TRANSACTIONS

OF THE

Norfolk & Norwich

NATURALISTS' SOCIETY:

Presented to the Members for

1870-71.

Norwich:
PRINTED BY FLETCHER AND SON,
1871.

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ADDRESS

Read by the President, the Rev. Joseph Crompton, *to the Members of the Norfolk and Norwich Naturalists' Society at their second Annual Meeting, held at the Norfolk and Norwich Museum, March* 31*st*, 1871.

Ladies and Gentlemen—In closing the second year of the existence of the Norwich Naturalists' Society and making way for my successor in the chair, my remarks must be few. Our year's publication of Transactions will show that the past has been neither a useless nor a barren year. Professor Newton's paper on the "Method of Registering Natural History Phenomena," would of itself give a permanent value to our little book, and I believe will cause it to be gladly received by the many kindred Societies with which we are now in correspondence. The great value of the plan consists in the variety and completeness of the information with regard to each species of bird found in the neighbourhood, and the slight amount of labour required to keep up the daily record. Some results derived are highly interesting as, *e.g.* the migratory habits of the Song-Thrush, and there can be no doubt that important results would be obtained by the comparison of Registers kept on Professor Newton's plan in different districts of the county and country.

We have to thank heartily Mr. J. H. Gurney, jun. for his paper giving some of the results of his journey in Spain and Algeria, a district rarely visited by ornithologists, as also to rejoice in finding him following with such ardour and scientific accuracy, the steps of his father, to whom this Museum owes such a large debt for its celebrated collection.

Mr. Kitton has brought before us in his paper "On Growth and Reproduction in the Lower Forms of Vegetable Life," a class of objects for the study of which this region offers peculiar advantages, and of which few men in Europe are more fitted to speak than himself; while Mr. Barrett has contributed a paper I do not hesitate to call one of unusual importance "On Coast Insects found Inland." To this paper I shall again refer before I close, as it seems to me to open views of great interest touching the question of the perpetuation of species; when we think of such extremely frail genera of insects retaining their forms, or even existence, through enormous periods of time, and under circumstances singularly changed. Mr. Stevenson's remarks that same evening on the breeding of certain coast birds on the same spots, corroborated, as they were, by the examples quoted by Mr. Bayfield of the existence of seals in the Caspian Sea and Lake Baikal, in conjunction with the paper, form a good example of those unexpected coincidences which must occur in our studies when accurate observations are made, by which one branch throws light upon another while itself receiving illustration; for I do not suppose that the rationale of the existence of the insects or birds at Brandon would have been so fully made out, had not the little fluttering objects of Mr. Barrett's care been brought to notice.

Mr. Stevenson's paper on the abundant occurrence last year of the Little Gull on the Eastern Coast, with the light he has thrown upon its line of migration, is just one of that class of records combined with scientific discussion of facts, for which this and all Naturalists' Clubs are formed.

It will be remembered that a Sub-committee was formed for the purpose of compiling a Fauna and Flora of the county. The first part is published in this year's Transactions—the Mammalia, by Mr. Southwell, from whose pen we gladly print a former paper "On the Ornithological Archæology of Norfolk." I wish he would have allowed his letter to us from Diss, during his temporary absence, also to have appeared, if only as a specimen of how quiet and simple observation of natural phenomena,

visible from a window or in a garden, may be made as interesting as a chapter of White's History of Selborne. Another part of the compilation of Fauna and Flora is, I understand, far advanced under Mr. Barrett's hand, and, when the whole is completed, it will, we hope, be a valuable addition to the Natural History Literature of the county. We have further to acknowledge, though we do not print, Mr. Crowfoot's paper "On the contending theories of Spontaneous Generation;" also to thank the Rev. J. Bates for laying before us the present state of knowledge respecting "Sun Spots and Solar Eclipses."

Our miscellaneous collection of facts contains a few curiosities, but I regret that we have not kept a fuller record of our conversations, where such facts generally drop out from the experience of members, without the formal preparation of a paper. One point, however, I may be allowed to supply, viz.—that evidence has been given that the Sea Birds Protection Act is already doing good, by the return to their old haunts in increased numbers, of the various species which have for many years frequented them. It is clear that the Act needs only to be enlarged and extended to become a great benefit to the country, as well as a joy to all true students of Nature.

Our Excursions during the past season were not so numerous as we had hoped, for reasons I need not recal. Those which were carried out were much enjoyed, and the plan now proposed for their future arrangement will, I trust, make those of the next and future summers far more effective. All excursions in this neighbourhood labour under the local disadvantage of paucity of railway accomodation, while as with all other Clubs, our changeable climate is a continual drawback, though we are spared the peculiar liability of our Liverpool friends, who, we are told, now and then tempt Neptune on their pleasure and scientific trips, and spend the day in a woful study of anatomy by the aid of sea-sickness.

On one or two points more of general interest will I venture an observation. We meet for the sake of prosecuting Natural History, chiefly, of course, from our own delight in its subjects, but, as I conceive, also for the sake of extending that delight to others, and

with the hope that through us the mental and moral benefits of the study of Natural History may become more widely felt. Time was when objections were made to our studies, and fears were entertained of their tendency. We have passed, or nearly passed, through such fears and objections. No one now will talk of the danger of Geology, and even Darwinian theories are now seen in a better light, whether by supporters or opponents, than was the case not long ago; and therefore surely the desire and the power also, perhaps, has increased of spreading the refining tastes and pleasures of our science to many beyond our circle. The poet and the man of genius are the endowed ones, but we, who listen to and enjoy with understanding the results and outpourings of their genius, are the blessed ones. They exist for us and we for them mutually. So one great privilege and honour of the students of Natural Science will be found, not only in reckoning in their select circle a few successful and gifted observers, but in the fact that through their means the enjoyment and the privilege of an intelligent admiration of Nature is extended to and shared by thousands. May it not be possible, I would suggest, at this moment, when popular education is about to take a great stride, for us and our kindred Societies to devise and urge some means whereby the knowledge and pleasure of Natural History should be laid open both to the young and to the intelligent adults of our cities and villages. The late Bishop Stanley, when a rector, and Professor Henslow in the same position, succeeded to a marvel in their country villages in creating a passion for Natural Science. Some Clubs offer prizes to young people to stimulate them to the study, and with good effect. I look to our Museum and regret to see how little the curiosity which brings numbers here on open days is turned to effective account, and as to the schools already existing, and about to be called into existence, both for juvenile instruction by day, and adult education at night, I can only join with Professor Huxley's regret that popular elementary books for such classes are as yet so incurably bad, and that so little care is taken that the great works of Nature should be properly presented to the quick eye and heart of youth, or the

earnest inquiring mind of the working man. Could some plan to remedy these defects, even in part, be devised in our locality, I for one should be only too glad to support the effort, and believe our Society would be earning the gratitude of our city both for the present and for untold generations to come.

No address to a Naturalist Society, even of so slight a nature as this must necessarily be, can pass by in silence the questions raised by such papers as Mr. Crowfoot's on "Spontaneous Generation," Mr. Barrett's on "Coast Insects found Inland," and still less the remarkable issue of Darwin's "Descent of Man." That such frail species of Noctuæ should have preserved their identity unchanged during the long period which must have elapsed since Brandon was a coast line, and the changes involved in that alteration, though small compared with some of the periods Geologists speak of, opens the eye to the immensity of time that may be required, whether for formation of a new, for a slight variation of existing, or for the extinction of an old species. Personally I do not consider the facts so brought to our knowledge go further than to make us realize the lapse of time and extent of change of conditions required for such development of new or actual extinction of former genera; but it gives great force to an observation made to the Liverpool Society, that though we may regret the loss of rare plants, insects and birds from the few localities where they linger, whether by accident, agricultural changes, or by reckless collectors, yet the fact of such extinction or non-extinction is itself a valuable one for natural science, and an important point to be carefully noted, as much almost as the discovery of a new species. Without entering on the unsettled questions of the origin of species, or discussing the probable truth or error of my old teacher, Dr. Grant's maxim—for to him it is originally due—that the whole creation, from the monad to man, proceeded from a cell on which was impressed the potentiality of development; and without venturing to follow Professor Tyndall into the tremendous vision that all poetry, science, eloquence, and genius, existed potentially in the fire mist of primeval cosmical conditions, of which the sun's photo and chromo spheres may be the relics, I may be allowed to draw atten-

tion to the wonderful variety and extent of learning and observation in Dr. Darwin's last book. He calls it the "Descent" of Man, rather, as has been well said, it is the "Ascent" of Man. If—though I do not say he has succeeded, but if he has proved that man is in body developed from some hairy, sharp-eared arboreal quadruped, some of us will be made to remember our classic reading of Dryads, Hamadryads, Fawns, and other legendary creatures of poets and prehistoric traditions, quite as interesting as heraldic griffins, and dragons, which anticipated geologists, and which we would not willingly give up any more than quite believe; but I would maintain it is an "ascent," in one sense, rather than a "descent," Dr. Darwin exhibits, for when he shows how many creatures, four-footed or biped, far below man in *bodily* formation, yet far surpass not only the lowest, but even many considerably advanced races of men in mental and moral qualities he makes us feel, that whencesoever man has developed in bodily organization, he has risen from a lower condition even compared with the brutes, and certainly proves that whencesoever and howsoever derived, man can never in any stage of development become a complete animal worthy of belonging to the brute company. He must be in body and in mental condition either below the beast or above! We wrong the animals, whose natural history is our study, when we talk of a man being, or making himself a beast or a brute; for the beasts would disown him, and show him to be worse than they, if he is not higher; and we wrong our own higher nature, when we forget or disregard the physical condition in which we are here dwelling.

As the butterfly is ever but a beautiful winged grub, so man carries the limiting conditions of body in his highest flights of power, and in his bodily imperfections is conscious of higher energies and destinies. Whether developed from the protoplasmic matter lining the ocean's bed, and cleaving to its rocks miles deep, or descended from quadruped or biped in bodily organization, I care not; for to use the recent words of Mr. Froude to the students of St. Andrew's University—"It is nothing to me how the Maker of *me* has been pleased to construct the organized substance which I call my body.

It is *mine*, not *me*." The "Nous," the intellectual spirit being an ousia—an essence, we believe to be an imperishable something which has been engendered in us from another source. As Wordsworth says :—

> "Our birth is but a sleep and a forgetting ;
> The soul that rises in us our life's star,
> And cometh from afar ;
> Not in entire forgetfulness,
> Not in utter nakedness,
> But trailing clouds of glory do we come,
> From heaven which is our home."

