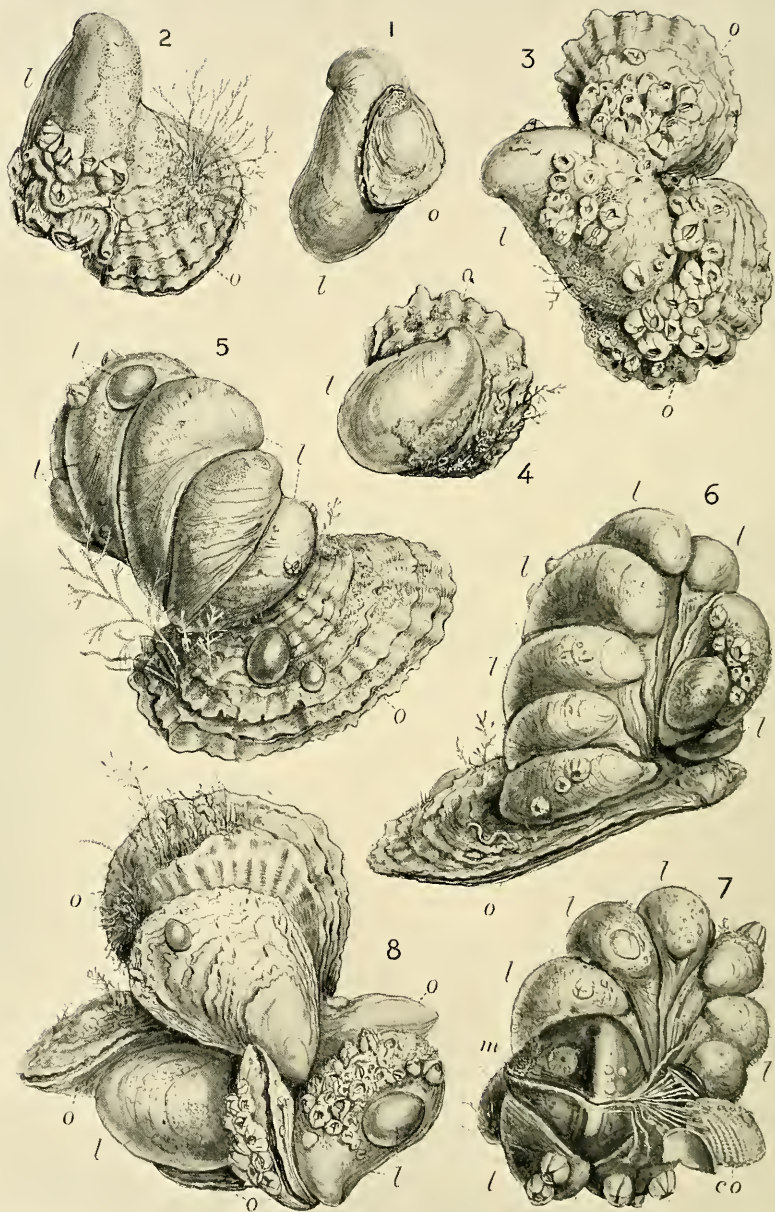
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THE ZOOLOGIST

No. 845.—November 15th, 1911.

“SLIPPER LIMPET” OR “BOAT SHELL” (*CREPIDULA FORNICATA*): ITS INTRODUCTION AND INFLUENCE ON KENT AND ESSEX OYSTER-BEDS.

BY JAMES MURIE, M.D., LL.D., F.L.S.
(Member of Kent and Essex Sea Fisheries Committee).

(PLATES VI. & VII.)

PRELIMINARY REMARKS.

As may be inferred from the title, the purport of this communication has reference to an American mollusc introduced into British waters, and whose presence is suspected to have a deleterious effect on the Oysters. This, be it observed, is the current opinion of many of the oystermen, though another section of them express doubts concerning its hurtful nature. The subject thus assumes an importance in so far as Oyster Fisheries are concerned, and these, it will be admitted, are historically and up to the present day a distinguishing feature of Kentish and Essex marine industries.

Before proceeding to deal with the American intruders, it may be useful to take a limited survey of what more pronouncedly are regarded as the enemies of our Native Oysters.

Among our oystermen and those engaged in the industry the so-called “vermin,” looked upon by them with decided aversion, are the Five-fingers, the Mussels, and the Tingle or Dog-Whelk.

(a). First and decidedly foremost of these is the Starfish (*Asterias rubens*), which notoriously is well known to be a dete-
Zool. 4th ser. vol. XV., November, 1911.

mined foe of the Oyster. This species has a wide distribution round our Kent and Essex shores, and even the deep water beyond. It likewise reaches up the river estuaries and creeks almost to the brackish water. Usually they are scattered hither and thither of various sizes, but occasionally swarm in multitudes, and literally cover some of the Oyster-grounds.

It is not our intention to enter into the manner in which the Starfish masters the Oyster and extracts the flesh. The latest and most reliable authority on the subject, Dr. P. Schiemenz,* shows from his observations and experiments that this is effected by sheer force. Large Oysters, therefore, are comparatively safe, the "brood" and "half-ware" permitting of easier extraction. The saving clause for the fishermen as respects the Starfish is that dredging for them has hitherto been a paying concern. At otherwise intervals of slack times—the spring and fall—the fishermen from various stations in Kent and Essex dredge for them, and the catch is sold as manure to the farmers. Moreover, it is asserted that the Starfish occasionally render a benefit by thinning the numbers of the Mussels so detrimental to the Oyster-beds (?).

(b). The Mussels (*Mytilus edulis*) come under a different category, namely, being only indirectly injurious to the welfare of the Oyster communities. They in no way attack the Oyster bodily, but they as effectually destroy "brood," "half-ware," and the "ware" by their byssus or gelatinous threads (like spiders' webs), entangling seaweeds, hydroid zoophytes, stray cockles, broken fragments of shells, &c., and, above all, their collecting of muddy and sandy material; the heaping of these latter stuffs around and over the Oyster simply means their effectual destruction. Mussels notwithstanding are profitable under certain conditions, but require cultivation as do Oysters.

(c). As to the "Whelk-Tingle" or "Dog-Whelk" (*Purpura lapillus*), their manner of attack on Oysters differs materially from either of the preceding. They fix themselves by their fleshy foot to the shell of the Oyster, and penetrate this by a lingual rasp-like borer; thence partake of the soft material of the Oyster's body to its final detriment. There is, though, no

* Mittheil. des Deutsch. Seefishver, Bd. xii. 1896; and Journ. Mar. Biol. Assoc., n. s., vol. iv. p. 266.

market for the Whelk-Tingle, which in Oyster-culling is either thrown anywhere overboard, or at sparse times is crushed under foot on deck, but seldom or ever collected and taken ashore to be destroyed for the ultimate benefit of the Oyster-bed.

Its ally, the Common Whelk (*Buccinum undatum*), some aver, has an occasional turn at the Oyster, but the injury they commit is slight compared with the Tingle. Besides, there is a regular fishery—"Whelk Trotting"—existent in the Thames estuary and Harwich neighbourhood. The catch therefrom as a constant trade is either sent to market and sold as food, or despatched to the North Sea trawlers as bait. Other enemies we leave aside as apart from the object at present in view.

"SLIPPER LIMPET" OR "BOAT SHELL" (*Crepidula fornicata*).

This Gastropod, as already intimated, is an American form of but quite recent acquisition among the British marine fauna. Its distribution in the North American continent is the Atlantic Coast from the Maritime Canadian Provinces along the United States shores to Florida and north of the Gulf of Mexico.

Although in the colloquial the animal is named "Limpet," yet it differs structurally in the soft parts, and the shell does not possess the conical form of our Common Rock Limpet (*Patella vulgata*). Thus it comes under another genus—*Crepidula*. Instead of a Limpet's figure, the shell is ovoid or oblong in shape, with a curled or twisted beak.

In our British specimens it may range from one-eighth of an inch to nigh $2\frac{1}{2}$ in. in long diameter, and in breadth from $\frac{1}{8}$ in. to $1\frac{1}{4}$ in. in greatest width. The height varies $\frac{1}{10}$ in. to $1\frac{1}{4}$ in., according to the different age and stage of the animal when alive. Much or nearly all depends, however, whether the shell is flattish or more arched on the top curve, and this varies to a remarkable degree, according to the contour of the object to which it is adherent.

A remarkable feature of the shell, and that which has given rise in the United States to the names of "Slipper Shell" and "Boat Shell," is the presence of a horizontal thin plate of porcelain-like nacreous material. This separates the powerful muscular foot from the softer viscera, which lie ensconced safely and securely above. Compare in Plate VI., figs. 7 and 8, where

the "step" or shelf in question is shown from below in the empty shell. In fig. 12 the upper surface has been partly removed, and the mantle-covered dorsum of the animal exposed. In fig. 11, on the contrary, the sole of the fleshy sucker-foot disk, &c., are demonstrated. Again, fig. 13 illustrates a mid-longitudinal section of the shell and position of the shelf, while fig. 14 gives a view of the same with the viscera, &c., *in situ*. Fig. 15 is a transverse median section with the soft parts in place, the thin shelf seen separating the foot from the upper soft parts.

Taking into consideration that the sea-margins of the United States are, so to say, the headquarters of several species of *Crepidula*, and particularly that of *C. fornicata*, it behoves us to hear what the American Naturalists, Fishery Commissioners, and others report concerning the structure, habits, and influences of the said mollusc to its surroundings. Leaving aside the works of pure conchologists of both earlier and more recent dates (T. Say and A. A. Gould, or W. H. Dall, for example), we may first quote Theodore Lyman's* simple description of the *C. fornicata*. He remarks that they are:—"In great numbers on odd shells, generally those occupied by *Eupagurus* [Hermit Crab], the smaller ones often sticking to the larger. The expanded animal has two snail-like horns with eye-specks at their bases, and between them a pair of lobes (tentacles?). The front part of the body and head have the form of a rather thin plate of tissue, which is very movable, while the sucking disk rests on the 'step' in the shell, and is very thick and muscular; the front edge of the disk is prolonged in the shape of a movable flap. Round the edge of the shell runs the mantle, which may be considerably contracted. The gills lie in a sheet on the inside of the roof of the shell. The *Crepidulae* were laying eggs which adhered in clusters to the surface on which the animals lay. Those clusters contained a bunch of transparent sacs, each of which was full of embryos. These embryos, before leaving the sac, have an active motion. They take on the form of little bags, tied as it were near the top; the bag itself is filled with yolk-cells, while the loose flaps above the

* "Habits of Animals observed at West Yarmouth, Mass.," in Proc. Boston Soc. Nat. Hist. vol. vii. p. 78 (1859-61).

constriction are bordered by rows of vibratile ciliæ, which create brisk currents, and serve to move the embryo. When the *Crepidula* is at rest the front edge of the shell is a little raised, and the tentacles thrust a little forth. They move slowly from time to time.”

In our waters, as yet, we have not met with the “Slipper Limpet” on shells occupied by the Hermit Crab, but certainly we shall keep a sharp look-out for them. The remainder of Lyman’s description of the soft parts corresponds or tallies with our examination and dissection of quite a number of the British-bred specimens. See drawings of same in Plate VI., figs. 11, 12, 13, 14, and 15.

In his Report to the Commissioner of Fish and Fisheries,* Prof. A. E. Verrill, in describing the fauna of the gravelly and shelly bottoms of the bays and sounds off Massachusetts, remarks of *Crepidula fornicata* that it:—“Was one of the most abundant species, often occurring adhering to each other in great clusters, the lowest ones in the group adhering in turn to dead bivalve shells, pebbles, shells of living *Fulgur* and *Sycotypus*, and still more frequently to these shells when dead and occupied by the larger Hermit-Crabs (*Eupagurus pollicarus*). The dead shells of this *Crepidula* were often found in great accumulations, covering considerable areas of bottom, and with little admixture, either with other shells or with sand and gravel.”

The same writer (*l. c.* p. 475), in enumerating the animals inhabiting the Oyster-beds in brackish water, says:—“Among the most common shells that are found attached to Oysters are *Crepidula fornicata* and *C. unguiformis*. They both occur together on the upper as well as the under valves, and in all cases retain their ordinary characters.”

See the figures in accompanying Plate VII. of how *C. fornicata* grasps and perches on Oysters, Mussels, &c., in the estuarine and creek waters of Kent and Essex, all showing its habits and attachments have not altered in new surroundings.

During the Great International Fisheries Exhibition, held

* “Report upon the Invertebrate Animals of Vineyard Sound and the adjacent Waters, with an Account of the Physical Characters of the Region,” in Rep. U. S. Commiss. Fish and Fisheries, vol. i. p. 417 (1873).

in London in 1883, when acting on one of the committees, we had the pleasure of constant intercourse with the United States representatives, among whom were Browne Goode and several others of his scientific colleagues. Among the United States exhibits of Economic Mollusca were specimens of the "Slipper Shell" (*Crepidula plana*) and the "Boat Shell" (*C. fornicata*). These, however, did not then particularly attract attention. In the Catalogue of Exhibits, though Lieut. Winslow, in allusion to them, states that they "are neither directly injurious nor beneficial, they are often associated with destructive Gasteropods. In addition, their absence from an Oyster-bed is one of the many indications of its deterioration." He further remarks that "when present in large numbers they form one of the indications of the health of an Oyster-bed."

The above epoch-making Exhibition certainly gave a stimulus to the consignment of American Oysters for replanting, for only a few years previously had they been introduced to the market.

The last to mention and doubtless the most important contributions to the literature of the "Slipper Limpets" are those of Prof. E. G. Conklin (1897-98). The first memoir* deals mainly with their embryology, and is illustrated, besides woodcuts, by nine large plates. His second paper† treats rather of their Sexual Dimorphism, accompanied by three plates of remarkable varieties of the shells of different species.

As it is not our intention to enter into minutiae of the biological aspects of the molluscs in question other than what applies to their influence on our fisheries, we shall only extract (from Conklin) such points as have a bearing thereon.

Referring to the New England species, *C. fornicata*, *C. plana*, and *C. convexa*, he mentions they all show remarkable individual differences in the shape of their shells. This, he avers, is dependent on the shape and position of the mantle edge, which moulds the shell to correspond with the surface upon which the animal is attached. Hence it may be unusually broad and flat,

* "The Embryology of *Crepidula*: a Contribution to the Cell Lineage and Early Development of some Marine Gasteropods," Journ. of Morphology, April, 1897, pp. 1-226, with nine plates and thirteen diagrams.

† "Environmental and Sexual Dimorphism in *Crepidula*," Proc. Acad. Nat. Sci. Philadelphia, 1898, pp. 435-444, with three plates.

or highly arched, or concave, or twisted or short or long, as the case may be.

C. fornicata occurs on the shell-back or on the ventral surface of the American King-Crab (*Limulus polyphemus*).

In early stages the “Limpets” (*C. fornicata*) move about, but when nearly half-grown they lead an irrevocably sedentary life. They occur on muddy sea-bottoms in curious chains* of often ten or twelve individuals, perched on the back of each other—heads all in one direction. Such chains are often found in which there is not a single male, and yet I have never found an unfertilized female.

The sexes are separate; the smaller-sized males, as a rule, lead a more roving life up to a certain age.

Breeding season, early summer to mid-August. The eggs, contained within a bunch of capsules (therefore analogous to those of our British Whelk), are seen about midsummer. After August absent, and instead clusters of spat are found within the shell. Conklin believes that copulation occurs only once in a lifetime. He found a seminal receptacle consisting of a convoluted tube within the female, and which at times was filled with spermatozoa. The latter, therefore, mingles with the ova before the egg-capsules are formed within the oviduct of the female.

The eggs of the several American species of *Crepidula* vary remarkably in size. Those of *C. fornicata* (now a British inhabitant) are nearly the smallest, although this animal is the largest of the several species. In one bunch 55 capsules were counted, and the eggs in each numbered 240, or a total of 13,200 to a single female.

The “Slipper Limpets” are supposed not to be increasing in numbers in American waters (?).

Regarding Conklin’s elaborate researches into segmentation of the ovum of *Crepidula* species and the dwarf race of *C. plana*, these are aside from the purport of the present paper.

THEIR BRITISH INTRODUCTION AND RESULTS.

It may be inferred from what precedes that up till within a comparatively recent date conchologists had never met with nor

* The “windrows” of some American writers.

recorded *Crepidula* as among the indigenous genera of British shells. Having located America as the original habitat of these "Slipper Limpets," the question arises, How and when were they brought alive to Britain?

A case in point may be cited, namely, that of our Common Periwinkle (*Littorina littorea*). This stranger to the United States fauna is supposed to have got there in 1868* from having been shot out alive among the ballast of the shipping. Since then it has become naturalized and spread abundantly. But the close adherence of the living "Slipper Limpets" to Oysters bespeaks that *they* undoubtedly were the means of conveyance. Proof of this will be given further on. Here sufficient for our purpose to refer the reader to paragraphs on the introduction of American and Dutch Oysters *for laying* in the 'Fish Trade Gazette' of Oct. 10th, 1891 (p. 11), where it is stated this was some fifteen or twenty years previously, otherwise between 1870-1876.

Among data concerning the presence of the "Slipper Limpet" on the coast of England facing the North Sea we give the following:—

York and Lincoln.—Arthur Smith,† of Great Grimsby, has recorded his having found the shells of *Crepidula fornicata* near Cleethorpes in November, 1887, and he mentions that he learned they were brought thither with consignments of [barrelled] American Oysters. Furthermore, B. Sturges Dodd‡ makes the rather important statement that in February, 1887, two barrels of Oysters were received from a firm from New Basford [query: New Bedford, U.S.—J. M.], in which were several dozen of *Crepidula*, *Anomia*, and *Barbatia*. He reasons therefrom that, seeing the Oysters imported to Britain are relaid at Cleethorpes and elsewhere in the Humber-mouth neighbourhood, they (*Crepidula fornicata*) ultimately may hereafter become acclimatized. H. Wallis Kew§ also alludes to their presence on the Lincolnshire coast. Quite lately, on inquiry of Herbert Donnison, Inspector of Eastern Sea Fisheries District, he tells us they

* Winslow, Cat. Econom. Mollusca of U.S.A.