Norfolk & Norwich Naturalists' Society.

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The Treasurer in Account with the Norfolk & Norwich Naturalists' Society for year ending 31st March, 1871.

Dr.

	£	s.	d.
Balance from last year - - - -	14	11	0
99 Subscribers for 1870—71 - - -	24	15	0
1 ditto for 1871—72 - - -	0	5	0
Sale of "Transactions" - - - -	0	10	0
Mr. Southwell for Manuscript Book - -	0	4	0
	£40	5	0

Cr.

	£	s.	d.
Fletcher—Printing "Transactions" for 1869—70	12	2	6
Share of expenses of Museum Soirée - -	2	12	0
Subscription to Museum - - -	2	2	0
Mr. Quinton, jun., Collector - - -	2	0	0
Stevenson—Printing - - - -	0	19	0
Fletcher—Printing and Stationery - -	1	7	6
Secretary, for Postage, &c. - - -	0	17	0
Balance in hands of Treasurer - - -	18	5	0
	£40	5	0

Examined and found correct,

GEORGE WILSON,

Auditor.

March 28th, 1871.

I.

ON THE ORNITHOLOGICAL ARCHÆOLOGY OF NORFOLK.

By Thomas Southwell.

It is singular how little information we find in the works of old writers, with regard to the Natural History of Norfolk, in the times of which they write, although Lincolnshire and Cambs. are often mentioned, and lists of the birds found there given. This may, perhaps, be accounted for in some measure by the "out of the way" situation of our county; certainly not by any scarcity of the feathered race, which was probably quite as numerously represented here as in either of the two counties named. There is no doubt some species lingered here long after they had ceased to frequent better known districts. Indeed, it would be surprising were such not the case when we consider the geographical position of Norfolk; the coast, projecting into the German Ocean, offering a resting-place for migrants passing to and fro; the broads and fens affording a secure home for the aquatic species; and the woods and uplands of the interior presenting every variety of attraction for those species whose habits required such retreats. So great is its diversity of feature and soil, that as old Fuller truly says, "All England may be carved out of Norfolk, being represented in it, not only as to the kinds but degrees thereof; for here are fens and heaths, light and deep, sand and clay grounds, meadow-lands, pastures and arable, woodlands and woodless."

Drayton, in his "Poly Olbion," says Mr. Lubbock, occupies pages with the enumeration of different species of birds found in Lincolnshire, but dismisses poor Norfolk with a passing intimation that the open country around Brandon is admirably suited for hawking. Camden, too, gives an interesting account of the Lincolnshire fens, but of Norfolk only tells us, when speaking

of Hunstanton, "The catching of hawks, the abundance of fish, with the jet and amber commonly found upon this coast, I purposely pass by, because other places also in these parts afford them in great plenty," (Edition 1695). Gough, however, in his edition of Camden's Brit.,—writing, probably, about 1789,—gives a description of a Lincolnshire Fen, which I will quote, as from the similarity of the country, I have little doubt it would apply equally well to our Broads at the same period :—

"The East Fen is quite in a state of nature, and exhibits a specimen of what the country was before the introduction of draining. It is a vast tract of morass, intermixed with numbers of lakes, from half-a-mile to two or three miles in circuit, communicating with each other by narrow reedy straits * * * * * The multitude of starlings that roost in these reeds in winter break down many by perching on them. A stock of reeds, well harvested and stacked, is worth two or three hundred pounds. The birds which inhabit the different fens are very numerous. Besides the common wild duck,—wild geese, garganies, pochards, shovelers, and teals, breed here. Pewit-gulls, and black terns, abound, and a few of the great terns, or tickets, are seen among them : the great crested grebes, called gaunts, are found on the East Fen; the lesser crested, the black and dusky, and the little grebe, coots, water-hens, spotted water-hens, water-rails, ruffs, redshanks, lapwings or wypes, red-breasted godwits, and whimbrils, are inhabitants of these fens. The godwits breed near Washenborough, the whimbrels only appear for about a fortnight in May, near Spalding, and then quit the country. Opposite to Foss-dyke Wash, during summer, are vast numbers of Avosettas, called there yelpers, from their cry as they hover over the sportsman's head like lapwings ; knots are taken in nets along the shores, near Foss-dyke in great numbers during winter, but disappear in spring. The short-eared owl visits the neighbourhood of Washenborough with the woodcocks, and probably performs its migrations with those birds, quitting the country at the same time. It does not perch on trees, but conceals itself in old, long grass. Michael Drayton enumerates the following birds inhabiting the fens : 'the duck and mallard, the teale, the goosander, the widgeon, the golden-eye, the smeath, [smew ? ?], the coot, the water-hen, the dabchick, the puffin, the wild swan, the ilke, [elk ? ?], the heron, the crane, the snipe, the

bidcock, [water-rail], redshank, bittern, and wild goose: among such as flying feed, the sea-mere, sea-pie, gull, curlew, cormorant, and osprey,'" (Camden's Britannia, Gough's Edition, 1806, vol. ii, pp. 380, 1). In another place, speaking of Crowland, he tells us: "Their greatest gain is from the fish and wild ducks that they catch, which are so many, that in August they can drive into a single net 3000 ducks; they call these pools their corn-fields; for there is no corn grows within five miles."

In addition to occasional scraps of information which come to light, often presenting themselves in strange forms, such for instance as a "bill of fare" at some great feast,—we fortunately possess two very valuable records, one the "L'Estrange Household Book," kept during the years 1519 to 1578; and the other,—the most valuable of all our local records of the past,—a paper by Sir Thomas Brown, referring to a period about a hundred and fifty years later, and giving an account of the birds found in Norfolk in his time; his known accuracy and keen-sightedness render this list perfectly trustworthy so far as it goes, and a most welcome legacy to modern ornithologists.

First in point of date comes "the household and privy purse accounts of the L'Estranges of Hunstanton," kept during the reigns of Henry the Eighth and his children, from 1519 to 1578, communicated to the Society of Antiquaries by Mr. Daniel Gurney of North Runcton, in 1833. This curious record of the expenditure in the house of one of the "better sort of gentry," when Henry the Eighth filled the throne, is full of all sorts of antiquarian interest, but its great attraction to us consists in the entries containing the names of the wild birds supplied for the use of the household, with the price paid for them, or the rewards given to the servants who brought them as presents from the neighbouring gentry, and often specifying the mode by which they were procured,—as by hawking, the cross-bow, or the gun. In those days the landed gentry depended almost entirely upon home supply for provisioning their establishments, and as most of their out-door servants were boarded in the house, no small quantity was required to supply those patriarchal abodes.* Provision seems to have been

* On festive occasions the quantity of provisions provided was prodigious; take for example a feast given on the occasion of the "intronazation" of Nevell, Archbishop of York, in Edward IV's reign: Among the goodly provision

more plentiful than money, and we find the rent often paid in kind : thus, in 1519, is an entry, received "A goos, a pygge, a crane, iiij conyes, and a loyn of veile of gyst," or in lieu of rent.

Amongst the birds sent in, the crane is mentioned five times, and, from the price attached to it, I am inclined to think, it was not so much esteemed for the table, (at least at Hunstanton,) as has been generally supposed. The first entry in which a price occurs is as follows :—

Itm pd. for a crane and vj plovs . . . . . xx^{d}.

Six plovers, in a subsequent entry, are valued at 1/2, which leaves 6d. for the crane ; in another place it is charged 4d., and in a third 6d. The curlew, a common bird now, and, probably, more common still at that time, is valued at precisely the same amounts, 4d., 5d., and 6d. To show that the value attached to the curlew was not excessive, I may mention, that in the Duke of Buckingham's Household Book, (A.D. 1507,) it is put down at 4d. and 5d. ; and in Lord North's Household Book, (1577,) at 6/8 per dozen, or rather more than 6$\frac{1}{2}$d. each ; as neither of these books gives the price of the crane, I am unable to compare it, but the agreement of the three records fixes the price of the curlew at exactly that assigned in the L'Estrange Household Book to the crane. I am unable to compare the price of the crane with that of the heron, as, although the latter is mentioned ten times, in no instance is the price given. In the Duke of Buckingham's book, however, it is charged 8d., and in Lord North's, (so far as I can make out,) 3/4 per dozen, or a little over 3$\frac{1}{4}$d. each. In the present day, I suppose we should not hesitate to choose the curlew for our table in preference to the crane, although, from the latter being to a great extent a vegetable feeder, I see no reason why it should not be excellent eating—certainly as good as a curlew fresh from the sea-shore—but in the time of which we are speaking, it was generally included in the "bill of fare," on festive occasions,

made for the same, were 400 swans, 400 herons, 204 cranes, the same number of bitterns, 1000 "egrittes," 104 oxen, 6 "wylde bulles," 1000 "muttons," 2000 "pygges," 2000 geese, 2000 chickens, 4000 pigeons, 4000 conyes, 1500 hot pasties of venison, 4000 cold ditto, "stagges, buck and roes, 500 and mo," 12 "porposes" and seals, and a profusion of game, fish, and sweets.—*Broderip Zool., Rec.*, p. 159.

where it would make a much handsomer dish than the curlew. I can only infer, from the value attached to these two birds being precisely the same, that the crane was less esteemed for the table than has been generally supposed, or that the curlew was considered more of a delicacy than it now is, or it might be that its wary habits being too much for the cross-bow it was more of a rarity.

The bustard is only twice mentioned; the first time, Christmas, 1527, as having been killed, with eight mallards and one heron, by the cross-bow; the second time, three years after, in the following entry :—

Itm in reward the xxv day of July, [1530,] to Baxter's svnt. for bringyng of ij young bustards . . . . ij^{d}.

The "reward" does not seem to have been very large, judging from some other entries of the same nature which I add by way of comparison.

The bringers in of 3 "feasands," half a buck, some strawberries, and a "cygnett," each received 4d.; the reward for a fresh salmon was 2d., except on one occasion when the following entry occurs :—

Itm in reward the xxj daye of December, to a felaw that brought a samon from Lambard, the Miller of Swanton Mills . . . . . viij^{d}.

Possibly the distance may have produced so large a reward in this instance. I am surprised to find the bustard mentioned only twice, as it must have been frequent in Norfolk in those days.