† 'Yorkshire Naturalist,' 1888, p. 27.

‡ Proc. Malacological Soc. vol. i. pt. ii. p. 31 (March, 1894).

§ 'Yorkshire Naturalist,' 1889, p. 368.

have not been observed by him in the Boston (River Witham) estuary. We have no information as to the southern portion of the Wash, or around Norfolk and Suffolk coastal lines generally.

Essex and Kent.—It has to be noted that about 1880 or a few years earlier Mr. Musson, a Liverpool firm, established an agency (Mr. Stammers) at Brightlingsea. The former regularly imported American Oysters, and these were transmitted on to Brightlingsea in quantity, and sold and distributed among the various Essex Oyster merchants and Oyster growers for relaying. The business, so far as we know, still continues. At a meeting of the Essex Natural History Field Club, held at Brightlingsea in September, 1891, Mr. Walter Crouch* exhibited the shell of a specimen of the “Slipper Limpet” (*Crepidula fornicata*) fixed to the back of an Oyster-shell. This he had picked up on the beach, and he traced the origin of the specimen as derivative of the American Oysters imported. Furthermore, in March, and again in April, 1893, he received from John Bacon,† a Burnham dredger, live examples of said species. This form of shell-fish, Bacon assured him, he had seen in the Rivers Crouch and Roach for some fifteen or more years previously, but then they were quite scarce. He seemed doubtful as to American Oysters or spat being laid down in those rivers (?). He mentioned they were common in the Blackwater. In May and in September, 1898, Mr. Crouch‡ received from Dr. Laver (of Colchester) living specimens from the River Colne, these containing masses of yellow spawn inside the shell. The specimens were large ones.

Coming to the Thames estuary, the Oyster-beds in “The Ray,” opposite Leigh (now practically closed), formerly passed in succession through the hands of Messrs. Baxter, Tabor, Hammond, and, lastly, Hobart. We are indebted to Frank Bridge, formerly foreman, who tells us that it is quite over twenty years since Americans, *viz.* “East Rivers” and “Blue

* ‘Essex Naturalist,’ vol. v. p. 260.

† *Ibid.*, vol. viii. p. 36.

‡ *Ibid.*, vol. x. p. 351 (1898). Here may be added the names of a few other observers, to wit: W. M. Webb (1897), Wm. Cole (1904), J. E. Cooper and John French (1906). Their examples were respectively from Brightlingsea and the Crouch River (see ‘Essex Naturalist,’ vols. x., xiii. and xv.; and Proc. Malacol. Soc. vol. vii.).

Points," were laid on the beds. From their inception living groups of the so-called "Slipper Limpets" (*Crepidula fornicata*) were seen adhering to the Oysters. At first not much notice was taken of them, though Bridge, thinking they might be saleable, cleaned some and took them to London, but he could find no market, and there the matter dropped. Gradually, however, they increased in numbers on the grounds, and now are scattered broadcast in "The Ray" (adjoining Canvey Island), and along the shore to right opposite Westcliff. Few comparatively are found on the sandy flats, but they are innumerable on the sides of the rivulets and near the muddy ground towards low-water mark, where they seem to thrive amazingly. Further down the estuary, namely, at the shore-mouth of the Swale, many years back, American Oysters were there relaid. As time passed the *Crepidulae* therefrom flourished and spread about, finally invading the Sea Salter and historic "Royal Whitstable Natives" beds. This, notwithstanding the great care and labour bestowed on the culture of these beds by constant dredging, weeding, and selection of the "ware," &c. Incidentally, it may be added that A. S. Kennard* has intimated his finding *Crepidula fornicata* near Herne Bay, where also E. F. Wheeler (Fishery Officer) tells us they are to be got. The whitebaiters in Queenborough neighbourhood (mouth of the Medway) also occasionally get the shells in their drag-nets.

To sum up, it goes without saying that the "Slipper Limpet" or "Boat Shell" has now established itself firmly, and become naturalized† and acclimatized in nearly all the Oyster-grounds of Essex and Kent. With our present knowledge it would seem as if it were beyond the power of man to root them out.

It now comes to the essential, practical issue of the facts; otherwise expressed: Are the "Limpets" to be classed among the vermin of the oystermen, or is their influence to the good, bad, or indifferent?

Public attention has been drawn to the topic by the occur-

* Proc. Malacol. Soc. vol. ii. p. 134 (1896).

† Alfred Russel Wallace lays some stress on the distinction between Naturalization and Acclimatization (see his article in 'Encyclopædia Britannica' (9th ed.), vol. i. p. 84).

rence of a legal case* last July, wherein “Limpets” stood forth prominently. At the trial were numerous practical oystermen as witnesses. What struck one was the apparent contradictory, though explainable, evidence given respectively by the Burnham and West Mersea dredgers. The question resolved itself into whether at end and settlement of a five-years’ lease the ground was left in an untenantable condition through the negligence shown in clearing off the superabundance of “Limpets.” For the plaintiff it was affirmed the “Limpets” *were pernicious*, their quantities so enormous,† and their attachment to the Oysters such as to impede the latter’s growth, besides detraction from their food. For the defendant it was asserted that “Limpets” *were not injurious* to Oysters. The latter fed well, even where surrounded by them, both rising or opening simultaneously when feeding. They did not eat the Oyster-spat. The more the “Limpets” the cleaner the ground from mud.

Notwithstanding individual diversity of opinions, it ultimately came out that in the main both parties were unanimous as follows: that the root and sore of the evil lay in the great expense incurred by the Oyster-growers—in extra hands, time, and labour bestowed—in dredging for the “Limpets,” and the chopping them off singly (by “cultack”) from their very firm adherence to the Oysters. On the other hand, this constant or over-dredging induced another evil, namely, it caused the young Oysters to become “stumpy” or “dumpy” or “nubby” (local terms for imperfect or broken rimmed), which considerably lowered their mercantile value. In the words of one notable Oyster-grower, “Limpets”—“if not ‘vermin,’ are a horrible nuisance.” The Oyster industry of Essex and Kent is therefore on the horns of a dilemma, with no bright prospects in the horizon. It behoves, then, those financially interested, with the

* That of W. R. Campion (plaintiff) *versus* H. L. Brand Cooke (defendant) relative to “The Ray” Oyster-laying on the Crouch River above Burnham. Judge Tindal Atkinson gave a verdict in favour of Campion, owner of the grounds.

† In one minute’s dredging on the Crouch River ground at issue four hundred and ninety clumps of “Limpets” were counted. Another witness stated that in the Blackwater grounds thirty-five tons of “Limpets” were dredged within four weeks.

aid of Fisheries District Committee, to institute inquiries and research in furtherance of such steps as might lead to the mitigation of the mischief threatening a prominent and important commercial industry of the two counties.

There are other matters concerning "Limpets" (*Crepidula fornicata*), e. g. their habits, relations to associate organisms, wherefore deleterious to British stock—though presumed to be less troublesome in America—uses to be put to, &c., which we reserve for a future occasion. Meantime, the present accompanying illustrations may help to convey an idea of how things stand with the Oyster's parasite messmate.

Appendix.— Since the foregoing was in type, and on my exhibiting specimens of the "Slipper Limpet" at the Linnean Society Meeting (Nov. 2nd), Prof. Dendy called my attention to a paper bearing on the subject by a pupil of his: "On the Occurrence of Protandric Hermaphroditism in the Mollusc *Crepidula fornicata*," by J. H. Orton, Proc. Roy. Soc. B. vol. 81, (1909). Unfortunately this had escaped my attention, else should have been referred to in the body of the present paper, especially as based on animals collected on Essex shores.

At the same time, Orton's researches and deductions, like Conklin's (*l. c.*), dwell more particularly on the biological or physiological phases. Indeed, with some few exceptions, they only indirectly pertain to the everyday wants and working of the local fisheries, therefore irrelevant to the object of our paper. Withal, we here give in extract Orton's otherwise interesting investigations, which seem to be a continuation of Conklin's on the sexuality of the genus. He first draws attention to and gives a diagram of seven *Crepidulae*, in arched form on an Oyster-shell (similar to our fig. 6 in Plate VII.). The three lower "Limpets" are females, above which an imperfect male, and then three fully developed males. He agrees with Conklin as to chains once formed are thereafter permanent fixtures, whereas the youngsters are motile. Five diagrams follow, illustrative of sexual anatomy; one of these shown as hermaphrodite by possessing both penis and uterus. He

further enters into the sex relations of the chains by tabular data and otherwise. As above indicated, the females are at bottom, the hermaphrodites in middle, and males atop, their size decreasing upwards.

From his examination of the gonad, it looks doubtful whether pure males with only sperm in them are ever found in *C. fornicata* (?). The youngest forms are doubtless males as regards function, and the oldest exclusively females. He infers: "There is no doubt that all the individuals of this species are born males, and change in the course of their life-history into females." He suggests that chain formation and hermaphroditism are in some way casually connected. They would seem to have arisen along with, and favoured the acquisition of, Protandric Hermaphroditism. Thus *Crepidula fornicata* appears to have become adapted to a sedentary life without losing any of the procreative advantages of a free-living habit.

After some remarks on dwarf females, Orton concludes with memoranda on sex phenomena in allied species, and in those of the Limpet genus, *Calyptraea*.

To Prof. Conklin, all the same, is due the credit of first promulgating the idea of conversion of the sexes in *Crepidula*, which Orton has afterwards worked out in a creditable manner. The theoretical or speculative views of both authors, notwithstanding, leave still a gap in application to Fisheries' practical interests other than explanatory of the prolific nature of the parasitical "Limpet."

We can corroborate Orton's allusion to West Mersea chains being larger and more numerous than outer coast ones, and his anatomical diagrams fairly representative. (Compare our figs. 11, 12, 13, 14, and 15 in Plate VI.) He makes a few introductory remarks on its American origin and distribution, with Dodd's hint of 1880 introduction and favourable propagation in Essex.

We may here emend the paragraph (*ante*, p. 405) by mentioning that since it was in type we have had the good fortune of receiving from a shrimper specimens of Hermit Crab-shells with numerous small "Slipper Limpets" attached to them. Nay, more, a young Shore Crab (*Carcinus mænas*) with several on its back. These were got in the trawl-net, Sea Reach,

between the Chapman Light and Holehaven. This is but another link in the evidence of *Crepidula fornicata* retaining its native choice of objects to settle on in its new British home.

DESCRIPTION OF PLATES.

PLATE VI.

FIG. 1.—On the left (*a*) is a bunch of the capsules and a few extruded eggs, as seen by us among specimens in early and mid-July. On the right (*b*) are some of the more elongated spat ("veligers"), carried within the shell in Thames live specimens gathered in October.

FIG. 2.—Dorsal view of three of the shells grading from smaller to larger size.

FIG. 3.—Interior of shell of a bigger animal, showing the shelf or horizontal nacreous plate.

FIGS. 4 and 5.—Exterior top view of larger shells. On fig. 4 at the apex a little younger "Slipper Limpet" has become attached.

FIG. 6.—A group of three of the "Limpets," as affixed to each other, varying in size.

FIGS. 7 and 8.—Interior of the shells of older and larger animals; *s*, the nacreous shelf, comes half-way down the shell. The colouring of the latter varies considerably.

FIGS. 9 and 10.—Exterior lateral surface of two full-grown shells of *C. fornicata*; *be*, spiral or slightly twisted beak.

FIG. 11.—View of lower surface, with the animal itself in place; *f*, sucker-foot (*mesopodium* or sole of Conklin), slightly contracted. Its thinner flexible extension downwards in figure (so-called *propodium*) has beyond it the horns and mouth-lobes.

FIG. 12.—A top view, in which a portion of the shell has been removed, exposing the mantle covering the visceral structures of the animal; *m*, the mantle; *g*, the gills. On opposite side, viscera, contorted blood-vessels, turn of gut, &c.

All the figures from 2 to 12 inclusive are drawn to natural size.

FIG. 13.—A vertical, median, longitudinal section of a dried shell, wherein *s* represents the horizontal shelf, and *be*, outside of beak.

This and the succeeding figures in this plate are two-thirds their natural size.

FIG. 14.—A similar section, with the fleshy parts of the animal *in situ*; *s*, the shelf; *v*, the viscera above it; and *f*, muscular foot below.

FIG. 15.—A transverse middle section of the animal in the shell ; *v*, viscera above the shelf, and *f*, the fleshy foot below.

FIG. 16.—A small smooth-surfaced pebble on which a young "Limpet" has fastened itself.

FIG. 17.—The upper valve of a Mussel (*m*), whereon four "Limpets" (*l*) of different sizes are piled one on the other.

FIG. 18.—An Oyster (*o*) covered with barnacles, whereon (*l*, *l*) six "Limpets" varying in age are attached.

FIG. 19.—An Oyster (*o*), to which a "Limpet" (*l*) is affixed. On the surface between them a group of barnacles, *serpula*, &c.

FIG. 20.—Two Oysters (*o*, *o*) (marginal view), on which are several "Limpets" (*l*, *l*) of different sizes.

PLATE VII.

FIG. 1.—A "Limpet" (*l*), on which a young Oyster (*o*) has fixed itself ; the contrary of the other specimens.

FIG. 2.—An Oyster (*o*), upon which a "Limpet" (*l*) is attached.

FIG. 3.—Two Oysters (*o*, *o*), held together by a "Limpet" (*l*). Barnacle colonies on all three.

FIG. 4.—A young Oyster (*o*) almost covered by a "Limpet" (*l*).

FIG. 5.—An Oyster (*o*), to which a pile or chain ("windrow" of some American naturalists) of "Limpets" (*l*, *l*, *l*) is affixed. Several small-sized "Limpets" are seen adhering to the Oyster, and also to the larger "Limpets."

FIG. 6.—Another view of the same specimen, whereon it can be seen there are ten "Limpets" (*l*, *l*, *l*, *l*, *l*) fastened one above another in an arched form ; their beaks all in one direction facing the observer ; (*o*) Oyster.

FIG. 7.—An end view of a Mussel (*m*) surrounded by "Limpets" (*l*, *l*, *l*, *l*, *l*). A few small "Limpets" and some barnacles are adherent to the larger "Limpets." From the lips of the Mussel there issue fibres of its byssus, and these are attached to a dead Cockle-valve (*co*) and fragments of other broken pieces of shells.

FIG. 8.—An agglomeration of six Oysters and several "Limpets" (*l*, *l*) of various sizes.

All the figures in Plate VII. are drawn to two-thirds natural scale.

MISCELLANEOUS NOTES ON ZOOLOGICAL INSTITUTIONS RECENTLY VISITED IN EUROPE.

BY CAPT. STANLEY S. FLOWER, F.L.S.

(Concluded from p. 345.)

13. STUTTART, WURTEMBERG.

(i) *Zoological Gardens.*

IF anyone, wishing to start a zoological garden in the British Isles, were to ask me which *one* of the standing menageries, public and private, would best repay them to study before embarking on their enterprise, I should say, as far as my present (May, 1911) experience goes, that, of the forty-eight menageries I have actually inspected, the Tiergarten, at Doggenburg, near Stuttgart, would be the most profitable to visit. The site is small, the collection is small, and the animals are of no great value, but the arrangement is such that everything is exhibited to its best advantage. The lover of animals who visits Doggenburg will carry away with him the impression that he has seen but few species, but these all carefully provided for and happy; the schoolchild will have seen the principal types of the vertebrate fauna of Europe, and enough exotic ones to excite his further interest; the casual visitor will not know exactly what he has or has not seen, but will feel satisfied that he has had "his money's worth."

About five years ago Herr Nill's famous, though small, zoological garden in Stuttgart had to be closed, as the site was required by the State. A new railway station is now being built on it. Meanwhile Herr Theodor Widmann contemplated starting a really large zoological garden in the capital of Wurtemberg, and, to begin with, having purchased Herr Nill's cages, opened, about 1907, a small garden at Doggenburg, a suburb on the heights above Stuttgart. Herr Widmann then proceeded to travel about the world in order to visit other zoological gardens and collect notes on their management. When I was staying in Stuttgart in May, 1910, Herr Widmann had not

yet returned, and I was informed that Herr Nill was the actual proprietor of the Doggenburger Tiergarten.

The live animals that I saw there were Grivet Monkeys, three species of Macaques, Drill, Marmoset, a magnificent European Lynx, Serval, Genets, Striped Hyæna, Wolf, Fox, Pine-Marten, Beech-Marten, Badger, Otter, Coati, two Bears, Hedgehogs, Squirrels, Marmot, Dormouse, Hamster, Rats, Mice, Ponies, "Stein" Donkeys, Chamois, Goats, Sheep, a pair of Red Deer, a pair of Roe Deer, a remarkably fine Arabian Camel, three Wild Boar, a Spotted Dasyure, a very nice collection of European birds and some foreign species, Parrots, Pheasants, &c., Tortoises, Snakes, Toads, Newts, Axolotls, and a select and attractive series of small fishes.

Besides the Restaurant (a prominent feature in most zoological gardens), the most noticeable buildings were the "Flying Cage," in which White Storks were nesting, and a combined Bird House and Aquarium, cleverly arranged and charmingly fitted up. The outer walls were mostly occupied by aviaries, communicating with out-of-door flight cages. Down the centre of the house there was a double row of small compartments, with a service passage between them, all lit from above, on the aquarium principle. Each of these little compartments had evidently been the subject of much careful thought on their designer's part; the scheme of decoration differed in almost each case, and combined providing comfortable homes for the little animals on exhibition with giving the visitors both pleasure and amusement. While the Batrachians lived in miniature gardens well supplied with water, the Japanese Mice played about in a completely furnished sort of doll's house upholstered in blue and white, and a family of Rats occupied an original house, the domed roof of which was made of an Armadillo's skin.

(ii) *Museum.*

The Royal Natural History Museum (Königliches Naturalien-Kabinett zu Stuttgart) is situated in the State Archives Building, in the Neckarstrasse, conveniently near the centre of the city.

This museum is of very special interest, not only from the extent and value of the collections which it contains, but also from its being one of the oldest zoological institutions in the

world. Its origin was the collection of curiosities owned for centuries past by the ruling family of Wurtemberg (the oldest specimen now in the collection is said to have been there for three hundred and ten years*), and the institution was placed on its present and more scientific basis in 1826.

The ground-floor is occupied by the famous Wurtemberg geological collection. Special attention may be called to the skulls of *Labyrinthodon*, *Mastodonsaurus*, and *Metopias*; to the series of skulls of various species of *Belodon*; to the skeleton of *Dacosaurus maximus*; and to the group of twenty-four Fossil Lizards (*Ætosaurus ferratus*).

The first floor contains the general zoological collection. The more recent additions (at the date of my visit in May, 1910) to the series of stuffed mammals are extremely well set up, the accomplished taxidermist being Herr Fred. Kerz, Inspector of this museum. The specimens I particularly noted on the first floor were:—

MAMMALS.—A good collection of stuffed Monkeys (including *Theropithecus gelada* and *T. obscurus*) and Lemurs.

A fine *Felis puma patagonica*.

A stuffed Sea-Otter (*Latax lutris*), obtained in 1889.

Many South African Antelopes received from von Ludwig in 1837.

A male Hartebeest (*Bubalis tora*), received in 1879, which is stated to have lived for two years in the Hamburg Zoological Gardens.

A male Mrs. Gray's Waterbuck (*Cobus maria*) obtained from von Heuglin in 1855.

Three interesting Gazelles (*Gazella "levipes"*) from Keren, Bogos, obtained from von Heuglin in 1862. The Gazelles from North-east Africa are still so little known that it is very difficult to name them specifically.

A female *Gazella arabica* from the Royal Menagerie, 1816.

A male African Buffalo (*Bos caffer*, subsp.), labelled "*Buffelus pumilus*," from the South Cameroons.

A beautiful female Giraffe, labelled "*Giraffa capensis schillingsi*," from German East Africa.

* See Prof. E. Fraas, Führer Kgl. Nat. Kab. Stuttgart, i. p. 1 (2nd edition), 1906.

A nearly white specimen of a male *Cariacus virginianus* from Maine, U.S.A., obtained in 1863.

The big collection of Deer's antlers: Red Deer (*Cervus elaphus*), &c. on this (the first) floor, and Roe (*Capreolus caprea*) on the second floor.

BIRDS.—The fine collections of stuffed Birds of Prey and Bustards.

The adult female stuffed Shoebill (*Balæniceps rex*), obtained from von Heuglin in 1855.

The stuffed Great Auk (*Alca impennis*).

REPTILES.—A male Terrapin (*Staurotypus triporcatus*) from Guatemala. Terrapins of this family—the *Dermatemydidæ*—are rare in collections, and this individual is a particularly striking specimen.

A large stuffed Garial* (*Gharialis gangeticus*, or *Garialis gangetica*) obtained from Dr. von Barth in 1854; this specimen now measures approximately in total length fourteen feet, but nearly half of the tail is missing.

The second floor contains the collection of the fauna of Wurtemberg, and the general osteological and palæontological collections. Among the stuffed animals the following may be specially mentioned:—The last Lynx, a male, killed in Wurtemberg, in 1846; the last Wolf, also a male, killed in Wurtemberg, in 1847; two Beavers, both males, from near Ulm, on the Danubian side of Wurtemberg, one obtained in 1828 and one in 1869, the latter being the last Wurtemberg Beaver; a male Red-breasted Goose (*Bernicla ruficollis*) obtained at Leonberg in January, 1844. Among the fossils from abroad I noticed some Egyptian ones from the Fayûm, including the skull of a *Zeuglodon isis*, E. Fraas, 1906.

14. VIENNA, AUSTRIA.

(i) Zoological Gardens.

The Imperial and Royal Menagerie of the Palace of Schönbrunn, Vienna, is not only the oldest existing Zoological Garden

* Although W. Theobald, in 1876, corrected the spelling of the name of the Long-snouted Indian Crocodile, the words "Gavial" and "*Gavialis*" still occur in books. To those who, like myself, know the animal alive in India, the "v" instead of "r" sounds very unsuitable. See Lydekker, "Royal Nat. Hist.," 1896, vol. v., page 30.

in the world, but one of the very best. This institution has reached its present high state of efficiency under the direction of Inspector Alois Kraus, Ritter des Kais. Österr. Franz Joseph Ordens.

Herr Kraus was formerly in the Austrian navy, and gained both professional and zoological knowledge on board the frigate 'Novara,' in her celebrated voyage round the world in the years 1857 to 1859. In 1866 he took part in the battle of Lissa, being then in command of a section of marine artillery. In more recent years Herr Kraus was selected to accompany the late Crown Prince Rudolf in several ornithological and sporting tours, including visits to Egypt. The scrupulous cleanliness of the Schönbrunn menagerie, and the alertness of the keepers employed there, give evidence of the good naval training of the man in charge, while the healthy appearance of the live stock and the accuracy of the labelling show that both practical and systematic zoology are subjects with which he is familiar.

This menagerie was founded in 1752 by Francis I., Emperor of Germany, and the great Empress Maria Theresa, the original Superintendent being Adrian van Steckhoven, a native of Holland.*

I formed a very favourable impression of this menagerie when I was in Vienna in 1905, and this was more than confirmed in 1910, when I had the privilege of staying at Schönbrunn for a week and thoroughly seeing the working of this institution at all times of the day.

The animal houses, with one exception, all date from the time of Maria Theresa. They have been, in most cases, altered from time to time in matters of fittings and methods of lighting and ventilation, and some of them have been enlarged; but substantially they are the same buildings as they were more than one hundred and fifty years ago, and it is wonderful to consider how well they answer their purpose. The house for small birds, however, is not now considered to be sufficiently ventilated, and it is proposed to utilize it for keeping reptiles in, and the winter quarters of the Flamingoes will be enlarged so as to form a permanent home for the small bird collection.

* Loisel, 'La Ménagerie impériale de Schoenbrunn,' *Nouvelles Archives des Missions scientifiques*, t. xv., Imprimerie Nationale, Paris, 1907.

The exception, mentioned above, is the new Monkey House, built since 1905, which appears to me to be neither useful nor ornamental.

A new piece of ground on the side of the hill at the back of the menagerie was opened to the public in 1910; in it fifteen very nice new paddocks for Chamois, Mufflon, &c., have been constructed. Each paddock is on the slope of a hill, and ledges of real stone (not cement) project from the ground. An eighteenth century ice-house which was found to occupy part of the line of these paddocks has been preserved in position.

The wild birds in the Schönbrunn gardens are numerous and very tame. It was particularly charming to see the Green Woodpecker (*Gecinus viridis*) feeding on a lawn within a few yards of the visitors.

During the week we were at Schönbrunn, neither my wife nor I saw a single Squirrel, Rat, or Rabbit at large in the grounds. We asked if there were any, and were told there were none—because the Emperor did not permit loose rodents in his gardens.

Contents of Schönbrunn Menagerie at end of April, 1910.

I noted representatives of one hundred and forty-eight species of Mammals, three hundred of Birds, twenty-five of Reptiles, and seven of Batrachians; in all, four hundred and eighty species, not counting domestic races. The number of individual animals, on the authority of Herr Kraus, was 2300.

MAMMALS.—*Primates*.—I saw about forty-nine Monkeys of eighteen species, the most interesting being a Douroucoli (*Nyctipithecus*) and twenty-four Lemurs of eight kinds.

Carnivora.—At least fifty-three *Æluroidea* of twenty-one species, including a very large red European Lynx, and a male African Chita (*Cynælurus jubatus*), presented by Prince Henry Liechtenstein, which has lived here, I am told, for over twelve years, a very long time for a Chita in captivity (or possibly in a wild state also).

The *Cynoidea* numbered ten specimens of five species. A Dalmatian Jackal was of special interest from its locality. The howling of the European Wolves in the early morning was most musical, but I felt glad, each time I heard the sound, that the musicians were safely caged.

Thirty-three, or a few more, animals of fourteen species represented the Arctoidea, including a nice series of Bears, one of which, identified as *Ursus behringi*, Herr Kraus told me was thirty-four years old. A Kinkajou (*Potos flavus*) has now been eight years in this menagerie, and the keeper told me that another specimen lived here for ten years.

The only representative of the Pinnipedia was one Seal. This animal stands up in the water in its pond, with a kindly, almost angelic, expression, and then, with its fore flippers, suddenly splashes water over the visitors who are looking at it, to the amusement of everyone who is not "in the line of fire."

Insectivora and *Chiroptera* are not represented.

Rodentia.—Sixteen species. Eight Capybaras make a fine exhibit.

Proboscidea.—Four Asiatic Elephants—a bull, two cows, and a female calf born here in July, 1906. The Elephants' indoor cages are paved with wood, this wood pavement being periodically renewed. A fact worth recording is that the Schönbrunn bull Elephant in 1909, when in a state of sexual excitement, climbed over the top of a stout iron fence 1.80 metres (5 ft. 10 $\frac{3}{4}$ in.) high.*

Perissodactyla.—Two Sumatran Rhinoceroses (both females), two American Tapirs, three Chapman's Zebras, an African Wild Ass, and some Ponies.

Artiodactyla.—Among the Pecora the following may be specially noted:—Magnificent specimens of the European and American Bison, one of the former was born at Schönbrunn, May 5th, 1910; a pair of very pretty, medium-sized domestic Zebras from Mysore; two Anoa's; three Addax Antelopes from Tripoli, one of which had been ten years here—the Cow Addax at Schönbrunn had horns of an unusual pattern, they lacked the spiral twist characteristic of the species, and curved simply backwards like the horns of the Sabre-horned Antelope (*Oryx leucoryx*); a series of seven different breeds of European and

* In designing cages for animals, it is very useful to have some data as to what height of fence is, or is not, capable of keeping them within bounds under circumstances of unusual excitement. A giraffe, when frightened by dogs, has been known to jump over a fence 1.75 metres (5 ft. 9 in.) high in the Calcutta Zoological Gardens; *vide* Sanyal, 'Management of Animals in Captivity,' Calcutta, 1892, p. 153.

Asiatic domestic Sheep; a pair of Sudan Giraffes; and two Reindeer.

The Tylopoda were represented by all six existing species, and the Suina by a young male East African Hippopotamus, and Gallician Wild Swine.

Edentata.—An Armadillo (*Dasyus villosus*) shared a cage with some Macaques in the Monkey House.

Marsupialia.—Besides Kangaroos and Australian Opossums (*Trichosurus vulpecula*), which breed here as they do in London and other European zoological gardens, I saw a very nice Pouched-Squirrel, referred to *Petaurus*, from Southern New Guinea.

Monotremata.—Two Echidnas, which had both lived for six years here.

BIRDS.—*Passeres*.—I counted one hundred and thirty-five different species; those that pleased me most were four Bearded Tits, two Nuthatches, five Nutcrackers, a white Jackdaw, five Indian White-Eyes (*Zosterops palpebrosus*), a Scimitar Babbler (*Pomatorhinus montanus*), which had been six or seven months here, and a Swallow (*Hirundo urbica*) was of interest, as, although it lived in a small cage, it was in good feather and tame; the keeper told me that this bird had been hand-reared from the nest and was now two years old, and that another hand-reared nestling had lived in a cage for nine years here.

Picariæ.—Eight Green-billed Toucans (*Rhamphastos dicolorus*) living together in one cage made a very fine exhibit, as did also five Blue-cheeked Barbets (*Megalæma asiatica*) in another cage.

Accipitres.—A magnificent Crested Serpent-Eagle (*Spilornis cheela*) should be noted.

Herodiones.—The large wading-birds' aviary is of a very good design. At the end of April we noticed that the Night-Herons and Spoonbills were busy nesting in trees, and a White Stork was sitting on a nest built on the ground.

Odontoglossæ.—Thirty-nine Flamingoes (*Phœnicopterus roseus*) in one enclosure made a very beautiful sight. Herr Kraus told me that he feeds his Flamingoes on grain, chopped horse meat (seven kilos. of meat is the daily ration for thirty-nine birds), and a mixture of food as supplied to the "soft-bills."

Two individual Flamingoes have lived between twenty-two and twenty-three years here.

Limicolæ.—Five species, including the Ruff (*Machetes pugnax*), of which a large number of male birds formed a good exhibit.

REPTILES.—*Chelonia.*—A Pond-Tortoise (*Emys orbicularis*) was remarkable on account of its exceptionally large size; Prof. Franz Werner told me that it had probably come from Lake Balaton, in Hungary. These large *Emys* apparently also occur in Southern Volhynia, as in 1909 Mr. Lydekker kindly showed me a specimen living at his house in Hertfordshire, which he had obtained during his trip to Count Joseph Potocki's estate at Pilawin in 1907.

Crocodylia.—One specimen of each of the three following species—*Crocodylus porosus*, *C. palustris*, and *Alligator sinensis*. All rarities in European menageries.

Ophidia.—The collection of Snakes consisted of five species of small non-poisonous Colubrines, one *Boa constrictor*, one Tree-Boa (*Epicrates striatus*), one *Python spilotes*, a very dark-coloured specimen of *P. molurus*, which Prof. Werner told me was probably from Java or Sumatra, and four individuals of *P. reticulatus*—a small one which had been bred at Herr Fockelmann's place at Hamburg, two medium-sized ones, and one giant which has lived about twelve years here, and is now supposed to be over 7 metres (say, 23 ft.) in length.

BATRACHIANS.—*Ecaudata.*—A very large specimen of the South American Horned Frog (*Ceratophrys cornuta*), which the keeper told me is fed on the common European Frogs. A very fine pair of the South American Frog (*Leptodactylus pentadactylus*). Both male and female were very large and in beautiful condition. They have to be kept in separate cages. Fourteen individuals of the American Giant Toad (*Bufo marinus*), all in beautiful condition, and some very richly marked and coloured.

Caudata.—Prof. Werner told me that the Japanese Giant Salamander has now lived for about twenty years here.

Two things which no visitor to Schönbrunn should miss seeing are:—

(i) The beautifully clean and neat and richly stocked Palm House, built in 1882 from the designs of Herr F. Segenschmid.

(ii) The Maria Theresa Pavilion in the centre of the Menagerie. In it are twelve mural medallions of great zoological interest, the subjects being animals that were living in this Menagerie in the middle of the eighteenth century. I learn from Prof. Loisel that these were painted about 1759 by Gregor Gugliemi. Prof. Loisel has published ('Nouvelles Archives des Missions scientifiques,' t. xv. page 241) a list of the species represented in the medallions. On comparing his list with one that I had made independently, I find that we are not in all cases quite in accord either in numbers or identifications as far as the mammals are concerned.

(ii) *Museum.*

It is impossible to give here a description of the magnificent building of the Natural History Museum of Vienna, or of the rich collections that it contains. Attention will only be called to the recent additions to the series of stuffed mammals extremely well mounted by Herr Fred. Kerz, of Stuttgart, especially a Gibbon, a Baboon, a Siberian Tiger, a Puma, and a Bear (*Ursus pruinosus*), and to sixteen out of the many thousands of interesting specimens that are exhibited here.

1. Model of skeleton, mounted, of *Megaladaphis edwardsi*, one of the largest of the subfossil Lemurs of Madagascar.
2. Seal (*Phoca vitulina*), born in the Schönbrunn Menagerie, 1908.
3. Hyrax (*Procavia slatini*, Sassi), the type, from the Sudan.
4. *Rhinoceros simus cottoni* from the Lado Enclave, 1909.
5. *Equus quagga lorenzi*.
6. A fine male *Capra ægagrus cretensis*.
- 7, 8. Two Shoebills (*Balæniceps rex*).
9. Incomplete skeleton of a Dodo.
10. Stuffed Great Auk.
11. Very large *Testudo daudinii*, presented by the Hon. Walter Rothschild.
12. Very large male *T. marginata*.
13. Large *T. pardalis* from Harar.
- 14, 15. Pair of Garials; male about 5·50 metres (18 ft. $\frac{1}{2}$ in.), female about 5·00 metres (16 ft. 5 in.) in total length.
16. Large *Tomistoma schlegelii*.

(iii) *Institution of Experimental Biology.*

The fine building in the Prater in Vienna formerly called the "Vivarium" is now occupied by an institution for zoological and botanical research attached to the university, and financially supported by the State. A full and most interesting account of this institution and its work has been recently published by Dr. Hans Przibram,* and a shorter notice by Prof. Gustave Loisel.†

I would like to take this opportunity of expressing my thanks to Prof. Wilhelm Figdor and his colleagues for their kindness in allowing me access to all parts of the building, and for answering my many questions about its contents, while I was in Vienna in the spring of 1910. It is very encouraging to see that there is a place where the scientific staff are really able to devote their time to watching the live animals under their care, instead of (as in most zoological institutions) being only able to do so in intervals snatched from administrative business.

While referring the reader to Przibram's and Loisel's papers for a general account of this institute, eight points may be specially noted here:—

(i) *Adelsberg Cave Fauna.*—Specimens of *Proteus anguinus*, Crickets, Beetles, Crayfish, and Isopod Crustaceans from the caves of Adelsberg are living under natural conditions of temperature, darkness, &c., in a crypt under the building. Dr. Megusar, carrying an electric lamp, very kindly conducted me through this crypt and pointed out its interesting inhabitants.

(ii) *Batrachians.*—I saw ten species of Batrachians alive here: including two Menobranchs (*Necturus maculatus*) received in 1905, so nearly five years in captivity; one American Hell-Bender (*Cryptobranchus alleghaniensis*); the *Proteus* mentioned above, which breed here; one *Siren lacertina*; and a female Toad (*Bufo vulgaris*), from Greece, which measured, from snout to vent, about 155 mm. ($6\frac{1}{2}$ in.), thus rivalling Fatio's Sicilian giantess (see Boulenger, 'Tailless Batrachians of Europe,' 1898, p. 217).

(iii) *Fishes.*—A small Electric Cat-Fish (*Malopterurus elec-*

* Przibram, "Die Biologische Versuchsanstalt in Wien," 'Zeitschrift für biologische Technik und Methodik.' Karl J. Trübner, Strassburg, 1910.

† Loisel, "L'Institut de biologie expérimentale de Vienne," 'Nouvelles Archives des Missions scientifiques,' t. xv. Imprimerie Nationale, Paris, 1907.

tricus), received October 14th, 1904, *i. e.* five years six and a half months here and still alive.