The principal means by which the birds mentioned were obtained was the cross-bow; some idea of the skill with which this rude instrument must have been used may be gained from a list of the birds killed with it, viz. :—wild geese, bittern, mallards, swan, crane, bustard, and heron. Next come the hawks—the goshawk sends in his pheasants; the sparrow hawk, rabbits and partridges; and the brave little hobby, on one occasion fourteen, and on another twelve larks. Water-dogs were formerly trained to take wild-fowl, and to the "spannyells" share fall six mallards and five coots.

Hitherto, both birds and beasts had only the snare, the hawk, and the cross-bow to contend against, but in the first week in November, 1533, a new era is introduced, and a much more terrible engine of destruction comes amongst them—"Itm a watter-

hen kylled wt. the *gun*," and in quick succession a crane, then another, next a mallard, then a widgeon, fall victims to the new foe. From that time, doubtless, the cross-bow would gradually fall into disuse, and the gun, clumsy as it then was, be used in its stead.

On 24th September, 1549, (?) xx^{s} were sent to "Barnes of London to buy gunpowder wth all." In Lord North's Household Book is the following entry :—

Feb. 22, 1577—A hand gonne and gonne powder . . xxxij^{s}.
And Sep. 14 of the same year, "Liiij lbs. of gon powder,
Lviij^{s} vj^{d}.
For 14 lb. of matches . . . . . iij^{s} ix^{d}."

Guns long remained much too costly articles to be extensively used, and, probably, it is not until comparatively recent times that they have aided largely in the work of extermination.*

The "L'Estrange Household Book" is so interesting a record, that I must ask your pardon if I have dwelt longer than I intended upon it—the difficulty is to know when to stop or what to make choice of.

Sir Thomas Brown's paper refers to the latter part of the seventeenth century, a period about 150 years later than the L'Estrange Household Book. Macauley draws a most vivid picture of the state of England at this time, he says :—"Could the England of 1685, be by some magical process set before our eyes, we should not know one landscape in one hundred, or one building in ten thousand . . . . many thousand square miles, which are now rich in corn-land and meadow, intersected by green hedge-

* Besides the birds already named the following also occur :—woodcock, spowe [whimbrel] stint, redshank, knot, teal, peacock, heron, dotterells, sea dotterell, blackbird, sea pye, bittern, popeler [shoveller] pigeon, stock-dove, brant, snipe, and sparrow. I may mention that the porpoise occurs several times ; a conger also seems to have been so much esteemed, that part of it was given to "my Lord of Norwich." Fresh salmon often occur, also oysters, (which cost the great Duke of Buckingham 2*d*. *per* 100,) crabs, "cravose" or crayfish, and a hare killed by the greyhounds. Rats seem to have required a great deal of killing, and "Peter the Rattoner" was frequently rewarded with xx^{d} for "laying of yc chams [chambers] for ratts," or 4d. for "laying of ratten bayn" or poison. We should be very glad to give him 20d. for one of the "old English" rats he took so much trouble to destroy.

rows, and dotted with villages and pleasant country seats, would appear as moors overgrown with furze, or fens abandoned to wild ducks . . . . many breeds, now extinct or rare, both of quadrupeds and birds, were still common." Foxes swarmed, the white-maned wild-bull was still found "in a few of the southern forests," the badger was common, and the wild-cat and yellow-breasted marten frequent. White-tailed eagles "preyed on the fish along the coast of Norfolk; on all the downs, from the British Channel to Yorkshire, large bustards strayed in troops," and our marshes were still frequented by the crane and the spoonbill. "Some of these races, the progress of cultivation has extirpated, of others, the numbers are so much diminished that men crowd to gaze at specimens as at a Bengal tiger or a polar bear."

The worthy doctor is singularly free from the curious "conceits" so frequent in the writers of his time, as indeed might be expected from the denouncer of "vulgar errors;" and what is most important, records the results of his own observations, scorning the glaring plagiarisms then so common, by which the most absurd stories were again and again repeated. The crane, he tells us, was often met with in hard winters, especially about the open country; but he considers they had been more plentiful, for he adds, "in a bill of fare, when the mayor entertained the Duke of Norfolk, I met with cranes in a dish." Bustards were then common, and "were accounted a dainty dish;" the bittern was also abundant and considered good eating; he "kept [one] in a garden for two years, feeding it with fish, mice, and frogs; in default whereof, making a scrape [*i.e.* laying a train of corn] for sparrows and small birds, the betour made shift to maintain himself upon them." Ravens were so plentiful that he attributes the scarcity of kites about the city to their presence. The black grouse was doubtless then, as now, found near Lynn; for he remarks: "The heathpoult, common in the north, is unknown here, as also the grouse; though I have heard some have been seen about Lynn." Very little is said about the hawks, although they must have been well-represented. The golden eagle he, with his usual caution, disclaimed as a Norfolk bird, although I am happy to say we may now, thanks to the exertions of Mr. Stevenson, add it to our already comprehensive list. The sea eagle, the osprey, found about the fens and numerous broads; the kite, then numerous, and the common buzzard and

marsh harrier, which both bred here in considerable numbers, are all he enumerates—we might safely add the hen harrier, Montagu's harrier (not then recognized as a species,) peregrine falcon, hobby, sparrow-hawk, kestrel, and short-eared owl. Of the fen birds, ruffs abounded in marshland, as also in the marshes between Norwich and Yarmouth; the avocet and cormorant bred here, the latter upon trees, whilst the shovelard or spoonbill had but recently ceased to do so, and the shelducks "herded in coney-burrows about Norrold and other places." Starlings, then as now, made the reed-beds their roosting places, and "settled in innumerable numbers in a small compass." The black-headed gull had its home at Scoulton Mere, and "in such plenty about Horsey, that they sometimes bring them in carts to Norwich, and sell them at small rates, and the country people make use of their eggs in puddings."

The moorhen and coot of course abounded, the stork was sometimes seen, the great crested grebe came in April to breed in the Broad waters, "so making their nest on the water that their eggs are seldom dry while they are set on;" with divers other sort of "dive-foul." "Teals," he says, "were in scarce any place more abounding. The condition of the country, and the very many decoys, especially between Norwich and the sea, making this place much to abound in wild-fowl." I will not tire you by enumerating all the birds mentioned as inhabiting the marsh districts at that time, but have given the most important, and will conclude by naming a few of those inhabiting the wooded districts:—The green and pied woodpeckers, the nuthatch and wryneck, the latter "marvellously subject to vertigo and sometimes taken in those fits," the hoopoe, the crossbill, which "comes about the beginning of summer," the shrike, the goatsucker, goldfinch, &c., &c., and a roller, killed about Crestwick on 14th May, 1664.

Things are greatly changed in all respects since the time of which we have just been speaking; within the last century (we are told) it is probable that a fourth part of England has been turned from a wild into a garden. Then locomotion was uncertain and attended with great difficulty; the land was unapproachable during several months in the year, and food has been suffered to rot in one place, when only a few miles off the supply fell short of the demand, so great was the difficulty of removing it: *(Macaulay.)*

Now the facilities of transit, both for passengers and merchandise, are so great, that the prices of produce are equalised throughout the kingdom, and any local attraction draws hosts of tourists to the spot. The wild cliffs and headlands which protect our island home from the ravages of the ocean are no longer the remote regions they formerly were, the railway brought them close to the great centres of "civilization," and man, the destroyer, soon found fresh material for the exercise of his avocation. Until the recent passing of the "Sea-birds Protection Bill" put a stop to such practices, excursion trains were run to certain parts of our coast, where during the breeding season multitudes of gulls and auks are known to congregate, conveying large numbers of so-called "sportsmen," who, thoughtless of the cruelty and mischief they were perpetrating, slaughtered them without mercy, leaving their callow young to die of starvation! Every humane man, even though he have not the love for those harmless and beautiful birds, which a study of their habits is certain to inspire, must rejoice that a stop has been put to this wasteful destruction of God's creatures.

One more glance, and that a very brief one, at the feathered population of our county. Another 150 years have passed, and the Rev. Richard Lubbock gives us his "Observations on the Fauna of Norfolk," a book of which it is impossible to speak too highly, and which, fortunately, is well known to most of us. It gives such a picture of the Broad district as almost makes one long for a return of the past; from its careful perusal we arrive (to quote Mr. Stevenson) at the "startling conclusion," that with the exception of the spoonbill and the cormorant, the same species found nesting here in 1671 were still residents up to the close of the present century.

During a period of 150 years, two species only has ceased to breed in Norfolk, but in the fifty years which have since elapsed, no less than six species have entirely deserted us during the breeding season, viz.;—the peregrine falcon, kite, common buzzard, bustard, avocet, and black-tailed godwit; five other species have virtually ceased to breed here, namely:—the hen and Montagu's harriers, short-eared owl, bittern, and black tern, only a pair or two of which, from time to time and at uncertain intervals, return to their former homes. Several other species are rapidly dis-

appearing, such as the hobby, marsh harrier, Norfolk plover, ruff, sheldrake, great crested grebe, the common and lesser terns, lapwing, redshank, and ring dotterell.

I have myself talked with men who have taken the eggs of the avocet and black-tailed godwit, and who have seen the bustard at large in its last stronghold. The bittern was so common in Feltwell Fen that a keeper there has shot five in one day, and his father used to have one roasted for dinner every Sunday. I have found the eggs of Montagu's harrier, and know those who remember the time when the hen harrier and short-eared owl bred regularly in Roydon Fen, and who have taken the eggs of the water-rail in what was once Whittlesea Mere.

I will not stop to enter upon the causes which have produced this change, nor upon the present condition of some species which are rapidly disappearing, as I should like to avail myself of another opportunity of doing the subject more justice than I could now, but will merely point out what I shall call the moral of this address—let us all strive to follow the example of the good Dr. Brown, and of the no less worthy Mr. Lubbock, in preserving for our successors a faithful account of what we see and know in our own time, and in collecting all the information possible from every source respecting those species which are passing away from us, or have been lost within the memory of man. I cannot do better than conclude with quoting the words of Professor Newton when speaking of the great bustard :—* "We, the naturalists of the present day, regretting that we know nothing of the extinction of the crane as a British bird two centuries ago—or of the capercally, in Scotland, one hundred years since, are, I think, bound to search out all the legends of the bustard before it is too late, in order to prevent our successors from reproaching us as we do those who lived at the times I speak of—and we shall be the more blameable, for we ought to have profited by their bad example. I need not say that this remark does not apply solely to the bustard's case—but all birds whose existence in this country has already become, or is becoming, a matter of history—and there are, I am sorry to say, many of them—deserve the same attention, and I am sure that however humble our efforts may be to effect this, they will not be thought despicable."