(iv) *Aeration of Tanks*.—I was surprised to find that the system employed here for aerating both the fresh- and sea-water tanks was that of pumping in air under pressure, machinery being installed for the purpose.

(v) *Insects*.—The “Faras el Nabi” (Mare of the Prophet, *i. e.* Mahomed) (*Sphodromantis bioculata*), a large green Praying Mantis, not uncommon in Egypt, has been bred to three generations here. Individuals live for less than one year here. In the Giza Zoological Gardens our attempts to breed this showy insect in captivity have been unsuccessful owing to their combativeness, but I found that in Vienna they tie up the arms of the female before the male is placed in the same cage with her, so that she is unable to hurt him.* Dr. Przibram has given an illustrated account of how this tying is done in the ‘Archiv für Entwicklungsmechanik der Organismen’ (Leipzig, Nov. 1909).

(vi) *Vivariums*.—The practical type of cage, useful for keeping various kinds of small animals in, employed here and called the “Kammerer-Terrarium” (after Dr. Paul Kammerer), is worthy of notice.

(vii) *Insect Cages*.—The “Przibram-Organtinkäfig” (called after Dr. Hans Przibram) employed here is a very light and simply constructed cage, admirable for its purpose.

(viii) *Mealworm Breeding*.—Very large numbers of Mealworms are of course required in an institution of this kind for feeding the live stock, and the problem of how to keep a sufficient supply of these larvæ on hand without going to the, at times most expensive, expedient of buying them, has been solved by employing the “Mehlwurm-Futterzucht,” invented by Dr. Franz Megusar, a system which, with the inventor’s kind permission, we are about to try at Giza.

* “Ferocity of Female Mantis.” See A. H. Mosse, ‘Journal Bombay Nat. Hist. Soc.’ xx. No. 3 (1911), p. 879, and L. C. Coleman, *loc. cit.*, No. 4 (1911), p. 1167.

NOTES AND QUERIES.

MAMMALIA.

Serotine Bat in Essex.—A short time ago I received from my friend Mr. R. M. Presland, of Manor House, Oak Hill, Woodford Green, Essex, three Bats for identification: one proved to be a Noctule (*Nyctalus noctula*), one a Pipistrelle (*Pipistrellus pipistrellus*), and the third a Serotine (*Vespertilio serotinus*). On looking up *serotinus* in 'A History of British Mammals' (Barrett-Hamilton), pp. 130–139, I find that this Bat has only been previously recorded three times from Essex, and that the example under notice (a male), obtained at the Manor House, Woodford Green, on July 14th, 1911, forms the fourth record for the county, and probably the nearest record to the Metropolis. The other three Essex examples recorded are—one killed before 1863 at Coggeshall, and detected by Miller Christy in 1883; a second taken by Miller Christy at Broomfield in 1894; and a third taken at Pitsea, near Tilbury, in August, 1906 (Barrett-Hamilton, 'A History of British Mammals,' p. 132). I am indebted to my friend Mr. J. L. Bonhote for the identification of the above Bat.—F. W. SMALLEY (Challan Hall, Silverdale, Lancashire).

Lesser Rorqual Whale at Lowestoft.—Observing a note in a local paper that a Whale had been washed ashore at Lowestoft on October 14th last, I journeyed over on the 16th, and found the rather dilapidated strong-smelling carcase rolling about in the wash of a heavy sea, within a few yards of the sea-wall, abreast of the herring-basin. Most of the skin had been abraded when I saw it, and the head with the jaw-bones had been removed and carted away by a local knacker, who presumably had an idea of extracting oil from the beast, two heaps of pieces of flesh of the size of a pumpkin then being piled under the sea-wall ready for removal. The pectoral fins were also gone. I was fortunate in discovering one large slice of flesh (looking very like the pickled beef in the days of our ancient mariners) from the throat of the animal, still showing the characteristic wrinkles of the Rorquals, and I hunted up a photographer who had snapped the carcase before the ghouls had been at work upon it. The photograph plainly showed the elongated jaw-bones (bare of flesh), the white

barred pectoral fin, and the corrugated under part of the Lesser Rorqual (*Balaenoptera rostrata*), thus placing its identity beyond doubt. It had in all probability been run into by a steamer. I estimated its length at about twenty-five feet.—ARTHUR H. PATTERSON (Ibis House, Great Yarmouth).

A V E S.

Nocturnal Habits of *Turdus iliacus*.—On reading Mr. Stubbs's very interesting notes on the movements of Redwings during dark nights (*ante*, p. 361), I then understood why I always failed to secure any of these birds when roosting in the hedges, their unusual alertness and wildness offering such a contrast to the habits of the Song-Thrushes and other small birds at night. When living at Moy View, Redwings, Thrushes, and various small birds roosted regularly during the winter in two hawthorn hedges at the sides of the middle avenue. Wishing to obtain some Redwings alive, I made several attempts from time to time to take them on the roost, using a lantern on dark nights to show where they sat on the branches, but all my efforts were in vain, for no sooner did the light shine on the bushes, and before we got near, the birds rose with loud cries from the roost and vanished into the darkness. I then tried the plan of keeping the light shaded, and only showing it when at the hedge-side, but nothing would induce them to remain; almost invariably on the darkest nights, even without a light, we could not get near the hedge before the birds left with their wild cries. This habit at night was different to that of the Song-Thrushes and other small birds, sitting quietly on their perches, as if dazzled by the light, and in most cases allowing themselves to be taken by the hand.—ROBERT WARREN (Ardnaree, Monkstown, Co. Cork).

The Nocturnal Habit of the Redwing.—In 'The Zoologist' (*ante*, p. 361), Mr. F. J. Stubbs contributes an interesting article on the nocturnal habits of the Redwing. I gather from his theory that he considers the calls of the Redwings overhead during the colder half of the year to be chiefly due to the wanderings of the birds during the hours of darkness rather than to these being closely connected with the migratory movements of this species. Perhaps to a certain extent his surmise may be correct, but I cannot think for a moment that they are entirely non-migratory actions. He is good enough to favourably quote notes of mine from 'The Naturalist' three years ago, but asks why I should consider the phenomenon now to be (1)

as extraordinary, and (2) as migratory? Well, as to No. 1, the night of Nov. 4th, 1907, was certainly extraordinary as the greatest Redwing-night inland (by their calls in the air) that I ever remember, not only by my own experience, but chiefly by the observations of several of my friends, and over a wide area of this part of the West Riding (*vide* 'The Naturalist,' 1908, pp. 17, 18).* The calls during that night were both incessant and continuous, and were certainly abnormal, or otherwise extraordinary. In the same note, however, I partly appear to support Mr. Stubbs's theory by saying ('The Naturalist,' 1908, p. 17): "But the numbers to be seen in the day-time were trifling compared with those that passed over almost nightly." As to No. 2 (migratory), I think that I was justified in calling it thus from the fact that in this district we chiefly hear the Redwing at night during its migratory periods. For my own part, I am almost invariably first notified of its arrival in October by its call overhead in the darkness. We may hear desultory calls during the second and third weeks in October, and again in late February and in March, but here it is chiefly during the last week in October and the first week in November that their cries may be heard almost nightly, and sometimes for several hours together on suitable evenings. Therefore, I think that I am correct in associating their persistent cries at that season of the year with the immigratory movements which we know to be in progress then. They are most frequently heard on still dark nights, especially if the weather should be misty or damp.

Finally, I may say that I do not consider the periodical call of the Redwing in the evening to be at all equivalent to the cries of larger birds over a well-lighted town on a foggy or very misty night. I well remember the cries of various waders, ducks, &c., during a dark foggy night at King's Lynn when I was residing there twenty years ago, and how I stayed in the streets all the night until daylight endeavouring to trace *the migration*, as I thought it was at the time. But immediately the street-lamps were turned out (fully half an hour before any sign of dawn) the calls of the birds ceased, and the birds themselves disappeared. Thus when daylight came I did not see a single bird, although for many hours together I had been listening to a perfect babel of bird-voices overhead. My supposed migration was merely my first experience of a great crowd of birds

* In Yorkshire, thanks to the good services of the Yorkshire Naturalists' Union, members are able to meet together from different parts of the county, and to compare notes.

dazzled by the lights of a town, and which could not, or would not, pierce the surrounding gloom. This, however, I cannot attribute to the autumnal calls of the Redwings, which are certainly to a very great extent connected with their migratory movements. Mr. Stubbs suggests that probably Redwings may indulge in these nocturnal wanderings and callings at their nesting haunts. A friend, who has observed Redwings and Fieldfares nesting in Scandinavia, tells me that, although he repeatedly heard Fieldfares flying and calling at night, yet he had never observed the same trait in the Redwing.—H. B. BOOTH (Ben Rhydding).

Habits of the Redwing.—Mr. Stubbs's communication respecting this bird in 'The Zoologist' (*ante*, p. 361) must have arrested the attention of every reader, and all, I think, will agree that the remarks of the writer of the paper are worthy of discussion. To me his experiences appear unusual, if not unique—so much so that it would be satisfactory to know that records have been kept of this almost continuous movement of the bird in question after dark, and also—a matter of still greater interest—with reference to the occasions on which he has heard its song in England. After fifty years' observation of our birds and their habits—and during thirty years eyes and ears were in constant training and use—I should agree that the "seep" of the bird is *occasionally* to be heard on winter nights when there is a change in the weather, but certainly not on *any* night, and again tolerably frequently in the early spring when the birds are preparing for departure, although then not with any certainty or regularity. It is in October and early November, at the yearly immigration of the species, that the travelling call may be heard nightly, and, moreover, every few minutes when the wind is favourable for their passage. The Redwing is a restless bird, and apparently much more influenced by the weather than the rest of the Thrush tribe; it certainly becomes thinner, and succumbs to cold more readily than the others. This may account for its frequent change of locality during the winter months, and, being of a loquacious disposition, thus calls our attention to its travels. Then as to song. Congregations are not uncommon in the early spring when the birds are collecting previous to departure, and then it is that we hear them in "murmuration" or "jubilation." It is at this time, too, that an occasional attempt at song—much in the style of the broken and imperfect December song of the Thrush—may be heard; but anything at all resembling the beautiful song described by those who have visited the bird in its home has only twice delighted me, *viz.* at Little

Ealing in 1863, and at Kingsbury in 1877, on both occasions in the early spring.—F. D. POWER (Brixton).

Late Swallows.—On Nov. 2nd I observed two Swallows (*Hirundo rustica*) circling round my house and garden, and on the 4th the number increased to five. I thought the recent gale would probably have driven them away, but the following morning they were still here. Before the first date I had not noticed any for some weeks.—R. H. RAMSBOTHAM (Elmhurst, Garstang).

Little Owl and (?) Wood-Sandpiper in Lincolnshire.—Although the gradual spread of the Little Owl (*Athene noctua*) in the eastern counties is pretty well known, it may interest some readers of 'The Zoologist' to know that it has become almost numerous in Lady Winchilsea's park at Haverholm, where, as a woodman informed us, on Aug. 24th last, he first began to notice it only about two years ago. In walking through the park on that date, accompanied by my son, we happened to see one of the Owls roosting against the bole of a large elm where a branch had once been broken off, and were so entertained with its alertness and the rapid hawk-like flight with which it made off that we followed it up to the clump of trees whither it had sought refuge, and were there so fortunate as to encounter the man. He called the birds "Little Dutch Owls"—apparently their familiar name thereabouts—and pointed out to us some old and decaying ashes, not far from our path, in which he informed us one or two pairs of the Owls had bred, in holes in the trees, this year, and where we should be almost certain to see some of them, "if we could rouse them." Walking over to these trees we soon found one of the Owls, and again followed it the better to observe its actions in daylight, and should doubtless have seen more of them had our attention not then been drawn away from the Owls by three Sandpipers, which we noticed settling by the side of a stream. There they allowed us to approach them closely, and, although the general resemblance between Green and Wood Sandpipers is such as to render the positive identity of birds thus casually seen (especially immature examples, as these undoubtedly were) always uncertain, I had so good a view of them as to have but little hesitation in pronouncing them to belong to the latter species (*Totanus glareola*).—GEORGE BOLAM.

Long-tailed Duck breeding in Orkney.—I have received news of the Long-tailed Duck (*Harelda glacialis*) breeding in Orkney during the summer of 1911.—O. V. APLIN (Bloxham, Oxon).

Migration of the Coot (*Fulica atra*) in Bedfordshire.—Last year I visited the various breeding haunts of this species in the above county to ascertain the numbers nesting in the respective localities for comparison with their aggregate at other times of the year. The nesting haunts of the Coot in Bedfordshire are practically limited to the pools in a few of the private parks. At Luton Hoo, Woburn, Battlesdon, and Tingrith some thirty pairs may breed in all, and their numbers during the remainder of the year appear to be about in proportion, hence we may presume that, apart from forced migration owing to severe frosts, such are resident birds throughout the year. Whereas at Pouthill Lake, the largest sheet of water in that county—upwards of thirty-three acres in extent—different facts are gleaned. Here some eight to ten pair of Coot nest yearly, and these home-bred birds are very considerably added to, when autumn approaches, by immigrants that remain there until the following spring. I have a record counting over one hundred Coot there as early as July 30th in last year, half of which would be recent arrivals, and on Sept. 23rd of the present year some one hundred and fifty were on that sheet of water. From this time of the year onwards their numbers further increase, and many hundreds will be invariably seen together there during the winter months, the largest number I have a note of being on Dec. 10th, 1910, when about six hundred were counted, but, revisiting the lake on Dec. 29th following, only some three hundred and fifty remained. Coot are occasionally seen on the waterways of that county, but such occurrences are generally restricted to their movements in September and October. From inquiries and observations made by my friend Mr. Chas. Oldham at the large reservoirs at Tring, in Hertfordshire, which are the nearest extensive nesting haunts, he informs me that the number of Coot there is likewise increased during the same period of the year. Whence these migrants come, whether partly from some other breeding waters in this country or Continental immigrants, yet remains to be proved, and upon which subject further information from other contributors would be valuable.—J. STEELE ELLIOTT (Dowles Manor, Shropshire).

Gulls hawking for Insects.—Sept. 12th was a very hot and sultry day, and by the evening the stagnant air was filled with myriads of winged ants. This induced a number of Black-headed Gulls (*Larus ridibundus*) to adopt what seemed to me a most unusual method of feeding. Rising about one hundred to one hundred and fifty feet up these sea-birds joined a number of House-Martins and “hawked” for

the tiny insects. I spent at least half an hour watching the Gulls through my glasses, and there could be no mistaking their movements. Flying slowly round in the still atmosphere, every few seconds one of these birds would snap at some invisible object, frequently rising or swerving in its flight to effect the capture, just as a Swallow or Martin would do under similar conditions.—COLLINGWOOD INGRAM (Westgate-on-Sea).

Eared Grebe in Worcestershire.—On Oct. 9th an Eared Grebe (*Podiceps nigricollis*) was seen by an angler in the canal at Stoke, near Droitwich, to be in difficulties amongst the water-plants at the side of the canal, and he secured it by the help of a landing-net. Next day he took it to Messrs. Spicer & Sons, Birmingham, from whom I subsequently acquired it. It was found to have been suffering from recent gunshot wounds, which doubtless accounted for its easy capture. It is a female, and, I believe, immature, and small, but, as it was already set up before I saw it, I do not know the length. Other measurements are: wing, 4.67 in.; tarsus, 1.44 in.; culmen, 0.75 in. The stomach was quite full, and contained, Grebe-like, a number of its own breast-feathers, a few tiny pebbles, two or three univalve shells, a quantity of remains of coleopterous insects, and a red ant. These contents, after maceration in cold water for a few minutes, produced a filtrate of a bright dark green colour, changing in the course of a week to a dull cloudy yellow, due, so I am informed, to the presence of biliary matter, and this, I think, must be correct, for there was no other substance present likely to produce such a colour, unless possibly the beetles might be responsible. The colouring-matter in these, however, would not, I believe, be soluble in cold water, though to what extent the digestive process might affect them I do not know, and should be glad to be informed. There is but scant information as to the visits of this species to Worcestershire. Mr. F. Coburn stated in the 'Birmingham Daily Mail,' Nov. 16th, 1907, that he had at different times seen two on the canal reservoir at Bittel; whilst the late R. F. Tomes, in the 'Victoria History,' mentions occurrences on the Avon, but as his notices in the Worcestershire and Warwickshire Histories are almost identical, it is doubtful to which county those occurrences belong, though presumably he intended his readers to understand that he had records for both counties; data, however, are wanting. One would hardly look for an Eared (or any other) Grebe on the top of a straw-stack, yet in 'The Naturalist' for 1851, p. 21, an instance is given of one that was observed in such a situation, and was knocked

down by a snowball!—THOMAS GROUND (Whittlesea, Waverley Road, Kenilworth).

One of the Causes of our Rare Birds disappearing.—While I entirely agree with Mr. Warren's action (*ante*, p. 391), and hold no brief on behalf of the trading collector, I feel that a protest should be made against the assumption that, because a Yorkshire dealer or collector holds a large stock of duplicate Ospreys' and some Golden Eagles' eggs, this is the cause why "the Golden Eagles and Ospreys of Scotland are so steadily vanishing." One is accustomed to these statements from the more hysterical bird protectionists, but it is surprising to find it coming from a naturalist of Mr. Warren's reputation. In the first place, it is a well-known fact that the Golden Eagles of Scotland, instead of vanishing, have enormously increased in numbers, in spite of a certain amount of egg-taking, *because the old birds are not shot down now on many deer forests*. On the other hand, the Osprey is on the verge of extinction, but, as Mr. Warren must be aware, this is due to the wanton slaughter of the birds on migration through Ireland, and not to egg-collecting at all. How many clutches of British Ospreys have been taken of late years? Yet eyrie after eyrie is deserted in spite of strict protection, and simply because one or both of the birds have been barbarously murdered, either on their way south after the nesting season, or moving northward in the spring, to be finally recorded in the pages of the 'Irish Naturalist.' We are not guiltless in the matter in England, but I am inclined to think that the English birds are generally of Scandinavian rather than Scotch origin. Without knowing anything of Mr. Warren's correspondent, I will undertake to say that there is not a single British-taken egg among the fifty duplicate Ospreys' eggs of which he writes. In all probability they are American eggs taken some years ago before the passing of the present protection laws. I have looked in vain for some words of reprobation from Irish naturalists of note when these murders were duly recorded. Mr. Warren has told us how the gamekeeper and the sporting tenant have just exterminated the Sea-Eagle in Ireland. Cannot Ireland be content with the destruction of her own fauna without robbing Scotland as well?—F. C. R. JOURDAIN (Clifton Vicarage, Ashburne, Derbyshire).