* In a letter to the writer.

II.

ON A METHOD OF REGISTERING NATURAL HISTORY OBSERVATIONS.

By Alfred Newton, M.A., F.R.S., &c.

Read 30th August, 1870.

Anything that helps to facilitate or render less irksome the task of recording observations in any branch of Natural History, must need deserve the best attention of Naturalists. I accordingly trust that the remarks I have now the pleasure of communicating to the Society, may be thought worthy the notice of some of its members, and I do this the more confidently because I have found the method I propose to explain to work well in practice, having had experience of it for a period of more than ten years.

I may premise that I am one of those persons who have never been able to keep a regular journal—in the common acceptation of the term—for any length of time; and, without attempting to defend my failing in this respect, I may say that I believe I share this defect with very many others. But no one has been more fully aware than myself, of the importance of noting down a continuous series of observations in regard to that part of the animal kingdom to which I have chiefly devoted my attention. Accordingly, I endeavoured to discover a method which would at once secure this desirable result, and yet be free from the objection I have mentioned. It appeared to me that my end would be attained by using a sheet of paper which should be ruled with horizontal lines, so as to occupy each line with the observations of one day, and divided into vertical columns, so as to fill each column with the observations of one species—but in order to save time in entering such observations, as well as to bring them into a convenient space, it would be necessary to keep the record, as far as possible, by means of symbols; and, while naturally using

symbols of the simplest character, to be careful that they should yet be sufficient to express all that one would wish to record. This idea struck me more than twenty years ago—towards the end of the summer of 1849; and I at once began to devise such a set of symbols. A little consideration and a few trials gave me assurance that the plan would not be difficult to practice—and, in I think, the month of September of that year, my brother Edward and I began, by way of experiment, a *temporary* "Register." This succeeded so well that we set about the preparation of a *permanent* one on a large scale, in the form of a suitable book, in which, being ready by the close of the year, we commenced our work in earnest on New-year's day, 1850, and either jointly or severally we continued it with a few intervals, when it happened that neither of us was at home, until the end of 1859; then, my brother having taken up his abode abroad, and I (from various causes which I need not particularize) not enjoying the same facilities for observation as formerly, it seemed inexpedient to keep up the practice—for the absence of those facilities would have impaired the value of the observations made at the two periods.

Now before describing our method further, I would remark that the scope of our "Register" was much more extended than, so far as I am aware, any series of observations which had hitherto been carried on by other ornithologists. It was our object to record day by day the appearance not only of every or nearly every species of bird, but, to a greater or less degree, its relative abundance, or scarcity—and, with respect occasionally to some species, the appearance of every individual bird. Though undoubtedly such previous acquaintance as we had with the avifauna of our particular tract of country was advantageous, we did not wish to presume upon that acquaintance more than we could help. We wished to make the birds tell their own story for themselves, so that their appearance or disappearance, their abundance or scarcity, should be shown plainly by the pages of our "Register." We were not content with merely knowing the date of the first appearance of the Swallow, the Fieldfare and our other well-known migrants, but we wished to know how they appeared—whether singly or in force—whether the males preceded the females, and so forth. Further, we were not content with merely noting the date of the commencement of the song of the Redbreast or the

Chaffinch, but we wished to know whether this act—important as marking the accomplishment of a physiological change in the organization of the performer—was merely an individual peculiarity, or whether it had become general among the species. We hoped further—and in this we were not disappointed—that several hitherto unsuspected facts in the economy of birds might be revealed to us. Thus the series of observations we began to carry on was, as has been said, on a far more extended scale than any which had been previously brought to our knowledge, and, I may add, than any with which I have since become acquainted.

And now for the plan of keeping this "Register" which we pursued. I have already said that the observations were recorded by symbols in such a manner that each day's work was expressed in one horizontal line, and that the entries respecting each species formed a vertical column. The book we had prepared contains, besides space at the top for headings to the columns, *thirty-one* such ruled lines extending across both pages, so that whenever it is opened it displays at one view the observations for a whole month. The first column to the left marks the days of the month. Next follow ten columns for a rough meteorological register, which had been begun some time before by my brother, and was continued in the hope that it would throw some light on the movements of birds. To this I shall again return, merely mentioning now that nine of these columns are narrow and contain thermometrical and barometrical records, the direction of the wind, and the amount of downfall (if any). These are followed by one, some two-and-a-half-inches wide, left for a brief description of the weather. Then comes the strictly ornithological part—a series of some fifty-five narrow columns, at the head of each of which is written the name of a bird, beginning with the species which, roughly speaking, were supposed to be *Residents*, and then passing to the undoubted *Migrants*—the names of which were included or omitted according to the season. To these succeed three wider columns, wherein are written at full length as occasion requires, the names of birds seen the appearance of which is not sufficiently constant to justify the devotion of a column to them, as well as of downright stragglers; and also such other memoranda as seem worthy of note—the flowering of

certain plants, the appearance of some insects, and so forth. The last column shows the moon's age; this was introduced on the possibility of the movements of migrants and stray birds being thereby influenced. We continued this practice to the last; but I do not think any result followed therefrom, except a record of alternate moonshine and obscurity. The whole book is about eleven inches in height by about fourteen in breadth, or double the latter when open.

This being the general principle or scheme of the "Register," the code or system of symbols used to fill it up requires explanation. That the system is perfect I have not an intention of asserting—indeed if I were to begin a new "Register" it is probable that I should introduce some modifications, but they would, I think, be but slight. Still it would give me pleasure to hear further improvements suggested, only it may perhaps be borne in mind that the code used has worn well for a space of more than ten years, and such might not be the case with a new one, or with one much altered. It is obvious that the chief recommendation of such a code should be its capability of expressing various meanings, especially in combination, and its freedom from complication—in other words its variability united with simplicity. Our idea at the outset was to think nothing wonderful till we had found it to be so. The first symbol we therefore used signifies that the species under whose name it stands appeared (according to our previous knowledge) "*as usual*," this symbol is a plain cross, ×. Starting from this, when the species appeared "*less abundantly than usual*," one half of the cross is omitted, and the symbol is a simple sloping line, /; but on the other hand when the species appeared "*more abundantly than usual*," a horizontal line is added to the cross, ✳; and if a yet "*still greater abundance*" was noticed, a vertical line was superadded until the symbol had the look of a star of eight points, ✳. When the number of individuals seen admitted of being counted, the Arabic numerals were inserted in the column, 2, 5, 13, and so on; but for clearness' sake—to prevent the possibility of confusion between the numeral 1 and the half-cross (/) already mentioned—the number "*one*" is represented by a dot, •. At times too, when it seems expedient, the well-known symbols ♂ and ♀, originally astronomical and representing the planets Mars and Venus, are used to

denote the sex of the species observed; and very significant is such an entry as ♀ 3♂ under the heading of "Nightingale" or "Wheatear," recording the arrival (a few days, generally, after the male) of the female of the migrant species, an entry sure to be followed ere long by *p*, 2*p*, 3*p*, *pp*, and finally *ppp*; shewing that "*a pair*," "*two pairs*," "*three pairs*," "*several pairs*," and the "*usual number of paired birds*," had been seen on that day—for while 2*p* and 3*p* respectively denote two and three pairs, *pp* signify several pairs and *ppp* the usual number of pairs. But the mention of this symbol (which, variously combined, makes so great a show in the "Register" for the months of April, May, and June) should, perhaps, have been preceded by the notice of another. I have already referred to our wish of determining the date at which the song of a species commenced. Others, I believe, have kept a record of facts of this kind; but it seemed equally desirable to know how long the song lasted. For these two purposes whenever a bird was heard to sing a dash or short horizontal line — is placed above the symbol (whatever it may be) indicating the mere appearance of the species. If two birds were heard singing, two dashes = are so placed; if three, three dashes ≡; if four, four ≣; if five, five—the fifth being marked across the others ≣, and so on. But, as it was not always convenient to number precisely the musical performers, a single dash with a mark ⊀ across it indicates that several birds of the species were singing, and two dashes with a like cross mark ⋕ signify that the act of singing had become general.

On the same principle as the pairing of birds is shown, so also is their flocking together or associating in family parties—which last seems to be initiatory to the first; the letter *f* being here used as the letter *p* was in the former case, with this addition, however, that when the number of birds in the flock was counted, it is expressed by a numeral *after* the letter:—thus *f*15 notifies the observation of a "*flock of fifteen;*" but 2*f* means "*two flocks*," *ff* "*several flocks*," and *fff* "*many flocks.*"

These comprehend, I believe, the whole of the symbols we used; and I cannot think they will be deemed too numerous, or too complicated. Should the method appear otherwise on first acquaintance, I believe the difficulty will be speedily found to vanish in practice, though I will admit that the inventor of a system of

notation is perhaps not the best judge of the ease with which others may acquire it. However, I know that, by means of this method, the results of a day's observations of many species may be recorded in *less than five minutes*—perhaps in less than half of that time—and that this fact cannot fail to be regarded as a great advantage; for all must have known the discomfort of writing a journal when tired and longing for one's bed, and a tendency, if I may use the word, to "scamp" the work when a "marvellous exposition of sleep" begins to be felt. One more feature of this "Register" need, I think, only be here dwelt upon, and that is, that for the better and more conveniently marking off the different weeks, the Sunday entries are always written in red ink.

Now, as to the use of this "Register." I have just stated the result of my experience, over more than ten years, as to the comparatively little trouble it took to keep, and accordingly, I have only to shew that advantages sufficient to correspond were derived from it; yet I can safely declare, that they were out of all proportion to the time and labour bestowed by my brother and myself. There is no need for me to urge here the value of obtaining a habit of close, constant and accurate observation; but how much this habit must have been fostered by our 'Register,' may be easily imagined, when it is considered that every evening our conscience was not satisfied unless we could give a satisfactory account of each bird seen or heard during the day. It follows that we were thereby compelled never to neglect the feeblest call-note, the whirr of a wing, or the flirt of a tail. I do not mean to say that every bird seen or heard was determined and "booked"—for of course, in spite of every care, the contrary would happen; but I can honestly assert, that the cases in which the species was not identified, were extremely few in number; and great indeed was the benefit of the practice to us, as ensuring continuously our careful attention, as forcing us to take notice of everything that caught our ears or eyes, and as thereby making us become acquainted with innumerable peculiarities of the feathered tribes that are neglected by most men—even by those who are far from being inattentive observers. However good an outdoor ornithologist any man may be, let him adopt the plan here described, and he will become a better one. But the uses of our "Register" have not merely been personal—had such been the case I should not have troubled the

Society with this account of it; but I will give *two* instances of information acquired by its means which was entirely unexpected.

The very first autumn we tried the plan, (that of 1849,) we found, to our great surprise, that the Song-Thrush, after being unusually abundant in September and the beginning of October, about the middle of that month began to grow scarce, until, by the end of November, hardly one was left; and so passed on some ten weeks, when, at the end of January or beginning of February, the species reappeared. Succeeding years confirmed the observation and I was finally enabled to announce (*Ibis*, 1860, pp. 83,85) the unlooked-for fact that with us the Song-Thrush was one of the most regular migrants among birds—a fact which although well known on the continent, had been neglected by almost every English historian of the species. We found the most convenient way of counting the individual Thrushes we saw to be by transferring from one coat pocket to another a common gun-wadding. As shooting-coats have usually many pockets, the process was not difficult; and it was even possible to appropriate a pocket to each of the three species we wished to number. It will of course be understood that the same bird might be counted over again—but for the sake of comparison—one week with another, this did not signify.

Another fact—small, perhaps, but extremely suggestive, which I believe has never been publicly mentioned—we were also enabled by our "Register" to ascertain; and, like the last, it relates to one of the commonest and most familiar of birds. At the setting-in of a sharp frost it is to be noticed—as no doubt it has been noticed before—that the Redbreast suddenly becomes much more abundant in the neighbourhood of houses and gardens. But from repeated observations we found, what I think has not been remarked, that this abundance is caused by the birds, which commonly frequent plantations, hedgerows, and other places at a distance from human habitations, pressing toward the homesteads. The domestic birds remain in their usual haunts; but, if the cold continues, the strangers seem to migrate further—at all events they disappear; yet a few days' thaw will bring them back, Now, here, I think, we have what we may call the "premonitory symptoms" of a regular migration, and further investigation by the

same means and in the same direction would very possibly clear up that mystery of ornithological mysteries.

I could add some other instances of information being obtained by our "Register," were I not fearful of extending this paper to an unreasonable length. I must just return, as I promised I would, to the meteorological observations which I said we entered side by side with those relating to birds. Since our "Register" was discontinued, neither my brother nor I have ever had time to go through it with the object of digesting such information as it contains, and bringing out the results in a more compressed form; but I am constrained to say that our expectations, that the one set of observations would throw any great light on the other, has not been fulfilled. Beyond the case of the Redbreast just mentioned, and a few similar ones, it would seem that birds, though governed entirely in all their movements by the seasons as they roll, are singularly independent of the ordinary and sudden changes of the weather. Such changes do not appear in any great measure to affect them; and, this being the case, it is not surprising that such changes they do not seem to be able to forecast. However it may be elsewhere, at Elveden (where our "Register" was kept) there was no bird we could regard as a weather-prophet—not even the Green Woodpecker, to whose "warnings" so much credit is popularly given. Nor again, was the advent of casual stragglers ordinarily to be correlated with the occurrence of heavy gales of wind; but, when the distance from the sea-coast of the scene of our observations is considered, this will appear the less singular, for there can be little doubt that tempestuous weather is the chief cause which impels so many strange birds to our shores. Such birds, however, once driven inland may often contrive to maintain themselves for some days, or even weeks, and, occasionally, may wander still further from place to place, so that, when they are at length noticed by naturalists, it is impossible to connect their appearance with any particular storm. Though I am far from saying that meteorological observations should be omitted from any ornithological "Register" that may be kept, I think it is only in the neighbourhood of the sea-coast that the events recorded by such will be found to influence materially the habits of birds.

We daily entered our observations of every species of bird

which occurred in our neighbourhood, excepting only five—the House-Sparrow, Pheasant, Grey and Red-legged Partridges, and Moor-hen. None of these we thought likely to furnish any results that would be useful; for had columns been devoted to them, there would have been little variety in the entries throughout the year.

All these species also, with us at least, lived so much in dependence on man, that they could scarcely be regarded as free agents. But respecting every other species, the record was always kept as minutely as was expedient or possible. Should our "Register" be in existence an hundred or even only fifty years hence, we cannot but think the inspection of it would prove interesting to any naturalist living at or near the place where it was kept, and could other "Registers" on the same or a similar plan be established in other parts of the country, there can hardly be a doubt that some curious and unexpected facts would be revealed from a comparison of the observations.

*** The accompanying lithographs shew (nearly in *fac-simile*) two pages of the Register above-described as a specimen, and the next two pages are a copy of the Summary of the same, such as was drawn up at the end of the month. It is not thought necessary to insert a copy of the Annual Summary, made at the close of the year.

1851 – MAY

Moon: N. 1. 9h. 2' A.M. F. 15. 8h. 54' A.M. N. 30. 8h. 47' P.M.

Date	Night Max. (Shade)	Night Min. (Shade)	Day Max. (Shade)	Day Min. (Shade)	Sun Max.	Barometer 10 A.M.	Barometer 10 P.M.	Wind	Rain	Weather	Remarks	Moon's Age
1		29	52.8		75		29.43	SW	.1	Bright night and day with occ. showers	Accipiter fringillarius – EN – * On Lakenheath Warren, a pair killed besides. Salicaria phragmitis – * Hockwold.	●
2	40.8	28.7	50.5	38.4	88.7	29.42	29.56	WNW	} .17	Bright night & day shower 5 P.M. [P.M. Thunder & SW 1 P.M.	Alcedo ispida & nest (Barnham) E.N. – † By G. White of Barnham. * Barnham – P. Alauda arborea, (Brandon) –	1
3	41.9	28.7	45.2	37	52	29.53	29.5	NNW		Dull night – rain from 10.30 till 12 P.M. showery	Ardea cinerea – EN –	2
4	37	29.3	44.4	33.5		29.44	29.46	N	0	Bright night & day – showers about –		3
5	36	29.8	44.2	34.5	58	29.39	29.41	NW	} .16	Showery night & day – occasional storm	3. P. Gallinago scolopacinus & young (Barnham) – EN – * On Lakenheath Warren –	4
6	41	36.8	44.8	39.2	60	29.49	29.50	WNW		Showery night & day – windy –	Crab flowers –	5
7	44	32.8	54.5	44.8	70.2	29.58	29.56	SW	0	Dull night and day – no wind –	Sycamore – flowers –	6
8	47.7	36.8	55.8	48	68.3	29.52	29.45	S	0	Bright night – A.M. dull P.M. windy.	Falco tinnunculus – Salicaria Phragmitis – EN. * On Wangford Warren –	◐
9	48.7	33.5	60	48	73.5	29.44	29.5	SE	0	Bright night & day – windy –	Falco tinnunculus – Salicaria Phragmitis. (Wangford) EN. Oak leafes –	8
10	52.5	39.4	61.2	52	74.3	29.45	29.46	ESE	0	Bright night & day – windy –	* At Thetford – Ash leafes –	9
11	53	42.6	61	52	98.5	29.49	29.56	SSE	0	Foggy night – bright day –	P. Syrnium aluco & young – Alauda arborea. 5 Gallinago scolopacinus – (Barnham) EN	10
12	50.9	44.5	51	44.2	—	29.65	29.87	E	0	Foggy night – cloudy day –	Syrnium aluco – Alauda arborea – Fulica atra (Ringmere Elvetham) EN.	11
13	48.9	35.8	57.2	37.8	76.2	29.96	30.03	NE	0	Cloudy night – bright day –	P. Falco tinnunculus & nest. P. Pica caudata (Icklingham heath) Strix flammea, Alauda arborea – EN.	12
14	48	32.1	50.5	36.7	75.6	30.05	30.03	E	0	Bright night & day –	4. P. Anas boschas – (Culford) EN. * One at the N. wood (Culford), one at Cavenham. Lanius collurio Hockwold. J. Madden	13
15	46.8	31	55		87	29.95	29.84	ENE	0	White frost in the night. bright day.	P. Falco tinnunculus. Salicaria Phragmitis – (Hockwold.) * Wangford Warren EN – Podiceps minor EN.	○
16		31	57.8		87.6	29.77	29.72	SW	0	Dull night – bright day –	Swift. P. Corvus corax – (Lakenheath) – * Wangford Warren – EN – Horse chestnut,	15
17	48	41.3	58.2	48.5	66	29.68	29.65	SW	} .2	Dull night – cloudy day – with occ. slight showers	4. Syrnium aluco – EN – * At Thetford. Mallards turn brown –	16
18	55	44.6	56	44.2	}	29.58	29.56	W		Dull night & day rain at 5 P.M.		17
19	44	37.9	50.3		} 83.5	29.52		NW	.23	Bright night. bright day. with thunder storms, hail and rain – high wind	Tringa variabilis – (Thetford Warren) EN. * Wangford Warren –	18
20		34.4	50		}		29.92	WNW	0	Bright night & day – occ. cloudy windy	Syrnium aluco Picus major – EN. 7 Numenius arquata – EN –	19
21	57.2	43.4	57.2	51.5	75	29.88	29.93	SW	0	Dull night & day –		20
22	51	43.8	66	50.3	89.5	29.93	29.93	W	0	Bright night & till 11 A.M. cloudy after	Syrnium aluco & Motacilla flaveola. & Fulica atra * at Thetford (Ring Mere, E Wretham) EN.	21
23	55.5	43	56.8	47.3	85	29.94	29.99	WNW	0	Bright night, dull A.M. bright P.M.	Alauda arborea – Pica caudata (Icklingham) EN –	◑
24	51	32.3	56.8	51	88.2	30.01	29.95	WNW	0	Bright night and day.	Syrnium aluco – Curruca hortensis – EN. * On Thetford Warren. Lilac &	23
25	60	47.5	63.7	49.8	74.2	29.81	29.63	WNW	.17	Dull night. showery day cloudy –	Curruca hortensis – EN. Laburnum & White thorn	24
26	49.8	38.2	54.5	45.3	74.6	29.61	29.73	NW	.02	Bright night & day. slight showers – windy	3 Syrnium aluco – Accipiter fringillarius – EN. * On Thetford Warren – flower	25
27	47	34.3	55.8	48.7	73.4	29.77	29.83	N	0	Bright night & A.M. dull P.M. –	Syrnium aluco. EN. * One at Thetford, & one at Shadwell. Jacobaea Moth appears.	26
28	50.8	40.2	55		57		29.95	NW	0	Dull night & day.	Podiceps minor – EN. * On Thetford Warren – † at Brandon.	27
29		40	54		95	30.02		N	0	Bright night & day –	Ever green Oak loses its leaves	28
30		48	54		88	30.08	30.15	N	0	Dull night, cloudy day.	Syrnium aluco – Curruca hortensis EN. (Hockwold) – Holly flowers –	●
31	52	42.5	59.2	44.2	83	30.13	30.14	NNE	0	Bright night and day –	3 Syrnium aluco – Budytes flavola – EN –	0