A Note on Continental Birds.—I spent my two months' holiday in 1911, in July at Berchtesgaden, in Bavaria, and in August at the Rhone Glacier. I was not as fortunate as usual in my observations of birds, for after the very hot month of June nearly all the song-

birds were silent, and the lovely woods in that most charming place, Berchtesgaden, "the gem of Bavaria," seemed almost deserted. At the beginning of July the Garden Warbler and Bonelli's Warbler were singing, but they gradually ceased, and the only very interesting birds I noted later on were the Golden Oriole and the Crested Tit. When I left I had only a list of thirty-eight species to my credit, the Buzzard and the Sparrow-Hawk representing the birds of prey. In order to reach my second chaplaincy we took a long and delightful journey through Salzburg, the Tirol, Innsbruck, and the Arlberg to Luzern; there we had the Black Kite hovering lazily over the Lake, and the Alpine Swifts with their shrill and pleasant cries breeding in the Old Town at the covered bridge. At the Rhone Glacier we heard the shrill cries of the Marmots even in the hotel; they abounded in the neighbouring rocks. Five of these little animals are kept in a cage in the hotel grounds, and when winter comes on, and Herr Seilers's great hotel is closed on Oct. 1st, they are transferred to the cellar to sleep until the spring; but last winter, the director told me, one of the five did *not* sleep, but, he added, "he is sleeping now!" The predominant bird in the Rhone Valley is certainly the Alpine Pipit; there were numbers of these birds always about the hotel stables, where sometimes three hundred and fifty horses rested for the night. Are there two species there? Some of the birds were quite greyish, with no spots whatever on the breast, whilst others were profusely spotted, and their backs and wings were a rich brown. We walked twice over the Grimsel Pass, and saw no birds—all was still and desolate, and twice over the Nucka Pass, and there, at a height of about 7990 ft., the House-Martins had their nests in the Nucka Bliets Hotel; no other bird of the Swallow kind was to be found. On our second excursion to the Nucka Hotel, which commands what I think is the most wonderful view in Switzerland—the majestic Weisshorn shining in perpetual snow fifty miles away—we had our best "find." My wife drew my attention to a brown bird dropping into the road from an overhanging rock; it was followed by five or six more. They were quite new to me. We drew near cautiously, and I observed them carefully with my glass. They seemed very like Thrushes, but were of a uniform dull brown with a red spot below the scapulars. They repeatedly flew up and down from the rocks to the road, uttering a musical cry something like a Sky-Lark's, and I was greatly puzzled as to their identity. Going on a little farther to the Hôtel Belvedere, at a height of about 7300 ft., as we stood near the verandah outside, a bird alighted on

the road a few yards off, which I saw at once was a Rock-Thrush in blue and yellow plumage. He was quite tame, and hopped and pecked about till a youth threw a stone at him and frightened him away. I believe, therefore, that the brown birds were young Thrushes in autumn plumage, for Mr. Backhouse, in his very useful 'Hand-book of British Birds,' thus describes them: wings dark brown, beneath *orange rufous*, with a narrow bar of brown at tip of each feather. This was my fourth experience of this beautiful and very interesting bird: (1) at the Hospice of St. Bernard, 8120 ft., singing; (2) Pilatus, 7000 ft., singing with uplifted wings and alighting on the rocks; (3) at the Grimsel, near the Todten See, at about 7000 ft.; these also descending with wings uplifted. A circumstance which occurred at Berchtesgaden is perhaps deserving of notice. At the Hôtel Bellevue the Yellowhammers were so tame they came into the dining-room regularly when we were there to be fed by the waiters. There were also flocks of small birds which flew at a considerable height, and alighted in the tops of the trees at Oberwald; these, my kind friend, Herr Seilers, assured me, were Snowfinches. I should have taken them for some species of Redpoll. They were constantly crying "gip, gip," but I found it impossible to identify them from their height in lofty trees.—CHARLES W. BENSON (Balbriggan).

Errata.—In the October number of 'The Zoologist' (*ante*, p. 391), at the end of the first paragraph, for "female" read "male."—E. P. BUTTERFIELD (Wilsden, Bradford).

MOLLUSCA.

Notes on the Breeding and the Boring Habits of *Pholas crispata*.—

General Remarks.—*Pholas* is found around the Eife coast wherever suitable environmental conditions exist. The rocks on this coast are for the most part of the Lower Carboniferous age, and consist of alternating layers of sandstone and shale, with here and there a thin band of limestone. These bands have been thrown into a series of folds now denuded, and as the shale and sandstone do not resist the waves equally the sandstone forms long ridges or reefs, while the shale is cut out, as it were, leaving long trough-like hollows, which are locally called "lakes." It is in these "lakes" that *Pholas* is most commonly found. In any one they will, as a rule, be found evenly distributed, but those at the upper or landward end are smaller, because they are longest out of the water between tides.

The Body.—*Pholas* has a thick, white, elongated, fleshy body, and from the anterior end of the animal protrudes a long tube traversed by the two canals or siphons, through one of which the water neces-

sary for the respiration is drawn, and this water is ejected through the other. Through another opening in the mantle a short, thick, fleshy foot protrudes.

The Shell.—The shell is equivalve, gaping at both ends, swelling below, thin; transparent and white in appearance. It differs notably from most acephalous molluscs, for there are certain accessory pieces, smaller than the true valves, and placed near the hinges; these extra parts being connected in some way with the creature's peculiar mode of life. In addition to differences of structure, there are also differences in the use of the valves as compared with what is observed in such a form as the clam. When a clam is disturbed it contracts, completely closing the shell. In the case of *Pholas* the valves must remain open to make room for the siphons. There is no external difference between the male and female, and the eggs are fertilized in the water after being ejected by the female.

Spawning.—*Pholas* spawns in July, for some of them about the end of June were not ripe. As the tides were unsuitable, it was not until July 27th that a further examination showed ripe eggs and ripe sperms, and some eggs were fertilized by taking a few ripe specimens of *Pholas*, cutting them in pieces, putting them in water, and letting them stand for a short time. The separate fragments were then placed under running water until it was clear, when the eggs were transferred to clean water for examination. As the development of this type of mollusc is well known, it is unnecessary to describe it. The egg is surrounded by a thick dark brown membrane, within which there is a thin clear white layer, internal to which is the yellowish granular protoplasm. Within the protoplasm is a large nucleus, and within the nucleus a small body (nucleolus). The larvæ, unlike the parent, are free swimming. How they become attached to the rock and commence boring has not been observed. The smallest example found was an eighth of an inch long, and had already penetrated half an inch into the shale.

Boring.—Each *Pholas* lives in its hole; they may be very close together, and the divisions between them may be as thin as paper. Only once have I found two in one hole or burrow. The hole is narrowest at the top, is egg-shaped at the bottom, the greatest width being a short distance above the base. How the creature bores is not exactly known, though various views are current. The different methods suggested may be grouped as mechanical, chemical, and electrical. Mechanical means seems to me the most likely, but whether the shell only is used, or the foot alone, or both together, is not easy to determine. The fact that the widest part of the hole is

equal in diameter to the greatest width of the shell, while the foot alone projects farther into the cavity, would seem to show that the foot only is used. In the first instance, I think that the foot used in conjunction with the siphons acts as a pump, the fragments of sandstone, shale, and mud loosened by the foot being ejected by the siphons and got rid of. Exactly the same process is adopted on ships and boats where the pumps are close to the keel. I have seen a cup-shaped hole worn in the solid oak purely by suction. The objection may be raised that this is due to oxide of iron, but in my experience (that is, forty years ago) wooden pumps were most commonly used. Many a ship has been lost through the pump sinking into the cavity so formed, and becoming choked and useless. However accomplished, the power of boring possessed by *Pholas* is very considerable, for I have seen a burrow bored through three inches of hard ferruginous sandstone, and six inches into the shale beneath.

Economic Uses.—*Pholas* was used by the fishermen at St. Andrews sixty years ago as bait for Cod and Haddock. At that time much of the shale where the mollusc lived was dug up; not an example of *Pholas* is now to be seen at those parts, although these shellfishes are abundant where the shale has not been disturbed. Like all other living creatures, they have to bear their part in the struggle for existence; by far the greater part of the larvæ must perish through failing to find a proper resting place, or by being devoured. Even the adults in their burrows are not secure, for crustaceans (sessile-eyed) devour them, and sponges and polyzoa grow over the mouths of their burrows, preventing the ingress of food and water for respiration; by this latter occurrence many of the adult forms are killed.

Other boring Molluscs.—*Pholas* is not the only mollusc which makes a burrow. *Tapes*, *Saxicava*, *Mya*, *Solen*, and the common Limpet all construct tunnels. *Solen* burrows in the sand, and if dug out of the burrow and laid on the surface of the sand they protrude the foot and penetrate into the sand like a plough until deep enough to suit them. The foot then swells and shortens, drawing the shell down after it. The foot is again extended downwards, a new grip is taken, and the process is repeated until the creature is finally pulled downwards out of sight. Such is the *Solen's* method of escape. *Mya* bores through clay in exactly the same manner.

The smallest *Pholas* I ever found in the shale was about the size of a hemp-seed, and penetrated about one inch. The hole on the outside was only a hair's-breadth in diameter. The *Pholas* itself was in a small cavity. As it continues boring it makes the hole larger until it gets down about six or eight inches. When the *Pholas*

is to a depth in the shale of about three inches it measures externally round the shell about one inch and a half, but at a depth of eight inches it measures three and two-eighths of an inch round the shell at the widest part. The hole of the young one from the outside was not visible, but the hole of the second example was about half an inch, and the large one was a little wider. The method by which *Pholas* makes its hole in the rock or shale is as follows:—As soon as the *Pholas* gets underneath the deposit that is lying on the rock it begins to bore with its foot until it gets a cavity, then it moves its foot round and round, sucking away all the time, and pumping out the sand or shale with its siphons. As it grows larger it finds its hole too small for its siphons; it then uses its siphons to make its hole larger, when the *Pholas* is able to bore with its fleshy siphons upwards, so that it can bore with its fleshy foot downwards. To sum up, I conclude that *Pholas* working outwards with its siphons increases the size of the hole, which was at first merely a scratch in the rock. The downward boring must be accomplished by the foot only.—A. W. BROWN (Gatty Marine Laboratory, St. Andrews, N.B.).

VERMES.

The Angler as a Factor in the Distribution of Earthworms.—It is well known that the presence of some fishes in our inland waters may be traced to the angler, who, after a day's live-bait fishing, empties the remaining contents of his bait-can, procured from other sources, into the water he has fished. On reading Mr. Friend's valuable notes on the distribution of British earthworms, I was impressed with the probability of a similar agency at work, in, however, more circumscribed limits. The angler, when worm-fishing, has usually purchased his worms from a tackle-shop, and these annelids are procured by the dealer from many and wide sources. They are usually vended as the lob-, marsh-, red-, and brandling-worms, while "cockspurs" are sent from Leeds, and "pink-tails" from Edinburgh. Among the first-named—lob-, marsh-, and red-worms—I have frequently noticed strangers, but all are consigned to the worm-bag, the selection being made while angling, and the remainder being usually thrown away at the end of the day. It is in this process of "throwing away" that any interest in this note occurs. Some anglers empty the worm-bag in the water, and there is an end of the matter. As regards myself—and doubtless I am not alone—I always feel that the least I can do for the remainder of my annelid friends who have helped to provide the sport of the day is to empty the worm-bag in some damp spot in the meadow where for the time being I may be. In a moderately long experience as an angler I must have thus distributed earthworms from one county to another, and from north to south. Others must have probably done the same. *Mr. Friend, with his great knowledge of these creatures, might find some little expected species on the banks and adjoining meadows of streams and lakes that anglers frequent.—W. L. DISTANT.

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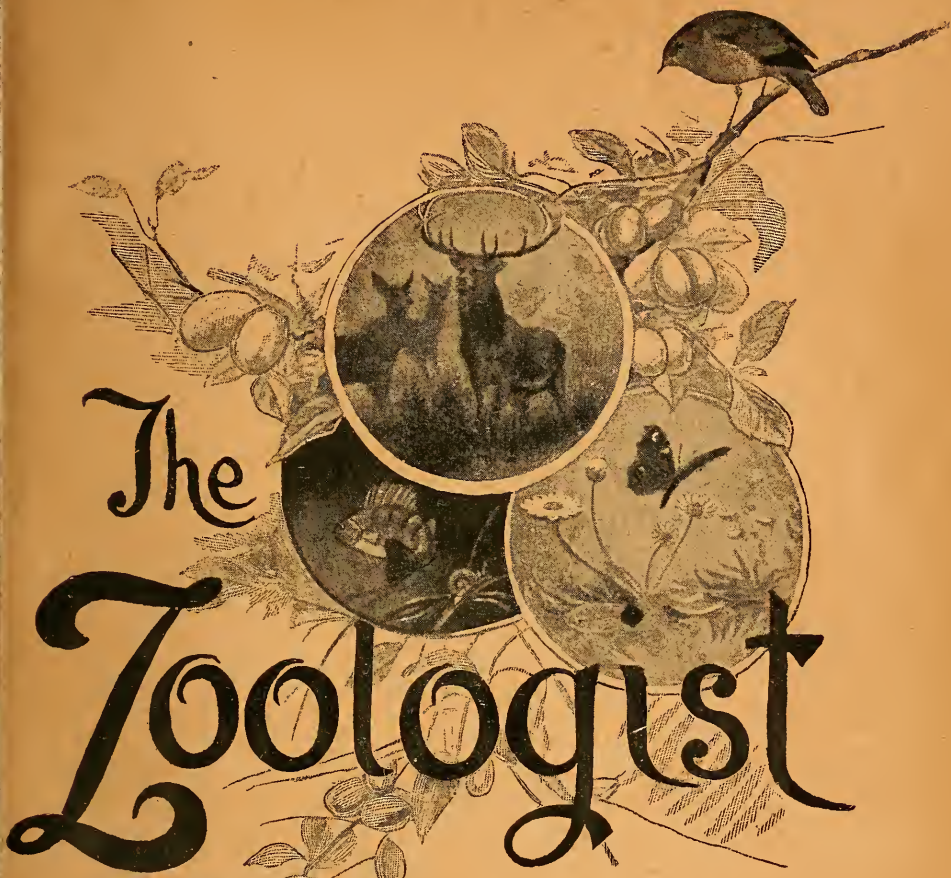
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THE ZOOLOGIST

No. 846.—December 15th, 1911.

SOME FISH-NOTES FROM GREAT YARMOUTH FOR 1911.

BY ARTHUR H. PATTERSON.

NOTWITHSTANDING the extraordinarily fine weather which characterized the summer and autumn of 1911, fishes, rare or interesting, such as we might have expected under existing conditions, were conspicuously absent. I have pleasure, however, in adding a Skate, which I take to be a good species, hitherto unrecorded for Norfolk, *viz.* the Sandy Ray.

One or two common species, at the beginning and at the latter part of the year, put in an appearance in remarkable numbers, affording local amateur fishermen considerable sport. An inset of Codlings was a marked feature of January. For two consecutive days I noted the number taken from the Britannia Pier: the summary which follows may be of some interest:—

Wednesday, 4th January.

Mr. Stone.....	18	Codfish	...	Weight, 44 lb.
Mr. Fuller	6	"	"	20 "
Mr. Salmon	5	"	"	14 "

Thursday, 5th January.

Mr. Brown	3	Codfish	...	Weight, 12 lb.
Mr. Chappel ...	20	"	"	50 "
Mr. Dalinger ...	14	"	"	35 "
Mr. D'Olier	10	"	"	25 "
Mr. Carr,	10	"	"	27 "
Mr. Rolling	9	"	"	20 "
Mr. Sweet	6	"	"	19 "

Total 266 lb.

The largest single Codfish taken in the autumn by an amateur was captured by Mr. Pownell, who was fishing from a boat in the roadstead on October 21st; weight, 20 lb. 15 oz.

During January a number of beachmen laid long lines in the roadstead, baiting with Mussels, and had very fair catches; they brought their fish to the Marine Parade, displaying them on net-barrows, and selling them to passers-by. On the 11th, five hundred Cods of goodly size were landed.

I made arrangements with a fish-hawker to send me the stomachs of freshly caught Cods. On the 10th several were brought; I found the contents included *Cancer pagurus*, *Hyas coarctatus*, *Pagurus bernhardus*, *Xantho rivulosa*, "brown" and "pink" Shrimps, and Sea-Mice. On the 16th six stomachs came in. I found one fish had packed away no fewer than thirty lugworms in various stages of dissolution, but all of them distinguishable, some being only recently swallowed. Several Hermit Crabs, without whelk-shells, were found in others, with Whelks, also shell-less. One *Cancer pagurus* was $2\frac{1}{2}$ in. across the carapace. What fishes I discovered were in such condition that identification was impossible.

January 17th my fish-hawker friend, Jerrard, brought me no fewer than fifty-seven bellies—stomachs, with all the other organs attached! It was a very cold occupation turning out and sorting the contents. The mixed "bag" my confederate described as having been taken from fish purchased on the fish-wharf—a mixed lot from Corton, Winterton, and off the town. The various Cods were easily detected by their food, which was characteristic of the localities mentioned: from Winterton there came lugworm-eaters; from Corton the food was Sprats; and from the Yarmouth ground *pagurus*. I made Jerrard remain while I dissected the stomachs, and returning the whole to his bucket, suggested he should drop the lot in the river on his way home, which he did.

Among the more unusual captures made by sea-anglers from the piers were a Skulpin (*Callionymus lyra*); a Salmon-Trout; a double Flounder; and, I believe, as many as four Scads in one day. These latter were taken quite close to the piles whereon are many Sea-Anemones and other marine creatures, by which these fishes were probably attracted. A rare catch in the shape of an $8\frac{1}{2}$ lb. Conger was made from Britannia Pier

early in November. On November 13th I received from Mr. Beazor, a fish-merchant, the largest Skulpin I have ever seen; it was gilled in the drift-nets with the Herrings, a unusual ending for so ground-loving a species.