Bird columns: Missel Thrush, Song Thrush, Blackbird, Hedge Sparrow, Redbreast, Stonechat, Golden-crested Wren, Great Titmouse, Blue Titmouse, Coal Titmouse, Long-tailed Titmouse, Red Wagtail, Meadow Pipit, Sky Lark, Great Bunting, Yellow Bunting, Chaffinch, Greenfinch, Goldfinch, Lesser Redpoll, Linnet, Bullfinch, Starling, Rook, Jackdaw, Green Woodpecker, Nuthatch, Wren, Tree Creeper, Ring Dove, Stock Dove, Fieldfare, Redstart, Wheatear, Whinchat, Nightingale, Blackcap, Greater Whitethroat, Lesser Whitethroat, Wood Warbler, Willow Warbler, Chiffchaff, Tree Pipit, Wryneck, Cuckoo, Swallow, Sand Martin, Stone Curlew, Dotterel, Ringed Plover, Lapwing, Turtle Dove, Martin, Spotted Flycatcher, Nightjar, Swift.


BRITISH
NATURAL HISTORY.

SUMMARY.

"*1851. June 2nd.*

"The following is the Summary of the Register of the weather for the past month :—

Thermometer.							Rain Total.
Shade.				Sun.	Barometer.		
Night.		Day.					
Max.	Min.	Max.	Min.	Max.	Max.	Min.	
60	28.7	66	33.5	98.5	30.15	29.39	1.05

"The greatest rise of the Barometer in twenty-four hours took place between 10 P.M. on the 11th and 10 P.M. on the 12th, when the mercury rose from 29.56 to 29.87, being .31 inch ; the greatest fall between 10 P.M. on the 24th and the same time on the 25th, when the mercury fell from 29.95 to 29.63, being .32 inch. The prevailing winds were :—on the 1st, SW. ; from the 2nd to 15th, Northerly and Easterly ; then Southerly and Westerly until the 18th ; and Northerly and Westerly till the end of the month. It rained on 10 days ; and the Thermometer was 7 times below the freezing point.

"The following is the result of the Register as regards the appearance of the three resident species of Thrush from the 2nd to the 8th inclusive :—

	No. of days on which each was seen.	Greatest No.	Least No.	Average No.	Total No. seen from 2nd to 8th.
		Seen in a day.			
Misseltoe-Thrush	7	26	5	12.85	90
Song-Thrush ...	7	34	6	19.42	136
Blackbird ...	7	28	8	17.28	121

After the 8th the usual number of each was seen daily.

"The following Table shews the result as regards the Singing of Birds during the past month :—

	Began to sing.	No. of days heard.	No. of days on which the singing was general.		Began to sing.	No. of days heard.	No. of days on which the singing was general.
Misseltoe-Thrush ...	SeeApr	21	21	Wren	See Apr	16	7
Song-Thrush ...	do.	30	30	Ring-Dove ...	do.	14	11
Blackbird ...	do.	30	30	Redstart	do.	3	0
Hedge-Sparrow ...	do.	17	8	Whcatear ...	do.	15	15
Redbreast ...	do.	30	30	Nightingale ...	do.	25	10
Golden-crested Wren	do.	13	5	Blackcap ...	do.	30	30
Great Titmouse ...	do.	12	2	Garden-Warbler ...	30th.	1	0
Blue Titmouse ...	do.	15	10	Greater Whitethroat	2nd.	3	0
Coal Titmouse ...	do.	8	2	Lesser Whitethroat	See Apr	10	4
Long-tailed Titmouse	do.	4	0	Wood-Wren ...	do.	6	0
Meadow-Pipit ...	do.	11	10	Willow-Wren ...	do.	30	30
Sky-Lark ...	do.	29	29	Chiffchaff ...	do.	28	6
Wood-Lark ...	do.	3	0	Tree-Pipit ...	do.	1	0
Great Bunting ...	do.	8	7	Wryneck ...	do.	16	2
Yellow Bunting ...	do.	29	29	Cuckow	do.	20	9
Chaffinch ...	do.	30	30	Swallow	do.	11	8
Greenfinch ...	do.	28	28	Martin	23rd.	1	0
Goldfinch ...	do.	16	4	Sand-Martin ...	See Apr	9	8
Lesser Redpoll ...	do.	10	4	Nightjar	12th.	4	0
Linnet	do.	2	0	Turtle-Dove ...	1st.	13	3
Starling	do.	30	30	Stone-Curlew ...	See Apr	8	3
Green Woodpecker	do.	5	0	Ringed Plover ...	do.	14	13
Nuthatch ...	do.	8	1	Lapwing	do.	16	11

"Arrivals of Birds of Passage during the past month :—

Turtle Dove ...	1st.	Martin ...	3rd.	Spotted Flycatcher	11th.	Nightjar ...	12th.

"The same birds, whose regularity of appearance was noted for the month of April, have been seen regularly during May, with the exception of the Great, Blue, Coal, and Long-tailed Titmouse, the Green Woodpecker, Nuthatch, and Wren, and the addition of the Meadow-Pipit and Stock-Dove, and, since their arrival, the Spotted Flycatcher and Martin.

"A female Dunlin in summer plumage was shot by myself on the 19th, on Thetford Warren ; a female Greater Spotted Woodpecker was caught in a trap baited with an egg, and set for the purpose of catching a Jay, on the 20th : from the appearance of its breast, it had evidently been sitting. On the same day I saw seven Curlews *(Numenius arguata)* flying within gun-shot of the ground, and towards Elden Warren. On the 24th I found a nest of the Garden Warbler with four fresh eggs.—E.N."

III.

A NATURAL HISTORY TOUR IN SPAIN AND ALGERIA.*

By J. H. Gurney, Jun., F.Z.S.

Read 27th September, 1870.

I left Bayonne for the Spanish frontier on the 25th of December, 1869, little suspecting that five days would elapse before I got to Madrid. As the train passed the pretty watering-place of Biarritz, which lies in a district full of interest, not only as the haunt of the stately Griffon, but as being the very ground which witnessed some of Wellington's greatest battles, (in 1813,) I obtained a fine view of the Bay of Biscay. I was disappointed in seeing no eagles in the Pyrenees, but the spectacle of these grand mountains, wrapped in snow, was surpassingly beautiful. We had the greatest difficulty in proceeding, and at Sumaraga the train came to a standstill, four engines being powerless to move her. After passing twenty-four hours at a village inn the train again started, and, after many stoppages, arrived at Alsasua, where we slept in the wagons.

It was not until the 29th that I reached the capital of Spain. In the game markets, (at Madrid,) which I made a point of visiting, I obtained the pintailed and black-breasted sandgrouse, (*Pterocles alchata*, *P. arenarius*.) crested and calandra larks, (*Galerida cristata*, *Melanocorypha calandra*.) and saw many little bustards, (*Otis tetrax*,) as also the following species:—little owl, (*Athene noctua*,) bean-goose, (*Anser segetum*,) water-rail, (*Rallus aquaticus*,) thickknee, (*Œdicnemus crepitans*,) green sandpiper,

* I am indebted to my father for assistance in the identification of species.

(*Totanus ochropus*,) corn bunting, (*Emberiza miliaria*,) partridge, (*Perdix cinerea.*) This last struck me as being very oddly speckled. But by far the most characteristic bird of Madrid is the red-legged partridge, (*Perdix rubra*,) which assumes a brilliancy it never gets in England, and is much more in request than the tasteless sandgrouse. There is a very remarkable melanism of this species in the museum of the Royal Academy. Two specimens very similar to it are in the museum at Paris, labelled as having been "bought in the market in December, 1859." Perhaps it is a race like that variety of the common partridge which has been termed *Perdix montana.* I was not a little surprised to find in the magnificent galleries at Madrid some pictures devoted to ornithology. Many interesting species were delineated, but without much pretension to scientific accuracy. Between the Spanish capital and Cadiz, I saw a grey shrike and many large hawks, at too great a distance for identification. Between Cadiz and Gibraltar, I saw a skua, (*Stercorarius catarrhactes.*) This bold bird was swimming about a gunshot from the vessel.

Gibraltar is rather a good place for birds. It has been surmised that many migratory species take advantage of its proximity to the African coast, and no shooting is ever allowed on the rock. The great tameness of the gulls in the harbour (*Larus ridibundus* and *L. marinus?*) arises solely from their never being molested. From O'Hara's tower I obtained a view of a pair of Bonelli's eagles, (*Aquila bonelli.*) One of these magnificent birds perched on a rock among the brakes, etc., at no very great distance. It exhibited a singular patch of white upon the back. They prey upon the rabbits which abound. That handsome species, the blue thrush, (*Petrocincla cyanea*,) is common on the upper parts of the rock. Its flight and manner reminded me of our ring ouzel, (*Turdus torquatus.*) At a distance it looks rather black than blue, unless the sun happens to shine upon it. It is not easy to get near this shy and solitary bird.

The gay but common Tithy's redstart, (*Ruticilla tithys*,) is much tamer. I saw more males than females. As young males as well have the grey plumage for at least one year, I could not account for it. One of the most attractive birds on the rock is the black wheatear, (*Dromolea leucura.*) It abounds. Here are the winter quarters of some of our common English summer migrants.

Countless willow wrens (*Sylvia trochilus*) enjoy Gibraltar's sunny climate, wintering among the cactus plants; and I often heard the Sardinian warbler's (*Sylvia melanocephala*) bantering note, and detected the black head of this lively bird clinging to a cactus stem. In fact, these hardy warblers enliven every hedgerow. In several I noticed a brown spot in the region of the chin, which I at first thought was a stain from contact with the red flowers of the cactus, but which Major Irby informs me is really caused by the berries of the pepper tree. With the Sardinian warblers were many blackcaps, to which they bear a general resemblance, as also to the orphean warbler, (*Sylvia orphea*,) and I observed the same peculiar spot on some of these. On the rough stony ground I saw the white wagtail, (*Motacilla alba*,) and the crested lark, (*Galerida cristata*,) and at the rock's summit that rare bird, the Alpine Accentor, (*Accentor alpinus*,) and several crag martins, (*Cotyle rupestris*,) the most stay-at-home of all the hirundines. The Accentor, when first noticed, was on the outside of the signal station, clinging within a few feet of me to the masonry. It was perfectly tame. I observed Kentish plovers, (*Charadrius cantianus*,) in troops of ten or twenty, scampering nimbly along the sandy isthmus which separates the rock from the mainland. A dog disturbed a small covey of Barbary partridges (*Perdix petrosa*) near the old Moorish tower, and I saw with surprise that on the wing this species far more nearly resembles the grey (*Perdix cinera*) than the red leg (*Perdix rufa*.)

On the 23rd I left for Oran in a French packet, which was to touch at Malaga. I noted a dark Lestris-looking bird among some gulls, and many a restless flock of what I supposed to be the Manx shearwater, but I did not on that voyage see any storm petrels, or Cinereous shearwaters, (*Puffinus cinereus*.)

To a person setting foot on a new continent for the first time, everything seems novel, and when at length on the 25th of January, 1870, I disembarked at Oran, capital of that province, my expectations were at a high pitch. I took the first steamer to Algiers, as travelling by land is expensive and slow. Ten days passed rapidly with me at that town. In the morning I generally went out with my gun, and among other birds I was fortunate enough to shoot a hooded shrike, (*Telephonus Ischagra*.) In the vegetable and poultry market I saw a concourse of birds. It

was melancholy to see the strings of robins, thrushes, stonechats, titlarks, willow wrens, sparrows, blackcaps, starlings, wrens, skylarks, and blackbirds.

Before commencing my journey into the Sahara, I visited one or two other towns in *the Tell*,* viz., Blida, Bouffarik, Miliana. The mountains of the Atlas raise their snow-capped summits behind Blida, forming the southern boundary of the valley of the Metidja. Bouffarik is merely a village. Miliana is a fortified town on the slope of Mount Zakkar, overlooking a level plain, watered by the river Chelif.

At these places I got the dipper, (*Cinclus aquaticus*,) mentioned by Loche as very rare, (Exploration se. oiseaux, 1, p. 306,) and many other interesting birds, such as Cettis' warbler, (*Potamodus cettii*, *Marm.*,) the Spanish sparrow, (*Passer salicaria*,) the dusky ixos, (*Ixos obscurus*,) the lesser spotted woodpecker, (*Picus minor*, *P. ledoucii*, *Malh.*,) the meadow bunting, (*Emberiza cia*,) and Moussier's redstart, (*Ruticilla moussieri.*)

After a month spent in this way, I finally started for the interior. I need not describe Boghari, the first halting-place; it is an Arab village, but very poorly represents what I afterwards saw in the Mzab country.

The first *caravanserai*, properly so called, and the best, is Bougzoul. It is in the Hauts Plateaux. [A *caravanserai* is a white one-storied fortified house, enclosing a large court-yard, with chambers all round for the accomodation of travellers, and stabling for several horses. The *Hauts Plateaux*, or *Steppes*, are interchangeable terms for the northern portion of the Little Desert, (or Algerian Sahara,) which commences where *the Tell* ends, and terminates at Waregla.]

Though but twelve miles distant from the mountains, the water at Bougzoul is nearly unfit for drinking. The guide book correctly states it to be "*rare*, *salée*, *amère*, *chaude*," four emphatic adjectives which apply only too truly. I suppose it comes by some means from the neighbouring marsh, where the phenomenon of mirage may be seen every day. I believe Dr. Tristram found a profusion of waterfowl at this marsh. When I was there it was nearly dry. The sandgrouse and the desert wheatear had sup-

* Dr. Tristram defines *the Tell* as "the corn-growing country from the coast to the Atlas." (Ibis. 1, p. 277.)

planted the waders, and only the delusive mirage, before mentioned, floated over the hard mud. I saw, however, what I believe to have been three Flamingoes, and was assured by many persons that they are frequently found dead here under the newly-constructed telegraph-wire, as well as *Ganga* (sandgrouse) and other birds.

I found Ain Oussera, which was the second stage, a very sterile lonely place. A muddy stream winds its tardy course before the entrance of the caravanserai, and some attempts had been made to cultivate the stony soil. Elsewhere, far as the eye can reach, nought but a scanty herbage clothes the plain,—a coarse kind of grass, to the height of two or three feet, (different from what grows in the weds,) forming a bleak retreat for the desert wheatear, the dotterel, and the tawny pipit. *Sans* a camel, *sans* a trace of cultivation, the eye finds no relief. As the setting sun sheds a yellow glare over the treeless plain, and the shadows lengthen, one may speculate on the not distant period when troops of lawless Bedouins roamed over the desert. The Barbary states are now at peace, from the palm-shaded oases of Tripoli to the bazaars and gardens of Moorish Tangiers, and the Nomad is brought into contact with the products of European civilization.

I collected specimens of two rare larks here,—*Galerida macrorynchа*, (Trist.,) and *Calendrella reboudia*, (Loche,) and of the desert wheatear, (*Saxicola deserti*,) which had not previously been observed so far north, also some calandras and common dotterels, (*Charadrius morinellus*,) and the first hoopoe of the season; but I was not so fortunate as to get the cream-coloured courser's eggs, (*Cursorius gallicus*,) which were here obtained for the first time by Dr. Tristram in 1856, having been previously unknown to science.

Guelt et Stel another caravanserai, is situate in a pass near the seven mamelons, (which were just visible from Ain Oussera.) It is nearly fifty miles from Boghari, and partakes more of mountain than of the desert; here I obtained several birds not in the Sahara catalogue, such as the ring ouzel, ultramarine tit, linnet, serin, goldfinch, Algerian chaffinch and greenfinch, which last was quite common. The water here was totally unfit for drinking.

At Rocher de Sel the soil becomes more sandy; a frost-like whiteness coats the plain; but after passing the salt mountains,

(from which the caravanserai takes its name,) the country assumes a more Tell-like appearance—becoming fertile and woody. These remarkable mountains are well worth a visit; seen at a little distance they present a blue appearance, but it is not difficult to find large pieces of salt of the purest white, and quite fit for the table. They have the additional recommendation of being the home of the kestrel, the raven, the neophron, the kite (*Milvus ater?*) and of other birds; I counted thirteen or fourteen kestrels in the air at one time, and observed that they took their insect prey upon the wing.

After this the road mends; lately built houses, an orchard of almond trees just coming into bloom, and other symptoms of civilization are noted; and, in process of time, our "voiture," if that miserable contrivance for jolting passengers deserves the name, passed the eighth halting-place and arrived at Laghouat.

Laghouat or El Aghouat, according as we prefix the French or Arab article, is the last French out-post; rendered pretty by the number of tall palms, it is in fact the first oasis in the Sahara, while to the north stretch plains as far as Djelpha. Rocky mountain ridges protect it from the wind, which frequently blows the sand in overwhelming clouds. Nearly all the houses are white, flat-roofed, and made of mud bricks. The same materials partition off the Arab gardens. The coach or *courier* arrives about 5.30 p.m., just when the last "red rays" of the setting sun are shedding "a golden pathway" through the forest of stately palms. These matchless trees encompass the town to the number of 20,000, and form a noble belt of verdure, beneath which the vine, the fig, the pomegranate, the olive, the peach, the apricot interlace their foliage, mingling in rank confusion. There is nothing picturesque about the Arabs at Laghouat. The French have improved away the old stock, and the present people are their degenerate descendants. Not so the wild tribes of the true desert, who still cherish a jealous hatred towards that people against whom their hardy fathers swore eternal enmity.

The beautiful desert bullfinch (*Carpodacus githagineus*) was common at Laghouat. Its resorts are gravelly *steppes* and rocky ground destitute of trees. Its trumpet note is one of the marvels of Algeria. The only other birds which I shall notice are the fantail and aquatic warbler, (*Cisticola shœnicola* and *Calamodus*

aquaticus,) which perch upon the reeds, and the *Ammomanes isabellina*. This inconspicuous bird is met with on hill sides and bare stony plains. In its habits it assimilates to the chats, except that it runs more.

Gazelles and jerboas abound, and in the small half-dry marsh there are a good many water tortoises. The ant of the desert digs a curious structure, and perhaps there is not such another place in the world for coleoptera. Beetles of every size and shape swarm. The chameleon is also found, and the deadly viper à corne would be common if not rigorously kept down. Large lizards were often brought to me; one was upwards of three feet long.

On the 9th of April, having engaged Mohammed Belhuri and another Arab, with mules, a camel to carry the luggage, and all the necessaries for an expedition into the Mzab country, I quitted the little hotel at Laghouat. Mohammed had called me early, and we were "en route" by 10 a.m. We had guns and pistols, for the Mzab are sons of desert chieftains, and no Frenchman would think of travelling unarmed among them. The embers of the late rebellion still smoulder. As we rode along I shot my first Bifasiated lark (*Certhilauda desertorum*.) Dr. Tristram truly remarks of this species, "that although its uniform of inconspicuous drab renders it most difficult of detection on the ground, the moment it extends its wings, the broad black bar across the snow-white secondaries attracts the eye, and renders it an easy mark:" (*Ibis* i, p. 428.)

By sunset we had reached some clumps of trees—jujubes, terebinths, olive, &c.; all the large ones had raven's nests, and I may here remark that the ravens of Algeria appear to be much smaller than English ones. They moreover breed in society, but this Professor Newton informs me they always do where they are sufficiently numerous. Our camel took fright at the assemblage of ravens, and utterly deserted us with all the baggage, and we passed the night in our thin burnouses on the ground. Mohammed was well nigh distracted when next morning there was no sign of the missing beast. We got breakfast, of which I stood much in need, at some Arab tents. It consisted of dry dates, "*couscous*," and sheep's milk. *Couscous* is a kind of broth mixed with half-ground barley, and one of its ingredients is often camels' grease.