The annual Sprat-dinner took place at Aldeburgh on January 18th. In one of the after-dinner speeches some interesting facts with regard to the Sprat fishery were given. German buyers had, the previous November, bought up large quantities, giving an impetus that was much appreciated, a glut previously having been equally as unremunerative as a scarcity. Smoked or "dried" Sprats were a disappearing feature. The figures of catches given for certain years were as follow:—1906, 1190 bushels; 1907, 2988 bushels; 1908, 8828 bushels; 1909, 988 bushels; 1910, 6620 bushels. The prices of the 1908 catches ruled very low. One speaker said that, although the present season had been a fair one, not a man made more than £10, whereas forty years ago a man could clear as much as £30. The fishermen went out to catch Sprats on days when they had no business to venture out; a foggy, misty night is preferable for spratting to a fine one.

On January 30th I received a note from Mr. Cook, of Lowestoft, informing me that some catches of Cods taken on long lines in that neighbourhood realized, when sold on the fish-market, the following prices:—Catch of 43 fish, £1 10s. 6d.; 36 fish, £1 19s. 6d.; 49 fish, £1 14s. 6d.

On January 30th I examined some so-called Sprats that were being hawked around the town, finding them mostly "yawlers" (probably derived from "yearlings"), or young Herrings a span long; only one-tenth were Sprats, a shameful netting of next to useless fish.

I obtained on January 31st a Streaked Gurnard (*Trigla lineata*) that had in all probability been taken off Cromer Knowle.

John-dorys were still abundant at the end of the month off the north-east coast of Norfolk. They ran about the size of one's hand. In one I discovered a Herring, and in another a Whiting. There was no ready sale for these fishes, but I found them exceedingly savoury, when, simply divested of head and fins, they were placed to fry in the fry-pan. The skin then peeled off easily, and the two sides came away boneless. The

flesh ate like that of the Weaver, with a piquant suggestion of seaweedy aroma.

February 11th. Several 1 lb. Flounders brought me from Lowestoft. Of three females I examined and ate, one with an unbroken roe was firm and well flavoured; a second in process of spawning was soft, limp, and flavourless. Evidently the species deteriorates rapidly by the process.

A glut of 10 in. Greater Weevers (*Trachinus draco*), hawked around the town, from the north-east coast of Norfolk.

A huge Eel, 64 in. long, $21\frac{1}{2}$ in. in girth, weight $32\frac{1}{2}$ lb. From the description and sketch sent me by a friend, who saw it exhibited at Lowestoft, I have little hesitation in recording it as a barren female; it compared in almost every particular with one I saw at Yarmouth on September 30th, 1909 (*cf.* 'Zoologist,' 1910, p. 65), which weighed 24 lb.

[I cannot claim for my Yarmouth list of fishes the Pennant's Globe Fish (*Tetrodon pennantii*, Yarrell). On February 27th I was fortunate in seeing a fairly well-preserved example of this species in the house of a woman whose husband discovered it among a "shot" from the trawl-net (so she informed me) when fishing in the North Sea, at no great distance from the county, in one of the Hewett's smacks (a long since dissolved company). He had himself preserved it. I give the record for what it is worth.]

A noticeable movement of the Bib (*Gadus luscus*) or "Whiting-pout." Fairly common off Aldeburgh, well-grown, it is not frequent north of Yarmouth, but quite a number taken early in March in the neighbourhood of Cromer Knowle. Very immature examples are plentiful enough in the local shrimpers' nets in early summer.

I saw a "Slinky" Cod on March 24th of some length, but most disreputable for its leanness; it was a veritable skeleton, encased in a shrivelled-up skin. It exhibited no parasites, usual in such examples; and had evidently been blind before capture in a net. Some blowing-up of wreckage in the sea near by had taken place, and it is just probable that an explosion may have injured it.

Megrim (*Arnoglossus laterna*), a 6 in. example brought me on March 28th.

May 20th. When passing a fish-shop on this date, my attention was arrested by two very fresh "sides" of a Skate

(the head, "dock," or body, and tail having been removed) spread on the slab among some Norfolk Thornbacks. Its unusual colour—a decided drab—at once reminded me of Couch's Sandy Ray (*Raia circularis*). On comparing these sides with Couch's figure I found it an exact replica, the distinguishing "ocellated spots, the size of the section of a large pea, the centre yellow, the border a deeper impression of the colour of the ground," were identical. In all other particulars there was a correspondence. Day ('British Fishes'), however, does not give this fish specific distinction, but for some reason places it under the heading of Cuckoo Ray, a species I am familiar with. In the 'Vertebrate Fauna of Yorkshire' (Clarke and Roebuck), the Sandy Ray as *circularis* is given, and referred to as "abundant in Bridlington Bay, frequently met at Scarborough, and once at Whitby." Matthias Dunn, of Mevagissey, considered the Sandy and Cuckoo Rays as quite distinct,* a decision with which I am in agreement. As the fish, with others, was undoubtedly taken off the Norfolk coast, I feel safe in placing it on the county list.

Saw a whole blue-backed Mackerel, 16 in. in length, on May 24th. The first dorsal fin numbered ten rays, the second eleven rays. Day describes it as *Scomber concolor*, a mere variety of the type. I find examples taken yearly by the Mackerel-boats, their length averaging $15\frac{1}{2}$ in.; and to me the body appears more slender for the length when compared with *S. scomber*. Is it possible that it may be a distinct species?

Some large Herrings were taken in June, some of them 14 in. in length; this is unusual for the spring fishing, and in local

* He writes:—"Since 1884 I have given the Skate family more than my usual attention. . . . In Mr. F. Day's works the Cuckoo and the Sandy Rays are given as belonging to one species. . . . The full-grown Cuckoo Ray is seldom found above four pounds weight, while the perfect male of the Sandy Ray is from fifteen to eighteen pounds weight. . . . Looking into the anatomy of the two, it was seen that in the spinal columns between the skull and the ventral fin the Cuckoo Ray has twenty-nine vertebræ, while the Sandy Ray, under like conditions, has thirty-six vertebræ. Moreover, the males of the Cuckoo Ray are in the proportion of about one to three females; while, in the Sandy Ray, I have only met with four males in ten years, and in the same time I could not have seen less than one hundred females" ('Notes on the Skates and Rays of Cornwall,' 1888). I am surprised he has referred to neither markings or coloration (A. H. P.).

waters. Most of the fish that size I have observed in the boxes sent over from Norway, taken later than our autumnal fishing.

A Scribbled Mackerel, 14 in. long, brought in on June 14th. Very rarely does this variety exceed 15 in.

The summer Mackerel fishing was not up to the average. The first catch came in on May 3rd, the last on July 20th. The recorded catch was about 175 lasts. They averaged something like eleven shillings a 100—of 120. During the autumnal Herring fishery the Mackerel were not so abundant as in some years, but very fine specimens came to the wharf. Fewer boats followed the fishery this year, and I believe only one specially fished with Mackerel-nets during the Herring voyage.

The want of some salutary legislation with regard to the catching of Herrings is sorely needed. Some catches of absurdly small Herrings, nine inches in length, were arriving from North Shields. Some I saw were, however, slightly deeper in proportion as compared with our own autumnal fish. No close season obtains, and fishing takes place more or less nearly all the year round; not even is there a Sunday respite, for the boats fish seven days a week. One day's immunity a week would be beneficial. Added to this untimely catching, Grimsby *trawlers* fished off the Yorkshire coast in the early autumn of 1911, a new departure which promises disaster, when it is known that the trawls relentlessly sweep across and across the spawning-grounds. When it is well known that trawling has long depleted the North Sea of Haddocks (which fifty years ago were taken off Yarmouth, where none are now found), and other marketable species, and cut up the feeding-grounds, it is easy to foretell a like result with the Herrings. Anyway, any large increase in trawling must seriously affect the drift-net fishermen. The fish taken were exceedingly fine ones, but sadly "rubbed," and denuded of scales, which rendered them utterly useless for certain modes of cure.

July—an extraordinary month for various Medusæ, which teemed in the North Sea.

Double Plaice: Saw a Plaice (*Pleuronectes platessa*) on Aug. 31st. It was dark coloured on both sides save for the under "cheek," which was white. The orange spots were distributed alike, above and below. There was a notch in the head wherein

the "travelling" eye was located. I sent it to Norwich Museum. On Sept. 10th I met with another exactly like it in every respect. Probably they were of the same brood. The first was one foot in length, the second a line or two longer.

Dead Eels by hundreds were seen at Oulton Broad, near Lowestoft, floating on the surface. Various reasons were suggested for the fatality, but undoubtedly the action of the acute and continued heat upon subaqueous vegetation accounted for the pollution of the waters; and to pollution Eels are very sensitive.

An immense quantity of "Herring-syle" was noted on Breydon and well up the local rivers during the hottest months; myriads of lively little fry, flashing like streaks of burnished silver, freckled the waters as they turned, as might heavy rain-drops. Early in September one of the marsh-ditches abutting on to the Waveney was found to be fairly alive with them, having come in with brackish water in company with numerous small Perch (*Perca fluviatilis*). A friend of mine who was "lamb-netting" secured as many as two thousand of these young Herrings at one lift of the net. I have no doubt that they either returned to the tidal waters when the sluice-gates were re-opened to let out the surface-water, or most likely were well-fished by the Herons, scores of which in summer alternate their fishing operations for Eels and Flounders on Breydon with spells in the ditches for Sticklebacks, small Pike, and other inhabitants of different orders.

A great many Scads (*Trachurus trachurus*), or "Horse-Mackerel," were taken in the Herring-nets during the autumnal fishing. These were variously sized, but invariably thrown away. Dozens are kicked about on the quays, and numbers thrown from the nets wash up on to the beach. There is a strong local prejudice against the fish, and very few people will trouble to cook it. I abstracted a fresh Scad from a basket of Herrings, and, having washed and hung it to dry for a few hours, had it skinned and fried. It was, to my mind, a very savoury fish, and ate very much like a cross between a Mackerel and a Weever; the flesh was juicy and firm, and there was little trouble from bones, which I cannot say of the Garfish (which I also tried boiled, and found excellent eating), for tiny sharp-pointed bones were a source of much annoyance.

An extraordinary inshoring of Whittings took place in October and November, when sea-anglers, from veteran sportsmen to tiny urchins, repaired to the piers and sat armed with all sorts and conditions of tackle, returning often with big catches. Some urchins discovered a sort of basin at the harbour-mouth works, wherein at low water a number of small Whittings were daily imprisoned when the tide fell. It is needless to say that this pool was well fished, and occasionally a surprising number of fish were captured, the boys using a quill-float in the still water, and thoroughly enjoying their novel method of fishing.

On November 12th I received from a Mr. Allen, of Cromer, an hermaphroditic Herring. He had slightly cooked the fish, and was about to eat it, when its queer mingling of roe and milt caught his attention. I found the milt a third larger than the roe, which fitted into the male organ somewhat after the fashion of a razor-blade in its handle, and was similarly proportionate.

Mr. Robert Beazor, Sen., fish-merchant, informs me that the Smelt fishery was below the average, the long-prevailing winds from the south-east making the working of the Gorleston nets impossible owing to the surf; and the water on easterly winds is so "sheer" (transparent) that the fish are not so easy of capture as when the water is "thick" or "muddled." The latter conditions also apply to the rivers and Breydon. I believe the Dutch fishing was much more remunerative. Mr. Beazor mentions a considerable capture of Salmon-Trout in September-end, when in a few days there was a goodly supply; these mostly come from the sea-coast villages north of Yarmouth. His heaviest Trout was one weighing $10\frac{1}{4}$ lb. The midsummer Herring fishery was below the average. Two Herrings he secured measured and weighed respectively: one, 16 in. long, 16 oz.; one, 15 in., 15 oz. I myself did well one day in the early autumn; with one sweep of a Smelt-net I secured one hundred and twenty fair-sized fish on Breydon.

Norfolk Seals.—That the Common Seal (*Phoca vitulina*) has become not only quite abundant on the sand-banks of the Wash, but a pest to the line-fishermen, is very apparent, and some small stir has been made by those interested with a view to

thinning out its numbers. At a recent meeting of the Eastern Sea Fisheries District Committee a member asserted that the damage done by Seals was enormous; fishermen frequently hauled in their lines with only Cods' heads attached, and in some cases they had been cleared altogether. It was suggested that the skins of any shot could be sold to the tanners for from five to ten shillings; for what purpose they could be utilized I am at a loss to suggest. The Fishery Inspector has seen as many as two hundred at a time on one of the sand-banks; he suggested that the Government send one of their small gun-boats, as their weapons could easily get within range, and not only kill but frighten. About one thousand Seals frequented the banks in the Wash. It is interesting to the naturalist to hear that such a thriving colony is still to be found in such busy waters as the Norfolk estuary. Two large Seals were discovered asleep under the shelter of the sand-hills on Yarmouth south beach late in October, having undoubtedly come from their favourite quarters on strong flood-tides. They were quite as surprised as the person who discovered them, and scuttled down to the sea in a violent hurry.

Other than one or two very small dead Porpoises in a deplorable condition, no cetaceans were thrown on the beach. But at Lowestoft, on October 16th, as already recorded (*ante*, p. 428), I saw the badly decomposing carcass of a Lesser Rorqual Whale (*Balænoptera rostrata*). Strangely enough, near the same date, another carcass of the same species was washed ashore at Sizewell, on the Suffolk coast. It was headless, the remaining portion covering a length of 22 ft. It must have been identical in size with its Lowestoft relative. I do not know how to account for their demise and stranding. It is just possible they were derelicts from the Norwegian small Whale fishery that may have escaped, and been finally stranded after having drifted southwards on successive tides.

Early in October my nephew, who serves on board the 'Leman and Ower' lightship, reported seeing an immense shoal of "Scouters" (probably Bottle-nosed Dolphins?), numbering, he thought, hundreds; they were continually breaching and disporting themselves, a lively mode of progression that would make count very difficult. They were working southwards.

THE PHARYNGEAL TEETH OF FISHES.

BY COLONEL C. E. SHEPHERD (Indian Army).

(Continued from p. 141.)

THE *Sparidæ* (Sea-Breams), and the *Labridæ* (Wrasses), beyond belonging to the Perciformes division of the suborder Acanthopterygii, or spiny-finned fishes in the order Teleostean fishes, have very little in common, except that many members of each of these families feed largely on Mollusca. It is interesting, then, to compare the way that their dentition, especially that of their pharyngeal teeth, has been arranged to meet the case of such very hard feeding. The *Sparidæ* get over the difficulty by strong crushing molar-like teeth being provided in the forward part of the jaws (see the teeth of *Pagrus auratus*, figs. 2 and 3). Crushed on entering the mouth, the ordinary shaped pharyngeal teeth can deal with the food as it passes on to the œsophagus. The *Labridæ* have not this crushing power in the forward part of their jaws, but are provided with strong pharyngeal teeth, well adapted to the work they have to perform, as will be detailed later on.

SPARIDÆ. (THE SEA-BREAMS.)

PAGRUS AURATUS. The Gilthead. Fig. 1 (p. 451).

There are seven gill-rakers on the first branchial arch from the angle forward and seven up its epibranchial; they are roughened on the inner side. The inner aspect of the first arch, both sides of the other arches except the fifth, bear tubercles which have a roughened surface. The upper pharyngeals have strong cardiform teeth, the points showing as white flecks; this is even apparent in the illustration (fig. 1). The plates of teeth do not show any distinct division, although this can be traced by a row of strong teeth along it. Strong cardiform teeth are visible amongst the lower pharyngeal teeth. The lower jaw (fig. 2) and the upper jaw (fig. 3) of this fish are figured to show the strong

molar-like crushing teeth in the forward part of the mouth for crushing the shellfish on which it feeds. There being this provision, the usual cardiform pharyngeal teeth found in so many fishes are enough to deal with the food once it has passed them. Food consists of fish, crustaceans, molluscs, echinoderms, and seaweed.

PAGELLUS CENTRODONTUS. The Common Sea-Bream.

There are ten horny gill-rakers on the first epibranchial, going high up, with sixteen on the cerato-hypobranchial portion

SPARIDÆ.

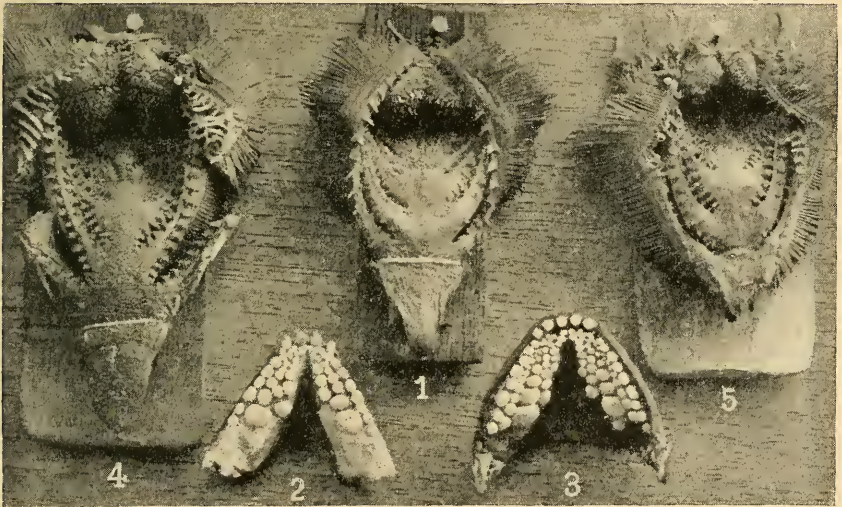


Fig. 1.—PAGRUS AURATUS; 2, lower jaw of ditto; 3, upper jaw of ditto.

Fig. 4.—CANTHARUS LINEATUS.

Fig. 5.—BOX SALPA.

of the first arch. The longest on this portion are about one and a third the depth of the gill below them. Along the cerato-branchial portion they keep fairly uniform in length, diminishing along the hypobranchial portion. The upper pharyngeal teeth are cardiform, and set in two oval-shaped shields, with the more prominent teeth in the upper part of the patch; the teeth are very thickly studded over these pharyngeal bones. The lower pharyngeals seem to meet across the floor of

the mouth, but the two arch bones are separate; a row of larger cardiform teeth than the rest of the lower pharyngeal teeth are set along the inner margin in front of the œsophagus.

PAGELLUS MORMYRUS.

The upper pharyngeals are seen as three well-defined patches bearing villiform teeth; they fit together, looking at the first glance like one broadly oval patch.

CANTHARUS LINEATUS. Old Wife (Couch). Fig. 4 (p. 451).

The first branchial arch has fifteen horny, toothed on the inner side, gill-rakers as its cerato-hypobranchial portion, and nine going up the epibranchial. On both sides of the second and third, and on the inner side of the first arch, there are tubercles that are covered with stiff bristles that stand up over their summits. The upper section of the upper pharyngeal teeth consists of strong cardiform teeth set in a circular form at the top of the upper patch. The circular patch below the upper one carries the same sort of teeth, well-developed in its upper portion (fig. 4), less so as they get nearer the œsophagus. The lower pharyngeals have a row of strong cardiform teeth, making portion of circular sweeps convex to the œsophagus, the rest of the surface of the lower pharyngeal bones being covered with smaller cardiform teeth. The food of this fish consists largely of molluscs and crustaceans.

SARGUS RONDOLETTII.*

There are ten gill-rakers on the first cerato-hypobranchials, with seven on the first epibranchial; the gill-rakers have minute bristles, rather than teeth, on them, as they do not respond to the touch as minute teeth would do. The gill-rakers on the other arches are tubercles also covered with bristles, and not fitting very closely together. The upper pharyngeal teeth are cardiform, and show as two patches each side, the lower in each case being roughly circular, and the upper patch fitting above it. The upper edge of each patch has stronger teeth than the rest of the surface. The lower pharyngeal teeth also have some

* A fish found in the Mediterranean.

strong cardiform teeth. This fish is furnished with strong molariform teeth in the front part of its mouth, suitable to feeding on molluscs.

OBLATA MELANURA.*

The upper pharyngeal teeth are minute cardiform ones ; the lower pharyngeal teeth are villiform.

BOX SALPA.* Fig. 5 (p. 451).

Fig. 5 of the illustration has ten horny upstanding gill-rakers, and a rudimentary one on the first branchial arch from the angle to the end of the hypobranchial, with seven on the first epibranchial. The inner surfaces of these are roughened, but not toothed. The inner side of the first, and both sides of the second, third, and fourth arches carry tubercles, but these do not fit into each other closely, and so make only a moderately fine strainer. The upper pharyngeal teeth show as two distinct patches on each side, the line of separation between the upper and lower sections being well-marked ; they carry well-defined cardiform teeth. The lower pharyngeal teeth cover a space over the whole floor of the gullet without showing any line of separation down the middle, but the arches are not united. There is a row of extra large cardiform teeth on the inner edge, with smaller cardiform teeth over the rest of the toothed area. The food of this fish consists largely of seaweeds, as well as the usual diet of crustaceans.

LABRIDÆ.

This is a large family of fishes ; those frequenting the British coast are known as Wrasses. Their lower pharyngeal bones are united into one bone, which materially adds to their strength, and forms a firm foundation for the rounded molar-like teeth, looking something like a piece of a miniature cobblestone roadway, that are the lower pharyngeal teeth. The upper pharyngeal teeth are generally somewhat similar in shape to the lower, but are set in two patches ; they are reinforced by two bony condyles or projections from the under side of the *basi-occiput*, materially adding to the strength of the bite, and so

* Both these fishes occur in the Mediterranean.

to break up the shells of the mollusca, and also of the crustaceans upon which they feed.

LABRUS MIXTUS. The Cook. Fig. 1 (p. 454).

On the cerato-hypobranchial of the first branchial arch grow twelve short horny gill-rakers, with seven on its epibranchial. The gill-rakers on the other arches are alternate, and fit into each other. The upper pharyngeal conical teeth are in two

LABRIDÆ.

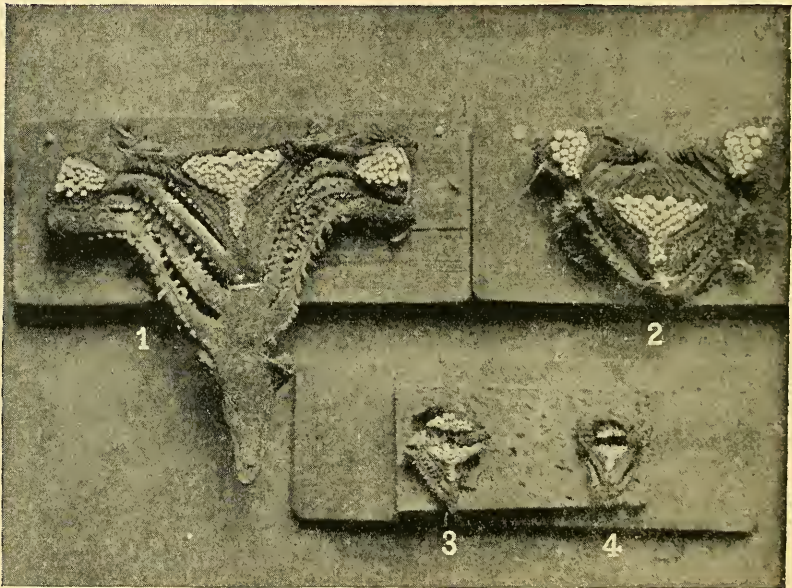


Fig. 1.—LABRUS MIXTUS.

Fig. 2.—L. TURDUS.

Fig. 3.—L. FESTIVUS.

Fig. 4.—CORIS JULIS.

sections, but looking like one that goes across the upper part of the back of the mouth, and they act against the lower pharyngeal teeth, which are similar looking teeth, but more rounded on their summits, and which go in an elongated shape across the floor of the mouth, but which throw out a promontory of teeth towards the front part as well, the teeth on which are smaller than those at the back. The gullet of this fish could not be opened back to show the upper pharyngeals distinctly, so it was

split along the centre line and opened sideways. To get an accurate idea of the working position of these teeth the extreme right and left edges must, in the mind's eye, be bent over toward each other, and the edges made to touch; this will then bring the upper pharyngeals into their correct relative position to and over the lower pharyngeal teeth. The food of this fish consists of crustaceans, molluscs, echinoderms, and fish.

LABRUS TURDUS.* Fig. 2 (p. 454).

The upper pharyngeal teeth are conical along the centre of the patch, with more rounded ones at the sides. The teeth of the lower pharyngeals have their summit more rounded than the upper pharyngeal teeth. There is a promontory of teeth projecting forward in the mouth. In the illustration those at the apex have unfortunately fallen out. The upper part of the gullet has been divided similarly to and for the same reason as explained for the last fish.

LABRUS FESTIVUS.* Fig. 3 (p. 454).

The illustration is from a small specimen; it has fourteen short gill-rakers from the angle forward. They bear one or two minute teeth on them. There are six gill-rakers along the first epibranchial. The other arches have alternate gill-rakers, on some of which are minute teeth. The upper pharyngeal teeth are conical, the lower pharyngeal teeth at the back part of the mouth are more rounded on the summit. Those at the apex of the forward promontory are conical and sharp, especially the most forward one of all, which also has a rake or leaning toward the back part of the mouth. This would prevent a shellfish being crushed by the molariform teeth from slipping forward into the mouth again.

CRENILABRUS PAVO.

The pharyngeal teeth are much the same as in the last one described. In the specimen examined several of the teeth both in the upper and lower pharyngeals showed signs of wear, as the tops of them were gone, leaving an appearance of a small dark ring, which was strongly suggestive of dental caries.

* Both found in the Mediterranean.

CORIS JULIS. Rainbow Wrasse (Couch). Fig. 4 (p. 454).

This is a small fish, even when full-grown ; it has the same conical teeth in the upper pharyngeals as described above, with more rounded ones as they get towards the back of the mouth. In the lower pharyngeal teeth there is one big one with a round summit in the centre at the back, with small rounded ones at each side. Along the promontory the teeth are more conical, the two at the apex standing well up, and are sharp. The food of this fish consists of molluscs, both bivalves and single shell echinoderms, and crustaceans.

The *Scaridæ*, or Parrot-wrasses, closely allied to the *Labridæ*, are furnished with pavement-like teeth for the lower pharyngeals set in a concave shape. The upper pharyngeal teeth are set on a convex surface working on to the lower set. A specimen of these upper and lower pharyngeals of a *Scarus* are to be seen in the Fish Room of the British Museum of Natural History at South Kensington.

(To be continued.)

SOME OBSERVATIONS ON *VESPA GERMANICA*.

BY MARION BLACK-HAWKINS.

ON July 10th of this summer I discovered a wasps' nest belonging to the species *Vespa germanica* in my garden, and being anxious to study wasp economy at closer quarters than I had hitherto had the opportunity of doing, I decided to dig the nest up and transfer it, wasps and all, to my room. I prepared a glass-box for its reception, lining the sides with brown paper, and fixing dark green muslin over the top, except for one entrance-hole or rather slit, which was about five inches long and one inch wide. The front pane of glass I kept two-thirds uncovered, through which I could watch the nest at work. I hung the case on the wall above my writing-table, where I could easily see all that was going on. On July 14th I went out at 2.30 a.m. with all the paraphernalia necessary for taking the nest. I smoked two cartridges from my bee-smoker down the hole, and then stopping it up I began to dig down from above. It was in rather an awkward place on a bank, and not knowing how far back the nest lay from the entrance-hole, I was working somewhat at random, but after an hour's work I located the spot, which was about ten inches below the surface. By this time a good number of the wasps had begun to recover, and were crawling out, still too dazed to fly off quickly. I killed them as they appeared, supposing there would be plenty more in the nest when I got it out. It proved, however, to be a very small affair—four small combs, the third, which was the biggest, being five inches in diameter and fifteen inches in circumference. Moreover, there were only about a hundred wasps hatched out; of these about fifteen escaped, I captured thirty, and the rest were killed by the smoke or crushed in the digging. Most unfortunately the queen also was killed. All the combs were, however, full of eggs, larvæ, and pupæ; in some of the cells

there were two eggs. The eggs were attached to the sides of the cells, and in those cases where there were two to one cell they were attached on opposite sides. In the third and fourth combs I noticed there were two eggs to about every fifth cell. Was this due to an insufficiency of cells for the queen to lay in? Certainly there were no empty ones, and I could only suppose that the workers could not build them quickly enough for her needs.

I had either put in too much smoke or else the wasps got hurt in the digging out, at any rate they crawled about feebly, and though, after I had transferred them to the box, I spent nearly an hour fanning them, by the end of the morning they had all died, so I was left with a nest containing (I estimate it roughly) some six hundred or seven hundred eggs, larvæ, and pupæ. I found to my surprise that the larvæ were quite easy to feed, rearing themselves out of their cells as I held the comb in my hand to suck up the honey from my finger-tips. Though the size of their head was no larger than the head of an ordinary pin, they worked their jaws with such vigour that I could feel the pressure against my finger-tips. Concluding that honey alone was not sufficiently nourishing for them and they would also require some food containing a nitrogenous compound, I extracted one from its cell, killed it, and cut it up into fragments, which I then distributed with a pair of pincers among the others. They ate it with avidity! It was really wonderful to see the way they managed to manipulate the morsel with their jaws and the rapidity with which it disappeared. I decided it would be impossible to rear the whole nest, so I extracted and threw away some two hundred larvæ, leaving about two hundred distributed between the three combs—the fourth comb contained eggs only.

In the evening, four wasps broke through their pupæ-cases. They appeared rather shaky at first, took a little honey from my hand, and spent the rest of the time wandering about the combs and poking their heads into the cells. I now removed one of the combs so as to still further lessen the number of larvæ to be fed. Before I went to bed one more wasp had bitten its way out of the pupa-case, making a total of five.

The next morning, July 15th, three more wasps had completed their development, while the five of the previous evening were quite active, and appeared to me from the way they were moving about to be already tending the larvæ. I lifted the top comb out of the box, and held it in my hand to watch them more closely, and they strayed on to my hand apparently without alarm or resentment till suddenly one stung my finger most viciously. I put the comb back rather hastily, though the others were quite calm. I did not feel inclined to put my fingers too near them again, so, as they had to be fed, I placed pieces of paper well soaked in honey between the combs. They ate it eagerly, and by this means I managed to keep them well supplied with food all day. There was something rather pathetic in the eight plucky little workers trying to keep the nest going, although they had no queen and about one hundred and twenty larvæ to tend. On July 16th, when I settled down to watch them, I found they were cutting a larva to pieces and giving the little bits to the others. I don't know if it was a dead larva or whether they had killed it under stress of circumstances. Evidently the honey was not considered a sufficiently nutritious diet. I extracted several pupæ and, killing them, placed them on one of the combs. The wasps at once crowded round them, cut small pieces off, and ran away with the chunks to give to the larvæ. In fifteen minutes not a morsel was left. Some more wasps had emerged, but exactly what their numbers were I could not tell, as they moved about too quickly for me to count them. In the middle of the morning one bolder than the rest flew out of the box, and after a moment's zigzagging in front of it, evidently to memorize its position, it darted out of the window. In three and a half minutes it was back again, flew straight to the box without a moment's hesitation and disappeared within. What a marvellous memory they have!

On July 18th I put in the box during the course of the day seven dead pupæ, six caterpillars, a blue-bottle fly, and half an ounce of honey, but by 7.30 p.m. not a scrap of any kind was left. Moreover, five or six of the wasps were in and out all day foraging for themselves. More imagos had emerged, in fact, each day now added its quota of fresh members to the com-

and there must have been sixteen or seventeen. It only took them half an hour to get through a quarter of an ounce of honey ; they never appeared to rest for a moment, and all their movements were marvellously quick. I was much struck by the use they made of their first pair of legs while cutting up the caterpillars. They stood reared up on the two *back* pair of legs, using the front pair to hold the morsel, and with these, together with their jaws, they manipulated the morsel with as much ease and freedom as I could have done with my two hands. After a close scrutiny in two cases (and I was able to verify it again later), I noticed that the calcaria were used like the prongs of a fork to hold the morsel in place and prevent it from slipping too far up between the legs. It was on this day also that they started building a paper envelope round the combs, for I had destroyed the original one when I dug up the nest. I had noticed that they were apparently nibbling on the top and round the edges of the combs, but I could not make out what they were at. However, half-way through the morning there was no possible doubt, for two large pieces were already made and they were hard at work on them. The rapidity with which they worked was nothing short of amazing. They took the edge *lengthwise* between their jaws, bending it about and depositing a fresh layer of material on it. A piece held up to the light displayed the structure perfectly, for it showed a series of lines where the fresh material was added, in just the same way as the lines show the increase of an oyster-shell.

During the course of the summer I had several opportunities of watching wasps scraping up the fibres of wood used in the construction of the nest, as there were some old palings in the garden which were evidently a recognized place for wood-scraping. It took them on an average about two minutes to collect the bundle, which was rolled up in a little pellet (in which action the fore feet assisted) and carried among the mouth organs behind the jaws, so that from in front of the wasp one could not see it. In this way the jaws were left free for scraping, and whenever the pellet became likely to slip away, the front pair of legs were used to push it forward again into the mouth organs. I noticed that they always walked *backwards* when

they were wood-scraping. Sometimes they tore up the end of a splinter, and then there was great trouble in breaking it off. Either they abandoned it, or else, holding it firmly in their jaws and steadying it between the first pair of legs, they stood firm on the others, and then threw their body from side to side, tugging and pulling at the splinter till it broke off.

Once the first layer of the envelope was completed, they used to ventilate the nest at night by waving their wings up and down with very rapid vibrations, which in the confined space between the combs produced a noise similar to a cat purring. They generally kept it up from two to five minutes at a time, then there would be a pause of varying length, sometimes an hour, sometimes only a few minutes, before the rumble would recommence. On July 19th it was very hot, and they kept up the ventilation most of the day, and I was very fortunate in seeing one wasp actually at work at it. She came up to the edge of the box, and stood there with her head down, her back arched up, and the end of the abdomen down; this position brought the thorax high up, making her into a semi-circle. She stood so for eighteen consecutive minutes, waving her wings up and down with such rapidity that they looked one broad blur. She then rested for two minutes, recontinued for four and a half, and after another short pause she again did it for nine minutes. It was about this date that I killed one wasp which showed the most unusual coloration of the head. The trapezoidal-shaped spot and the antennæ were wine-colour, and the vertex had a broad yellow band across it which met the yellow spots in the sini of the eyes, making it one continuous yellow band from sinus to sinus.

All this time I had been keeping a careful watch on the amount of food brought in for the larvæ, and by far the largest part of this consisted of flies. Usually only the trunk of the body was brought back, both the wings and legs having been carefully bitten off, but occasionally they were left on. Sometimes also they only brought back the thorax, or the thorax and the head. On July 28th I counted the number of flies brought into my nest during one hour. I commenced counting at 11.15 a.m., and by 12.15 they had brought in no fewer than

four hundred and twenty-seven. The numbers per minute were as follows:—

1st minute,	5 flies	21st minute,	2 flies	41st minute,	6 flies
2nd	2 "	22nd	4 "	42nd	4 "
3rd	7 "	23rd	3 "	43rd	3 "
4th	6 "	24th	5 "	44th	3 "
5th	2 "	25th	2 "	45th	5 "
6th	2 "	26th	3 "	46th	2 "
7th	4 "	27th	4 "	47th	4 "
8th	5 "	28th	3 "	48th	5 "
9th	1 "	29th	5 "	49th	6 "
10th	3 "	30th	3 "	50th	2 "
11th	2 "	31st	4 "	51st	2 "
12th	2 "	32nd	3 "	52nd	5 "
13th	6 "	33rd	2 "	53rd	1 "
14th	6 "	34th	3 "	54th	0 "
15th	7 "	35th	4 "	55th	2 "
16th	6 "	36th	6 "	56th	3 "
17th	7 "	37th	4 "	57th	6 "
18th	4 "	38th	6 "	58th	6 "
19th	5 "	39th	2 "	59th	8 "
20th	1 "	40th	2 "	60th	1 "

I counted them on several other occasions, and with much the same results. The number of imagos in the nest at this time was not more than sixty. The bulk of the food brought in was always flies, but there was also a small percentage of miscellaneous items, chiefly fruit. Several times I saw honey-bees or parts of them being carried in. As the sun rose later they ceased to start work so early. When I first had them they would commence work at about 3.15 a.m., but gradually it got later, till by August 1st they were seldom out before 4 o'clock, and they stopped work about 8.30 p.m. But these were long hours when one remembers that they are in a state of ceaseless activity the entire day, apparently seldom stopping for even ten minutes' rest.

The problem which now presented itself to me was what would happen when all the original eggs had reached the pupa stage and there was no more work for the wasps to do, for the queen being dead, there would be no more eggs laid for them. Would they lay eggs themselves, or would the nest come to an abrupt end? I reckoned that the original eggs must all be developed by Aug. 14th, and they would have reached the pupa

stage by Aug. 5th. On Aug. 6th I noticed a great slackness in work; only a little food was brought in, and a general inertness seemed to prevail. Some of the wasps still kept hard at work, but a large percentage spent their time motionless on the nest and the sides of the box, or else in cleaning each other. This state of things lasted till Aug. 13th, when I noticed that something of the old activity was resumed, and a larger supply of food was being brought in. It was therefore obvious that, since the original eggs must have passed to the pupa stage by now, one or more of the workers had themselves laid some.

I was now away for a few days, so do not know what happened, but on my return on Aug. 28th I found a number of drones in the nest. They continued to increase in numbers for the next few days till there were quite thirty of them. They were very sluggish in their movements, crawling about the window the whole day, with occasional flights outside, and creeping back to the nest at night. They were also extremely greedy, feeding on the honey I put in the box for them till they were positively bloated, and could hardly crawl out of the dish and back to the nest, dragging their honey-distended abdomens on the ground as they went. It was obvious that the nest was breaking up, for the workers had ceased all work, many of them died, and the rest were entirely devoid of energy. Since many of them had died in the nest, it became tainted, and I was forced, on Sept. 7th, to throw it away, although there were still some half-dozen wasps or so crawling about it.

NEW BRITISH HENLEAS.

BY HILDERIC FRIEND, F.L.S., F.R.M.S.

THE list of British Oligochæts is steadily growing. Aided by a Government grant, I have this year been able to adopt means whereby the minuter species are easily discovered, and it is here that our richest harvests are at present being gleaned. The genus *Henlea* was created by Michælsen in 1889, in honour of the naturalist Henle. It consists of a number of Enchytræids with colourless blood, simple spermathecæ destitute of diverticula, and nephridia whose anteseptal portion is small. There are no dorsal pores, the œsophagus goes suddenly into the intestine in the eighth or adjoining segments, in which the dorsal vessel arises.

Beddard's splendid 'Monograph of the Order Oligochæta' (published in 1895) gives us four species as being then well-known, while reference is made to others which were doubtful. There was nothing, however, to suggest that any one of these was to be found in England, though all were known to be European. I had, however, in 1892 found one species (*Henlea ventriculosa*, d'Ud.) in Yorkshire and Essex, and in 1896 I again discovered it at Cockermouth. In the former year I also obtained specimens of another species (*H. leptodera*, Vejdovsky, = *H. nasuta*, Eisen) between Woodhouse Grove and Bradford, as well as from Essex, while I found it again in Cumberland in 1896 (see 'The Naturalist,' 1896, p. 298, and 'Essex Naturalist,' 1896, vol. ix. p. 110). These were, I believe, the first British records.

In 1907 Mr. Southern ('Irish Naturalist,' xvi. p. 70) confirmed my first record by the statement that he had found it in various parts of Ireland. At the same time he reported the occurrence of a further species (*H. dicksoni*, Eisen), and described a new species (*H. hibernica*, Southern). Thus we find that in 1907 four species of *Henlea* were known. Southern gives these, with localities, in his useful 'Contributions towards a Monograph of British and Irish Oligochæta, 1909.'

Meanwhile Bretscher and others had been at work on the subject abroad, while I was engaged upon the species to be found in England. In 1898 I found a new species of *Henlea* at St. Anne's-on-Sea, Lancashire. It corresponds almost exactly with *H. lampas*, Eisen, and as it has never yet been described in English, I transcribe my original memoranda. A small worm, about one-sixth of an inch (= 3-4 mm.) in length, thirty segments, with yellowish blood. Setæ very large, strong, and equal in length; straight, with inner edge slightly bent, extending over half diameter of the body. In one specimen the setæ were chiefly three ventral and two lateral; but in a larger specimen of forty segments, fully developed, the setæ were chiefly four in ventral and three in lateral bundles in anterior part of body, with two posteriorly. Head-pore present between prostomium and first segment. Ventral vessel bifurcating in segment three, and dorsal vessel shading off here, reappearing in about four to seven as a kind of pulsating heart. Brain notched before and behind, rather longer than broad. Found among seaweed, zoophytes, and *débris* on the shore. My own notes, like those of Eisen, are wanting in important details, for it is only within the last ten years that we have learned exactly how to describe these puzzling species. But as no other worm with which I am familiar can be produced to settle the matter I provisionally enter *H. lampas*, Eisen, as British.

The next species to place on our lists (*H. puteana*, Vejd.) is one of the four mentioned by Beddard. It cannot be confused with any other, for it is the only species in the genus with two pairs of spermathecae, and it is in this respect unique in the whole family. I found it in Ledbury churchyard on Easter Monday of this year. It occurred with other Enchytræids among moss and algæ where water trickles over stones into a well. Unfortunately, during my absence from home the material suffered, and I was unable to study the living worms in detail as I purposed doing. For the present this remains the only known habitat within the British Isles.

Our next record is of special interest. On May 27th I went to Buxton and collected Annelids, giving particular attention to the microscopic forms. Along with *Enchytræus minimus*, Bretscher, I found *Henlea rosai*, Bret., which is slightly larger

than *E. minimus*, and has an average of thirty segments. The setæ range from three to five behind, and from four to eight in front. There are usually more setæ in the ventral than in the lateral bundles. The duct of the brownish nephridia is given off by the hinder part of the postseptal. The œsophagus enters the intestine abruptly at segment seven. The brain is about as broad as long, straight or slightly convex behind, and concave in front. There are three pairs of septal glands, and the spermathecae are destitute of glands and diverticula. Habitat: among *débris* by a wall in the Serpentine Walks, Buxton.

I come now to the latest addition to our list; and as the species seems to be new to science, it is necessary to give a detailed and explicit description. The worm is very small, and this accounts for its specific name.

HENLEA PERPUSILLA, sp. nov.

External characters.—Length of adult 2–3 mm., with about thirty segments. To the naked eye whitish, and in the microscope transparent. Setæ as few as two and as many as eight. As a rule four to six occur, those behind being long and equal, those in front being a little shorter and unequal. The girdle covers the twelfth segment and reaches to the setæ of the thirteenth. Sometimes it falls short of the setæ, at other times it just exceeds them. The head is slightly glandular, but this is a very variable character in all Enchytræids. The irregular cells of the girdle are not arranged in distinct rows as is often the case, nor have they the sharp definition which one finds in some other species.

Internal characters.—As the brain varies in all these creatures with tension, it is best to observe the organ at rest. In the present case then it is nearly or quite twice as long as broad, convex or straight behind, and concave in front, as in the last. The œsophagus suddenly merges into the intestine in the eighth segment, and the chloragogen cells commence in the seventh; they are often arranged in longitudinal rows. There are three pairs of septal glands in segments four-five to six-seven, not differing in any material way from the typical forms. Cœlomic corpuscles, which often appear cigar-shaped or elliptical when floating, are

circular or discoid when free. The dorsal vessel arises in segment nine; the segments eight, seven, six have an enlarged pulsating vessel, which then contracts, and the blood appears to be *shot* through the narrow portion. I could find no traces of salivary glands, even in a rudimentary state, in any of the specimens examined. The nerve is enlarged in the foremost segments, and the pharynx is evertible, so that one can observe it being used in taking in food. I noticed this peculiarity in another species many years ago.

The spermathecæ, as usual in this genus, are destitute of glands and diverticula. In one specimen I observed traces of an enlargement of the duct about the middle, but usually the organ is simple and uniform in size, and opens into the intestine. This is one of the species which is destitute of œsophageal glands. In one specimen the first nephridia were situated in segment five–six, but in other cases I could not trace them earlier than six–seven. These organs are of great importance in diagnosis. I find that they differ somewhat widely in this species. In the front segments the anteseptal is often very brown and somewhat large, while the duct springs from the anterior third of the post-septal. Behind, however, the duct is a continuation of the posterior end of the organ. It is then about two-thirds the length of the postseptal. It frequently happens that many oil-cells are present, and in one instance the rich yellow colour gave a golden hue to the specimen. The ampulla, found in the neighbourhood of the girdle in pairs, is very small, pear-shaped, hardly longer than broad, while the duct is very narrow. It will be seen that the new species in some respects resembles *H. tenella*, Eisen (originally described as *Archienchytræus tenellus*). Eisen, however, does not distinguish two kinds of nephridia, and the two present the following differences:—

H. TENELLA, Eisen.

Brain nearly as long as broad, notched before and behind.

Ampulla more than twice as long as the middle is broad; spindle-shaped.

Length 8–10 mm., with about fifty segments.

H. PERPUSILLA, Friend.

Brain about twice as long as broad, concave in front, convex behind.

Ampulla hardly any longer than broad; pear-shaped.

Length 2–3 mm., with about thirty segments.

I may here give a tabular summary for purposes of future reference:—

Species.	First described.	British records.
<i>Henlea ventriculosa</i> , d'Ud.	1854	1892
<i>H. nasuta</i> , Eisen (= <i>Enchytræus leptodera</i> , Vejd.)	1878	1892
<i>H. lampas</i> , Eisen	1878	1898
<i>H. dicksoni</i> , Eisen	1878	1907
<i>H. hibernica</i> , Southern	1907	1907
<i>H. puteana</i> , Vejd	1877	1911
<i>H. rosai</i> , Bretscher	1899	1911
<i>H. perpusilla</i> , Friend	1911	1911

It is in some respects fortunate that, so far, nothing has been written about these puzzling annelids in English, save by Southern and myself. We are thereby saved a great deal of confusion, and our British records can now be made in a satisfactory manner. As I am engaged on a Monograph of British Oligochæts for the Ray Society, I should be greatly obliged if readers would send me specimens of white worms, earthworms, or waterworms from different localities. Address: 110, Wilmot Road, Swadlincote, Burton-on-Trent.

Addendum.—Since the foregoing was sent to press I have found a further species of *Henlea*, which agrees in so many particulars with *H. tenella*, Eisen, mentioned on p. 467, that I record it provisionally under that name. There are three dorsal and four to five ventral setæ. The œsophagus widens in segment eight, and the nerve ganglia are enlarged in front. Eisen's description does not allude to the presence of a row of vacuoles or glandular cells, such as I find in each segment just in front of the setæ. The brain is mobile, but agrees with Eisen's notes. As the Continental authorities have recently added several new species, and given fuller details, it is possible that the new record may eventually be found to agree with one or other of these. Locality: Acresford, Ashby-de-la-Zouch, Nov. 28th, 1911.

NOTES AND QUERIES.

MAMMALIA.

Fidelity in the Dog.—The following instance of a dog's fidelity, the truth of which I am able to vouch, seems to me to be worthy of being recorded. About a fortnight ago the proprietor of the principal inn in this village, who was also a large farmer, died. A few days after the funeral a relative, who was unable to be present at it, came over to see the widow, and on visiting the grave was surprised to find a large hole scooped out in the soil beside it. Some men who were painting the church told her it had been made by the farm dog. They had driven the animal away several times, and filled up the hole, but it kept coming back, and scratched at the graveside as hard as ever. The dog has now given up doing this, but it still visits the grave four or five times every day, always returning home in a very dejected state. During his master's last illness the family could hardly keep the dog out of his bedroom; but it is a mystery to them how he knew where his old friend had been taken to, and was able to pick out the right grave. The dog is a collie.—R. H. RAMSBOTHAM (Elmhurst, Garstang).

AVES.

Late Swallows.—A solitary Swallow—a bird of the year—was hawking for food near my house on Nov. 12th; the previous note that I have of any being seen in this district was Oct. 12th, when about one hundred Swallows and House-Martins were along the Severn meadows. In only one other instance have I ever seen the Swallow in the Midland counties later than October, and that at Sutton Coldfield Park, Warwickshire, Nov. 2nd, 1890, when two were together.—J. STEELE ELLIOTT (Dowles Manor, Shropshire).

In my last communication (*ante*, p. 433), for "Pouthill" read "Southill."—J. S. E.

On the Increase and the Habits of Jackdaws in Islay.—The increasing numbers of Jackdaws (*Corvus monedula*) on this island are very noticeable. I have recently gathered a few particulars from the keepers here which may be worth recording. The increase of Jackdaws has been accompanied by a decrease of Choughs (*Pyrhocorax*

graculus) on the coast-rocks, though to what extent the two changes are connected I feel doubtful. According to "the old men," the Jackdaw was only known as a winter visitor in their young days. This, as far as one can discover, goes back to a time sixty or seventy years ago. It is long since that time that they began to breed here. The cliffs appear to have been first resorted to. Within the last six or seven years Jackdaws have taken to breeding in the rabbit-holes on the sandhills. This habit of the bird is, of course, well known, and for a number of years before they began to nest in the rabbit-holes here I am told that they had done so on a small uninhabited islet off Port Ellen. I was not here during the breeding season, but, according to my informant, there were this year "scores" of nests in the sandhills. Some were at the entrance to the holes, some a yard or more down. There were also a few Jackdaws' nests in spruce-firs in the plantations near Islay House.—HAROLD RUSSELL (Islay House, Islay).

Grey Phalarope at Yarmouth.—A fine example of the Grey Phalarope (*Phalaropus fulicarius*) was obtained here on Oct. 28th. When first seen on the wing the gunner thought it was a Dunlin, but suddenly it settled in the middle of a dyke which runs parallel with Breydon Broad. His suspicion was then aroused, and he thereupon secured the bird, and brought it to me the same day. This neat little species seems to prefer small ponds and dykes to Breydon and other large tidal estuaries, for in the former they are better able to obtain their food.—B. DYE (Yarmouth).

Gulls hawking for Insects.—Referring to the note on this subject (*ante*, p. 433), this is a habit of *Larus ridibundus* I have often watched. Many an evening we used to sit in our garden in Perthshire (quite near a large gullery) and watch these graceful birds hawking moths out and in and through the trees. Their movements at such times were very similar to the Swallows and Martins. This went on every evening. — T. THORNTON MACKETH ("Burndale," Kilmacolm, Renfrewshire).

THE habit of hawking for insects is not unusual on the part of Black-headed Gulls. They may often be seen thus engaged on summer and early autumn evenings. For other records, see Ussher and Warren, 'Birds of Ireland,' p. 330; and 'The Zoologist,' 1843, p. 246; 1844, pp. 455, 577-78; 1902, p. 216.—F. B. KIRKMAN (Letchworth, Herts).

NOTICES OF NEW BOOKS.

Marvels of Fish Life as Revealed by the Camera. By FRANCIS WARD, M.D., F.Z.S. Cassell & Co., Limited.

WE are familiar with the advance made in our knowledge of ornithological bionomics by the use of the camera; Dr. Ward has now applied it to the even more difficult study of the lives and methods of fishes and other aquatic animals. This extended use of the camera is only in its infancy, but the results are already of the highest importance, and have added largely to piscine lore. To observe properly and photograph fishes "swimming free in natural environment," Dr. Ward has constructed a special pond into which he can turn his fishes. "In one wall of the pond is a large open space, which communicates with an observation chamber, and between this chamber and the water in the pond is a sheet of plate-glass. Concealed in the chamber the observer can watch the fish as they appear to each other in the water. In consequence of the darkness in the chamber and the light in the pond, the glass is converted into a mirror, and the fish merely sees himself and his surroundings reflected, while the observer can plainly see into the pond. It is thus possible to observe a timid fish without disturbing him. In addition, an instantaneous photograph can be taken of moving fish under three feet of water." This is the method; the results are most informative and interesting, while a profusion of photo blocks fully illustrate the narrative. The author has also used his camera in the shallow waters of the sea around our shores, and has also given much information as to how fish photography is to be pursued.

Rigid and total abstainers will probably be somewhat shocked at the instructions given to revive fish which may arrive half-dead at the observatory, for, as is truly remarked, "many people can catch fish, few know how to keep them alive." If other means (advised) are insufficient to revive the fish, "pour a little

weak whisky and water down its mouth, or swab the gills with cotton-wool dipped in the same restorative."

This book foreshadows a considerable advance in the study of fresh-water and marine animals, and we may look forward with every confidence to a new and popular use of the camera.

Life in the Sea. BY JAMES JOHNSTONE, B.Sc. Cambridge :
University Press.

THIS small volume constitutes a *précis* of the knowledge which we at present possess of some aspects of life found in the vast marine area. Mr. Johnstone gives us some Dantesque sketches of the vast oceanic depths: "We can easily imagine the cold, and the darkness, and the great plains of semi-liquid mud, but not the extreme pressure of the water." And, again, referring to the abyssal animals of which the majority are phosphorescent, he writes: "In the absolute darkness of the abyss they would appear as ghostly silver-blue shapes glimmering like an electric lamp through dense fog on a dark moonless night." It will be long before man learns the story of these depths; up to the present time our zoological anticipations have not been justified, but still "one cannot say that there are no monstrous or gigantic animals still living in the abysses, for no form of fishing gear yet used would enable us to capture a very large abyssal animal." Science has already enabled man to fly and soar above the surface of the earth; will it one day equip him with the means of exploring these dismal oceanic depths? The first achievement, however, has a value in war and commerce as well as in adventure; while the latter can be appraised on the basis of science and adventure alone.

Mr. Johnstone deals with the categories of life, rhythmic change in the sea, the factors of distribution, modes of nutrition, and the sources of food; a necessarily short bibliography is also appended.

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