The rest of the day was spent in vainly searching for the lost camel; at night we were again the guests of the hospitable Arabs. I noticed several pairs of bushchats (*Saxicola philophthanma*) which, from being unmolested, had learnt to hop among the Arab tents, feeding upon what they found among the small stones, etc.

Next morning, to add to our misfortune, the mules had departed. The intolerable stupidity of the Arabs, in not tying their beasts, is beyond belief. When at length the mules were recovered, the wind was so strong we could hardly mount them. We now began to pass through a vast plain, slightly undulating, interspersed with dayats, each a mile, or half-a-mile apart. I saw many birds which I did not know, but we could not stop after them. I shot one small bird not unlike a white-throat, which, I have no doubt, was a spectacled warbler (*Sylvia conspicillata.*) I have the following note of it in my pocket-book—"Spectacled warbler, with the spectacle faint, and a blush of pink on the breast—eye the colour of a white-throat's." Nearly every terebinth, of any size, carried several nests, and the smaller trees were occupied in like proportion. I may here give Dr. Tristram's definition of a *dayat*. "An unimprovable oasis, in which there is no constant supply of water to be found at any depth." About noon we came to water; it was dirty, but drinkable: a gazelle quitted it as we approached. We often saw these graceful animals, but they were very wild. As we rode along, the desert-horned lark (*Otocorys bilopha*) ran before us like a little plover. Two birds, which I do not doubt were cream-coloured coursers, (*Cursorius isabellinus*,) flew before our mules, and I twice saw, what (unless I am greatly mistaken) was a benighted wryneck, (*Yunx torquilla*,) crouching upon the arid plain.

That night we were forced to sleep out again in the open air. The Arabs kindled a fire, but it was bitterly cold. The wind had got up during the day, and I had only a thin burnous, (for my wraps were on the camel.) At 9 p.m. it rained in torrents—of course our fire was speedily extinguished. The wind now howled over the Sahara. Vivid lightning shot across the sky, accompanied by loud peals of thunder. In vain we shifted to the other side of the bush. Everything was a complete sop. We were in the saddle again before daybreak, but my wet burnous hung on me like a dead weight. Some enormous griffon vultures were

observing us at a little distance, but my hands were so benumbed, that I could hardly hold the bridle, much less load my gun. The heavy rains of the preceding night seemed to have converted the Sahara into mud.

I kept a sharp look-out for ostriches, but had never the good fortune to see one. From what the Arabs said, I gather that many an ancient haunt of this noble species knows it no longer. Its impending extinction typifies the decay of the nomad. Step by step the hunters will drive it backwards. In process of time, its existence will be a matter of tradition—its appearance, its very name, will be forgotten. Like every other brevipennate bird, it must one day succumb to the march of civilization.

At length the wished-for landmark of the Mozabite town of Berryan hove in sight. A carpet was quickly spread for us in an unoccupied house, and the chief, with about thirty other Arabs, squatted in a circle. While Mohammed detailed our adventures, I produced the credentials, which had been furnished by the *Commandant superieur* at Laghouat, and which were afterwards of the greatest possible service to us. It was a two-storied court where we were located, but all the Arab houses are built on the same plan, viz.:—open on the inner side, with a ladder or staircase leading to the roof, which is flat and strong enough to walk upon. They are all full of draughty crevices. In the rafters of the establishment I observed a pair of house buntings (*Fringillaria saharæ.*) The Arab masons leave plenty of eligible chinks for them to nest in.

I must attempt some description of Berryan. The town is surrounded by a mud-brick wall, with a good many small towers, some of which I ascended. The fencework upon this wall serves as a favourite perch for the pallid shrike, (*Lanius dealbatus*), which with difficulty keeps its balance, its tail swaying with every gust of wind. The tallest building in the town is the mosque; its tower is in the shape of an obelisk, and about fifty feet high. But what interested me most was the wells. Every garden has one, and they are extremely deep: to draw water, the method is as follows: a long cord passed over the wheel of the well (which is ten feet above the ground) is fastened to two mules or a camel, which, walking down an inclined pathway, haul the waterskin, which is attached to the other end of the rope, to the top of the well, where

it instantly discharges all its contents into a stone tank, and is then let down again. Little trenches convey the water all about the garden : as the sand would soon soak it up, these trenches are of plaster. The water is limpid and tasteless. All day long the Mzab haul it up. They are all teetotalers and never touch wine, which enables them to work hard continually. "The Mzab work always," has become a saying. Men, women, and children, toil in the gardens even in the noontide hours, when no European could venture out of doors without imminent risk of a sunstroke. A different system of irrigation is pursued at Laghouat, where the water lies on the surface.

Having with difficulty obtained some gunpowder, for the French are not allowed to sell it to the Arabs under any pretence, I went out shooting. The Egyptian turtle-dove was so common, that I had only to take my stand in a garden, and load and fire until enough had been killed. Directly a bird falls, the Arabs rush up to it; their object is to cut its throat *before it dies*. Of course they ruin everything for stuffing. I soon found out that they would never cook a dove which did not die by the knife. Every house was tenanted by house buntings (*Fringillaria saharæ Bp.*) They nest in the large square court, and I think the eggs must be deposited in March. They are rather like sparrows' eggs, but rounder. The nest is composed of little sticks and twigs, and lined with hair.

On the 14th news came that the Touareg—a lawless tribe of robbers—were assembling in force on the Waragla route. This did not alarm us, but the following day a letter was brought to me (in Arabic) with tidings of a great camel razzia at Zergoun, (which though not in our road, lay to the north of us,) in which 2,000 camels had been carried off, and, it was said, six men killed; but as the Arabs habitually exaggerate, I did not place much reliance on this latter statement. The Spahis * were in hot pursuit, but with little chance of coming up with the fugitives. Trusting that they would not come our way, we on the 16th left Berryan and travelled to Gardaia, which is the chief city of the Mzab confederation. Our route lay through a dreary tract of country—stony, brown, and mountainous—save at rare intervals,

* The Spahis are Arab soldiers in the French pay.

where the dull prospect was perhaps suddenly broken by a patch of green, formed by the rain collecting in a hollow, but these fresh spots were few and far between. And now by narrow defiles our cavalcade drew near this Mozabite capital. I could not help thinking as often as I reined in my mule what awful havoc the long guns of the Arabs would make with an invading army in such a place; and no doubt, for them, many a winding pass here teems with historic interest. The bullet marks on the walls testify that the city itself has figured in many a sanguinary conflict. Standing upon a gentle eminence, crowned by the never-failing mosque, its flat-roofed houses rising tier above tier, above the evergreen palm trees, Gardaia's exotic aspect can never be effaced from my memory.

Her gardens, indeed, stand at some little distance, but they are far more extensive than would at first sight appear, and should be visited in the cool of the morning or in the red blush of sunset. Then the "woods resound" with joyous carols, and the sparkling bee-eater, the painted roller, and the gilded oriole flicker in the foliage like a fairy scene. Nothing can exceed the fertility of this oasis. Vines, surpassing any which I ever saw in size and luxuriance, were bent with many an unripe cluster, trained from palm stem to palm stem, and the figs and apricot trees were loaded with green fruit.

Above them towered 40,000 date palms, affording food and shelter to many species of birds. From bush to bush flitted the subalpine warbler *(Sylvia subalpina,)* and the white shrike *(Lanius dealbatus)* sat on every well, or rose to catch the passing locust; while here and there I saw the cunning Numidian malurus *(Crateropus fulvus)* fly with arrowy straightness from the further side of a bush or thicket. Beetles, flies, and *grain* constitute the principal food of this true denizen of the Sahara. When, as I have said, the broken rays of the evening sun were viewed through this mass of foliage the effect was superb.

To return to the city itself; a motley crowd gathered round us as we rode into the market place—brawny men and henna-stained children pressed forward, or mounted on the bench of justice, with greetings and cries of surprise. While we waited at the guest-house for the arrival of a negro with a ponderous iron key, I could not help remarking how many there were in the crowd

who were blind or mutilated. With sunken watery eyes, these poor people presented a sad spectacle.

When we had washed and taken coffee, which is an indispensable ceremony among the Arabs, the chief led the way to the Jews' quarter. We entered the house of a wealthy Hebrew. The Rabbi, as I suppose him to have been, was reading in the doorway; he seemed most anxious to please, and rose on our entry with many genuflections. He showed us his wife, who sat on a door-mat dangling a door-key; she was handsome but rather dirty; the lower half of her nose was painted black. I was much interested in all I saw, particularly the texts upon the wall, and many printed books, some of which I should have liked to purchase. They appeared to be portions of the Old Testament printed in Arabic. We were invited to partake of the thin Jew's bread and some absinth, the most dangerous of all fermented liquors. After that the chief led the way to where his masons were building a house.

I observed that instead of ordinary mud bricks, they were employing stones and plaster, which are probably found to answer better upon a rocky surface where little or no foundation can be obtained.

In conversation with the Arabs the term "tair el h'ohr" was often made use of, meaning the falcon *par excellence*, coupled with the name of Gen. Marguerite, who formerly lived at Laghouat, but is now governor at Algiers, and who is one of the best authorities on the subject of falconry among the Bedouins. It is stated in the "Chasses de l'Algerie" of this author, that the hawks trained for the chase are five:—*El Arem*, *El Meguerness*, *El Bahri*, *El Terchoun*, *El Kreloui*, but Dr. Tristram, an equally good authority, recognises seven sorts:—(*Ibis* i, p. 297,) *El Sakkr*, *L'Abli*, *El Terakel*, *Tair et h'ohr*, *El Bahri*, *El Bourni*, *El Zebarbach*. My father has kindly compared the evidence, and he is led to conclude that *El Arem* and *El Terakel* are the female Sakkr falcon *(Falco sacer,)* and *El Sakkr* the male of that species; *El Meguerness* being the Lanner * *(Falco lanarius,)* and *El Bahri*

* Some naturalists have considered the Lanner falcon as having a good claim to be included in the list of British Birds, on the ground that the figure of Lewin was referable to no other species, (B. B. i, § 17.) All the plates in my copy of that work are so poorly coloured that many are not recognisable.

the Peregrine, which bears the native name of *Bylri* in India. He would coincide with Dr. Tristram in identifying *El Bourni* with the Barbary falcon (*Falco barbarus*,) and *Zebarbach* with the hobby (*Falco subbuteo.*) There thus remains three names to be accounted for.

The missing camel turned up on Sunday the 17th, to my great relief. The Spahis had recovered it for me and taken it back to Laghouat. Several of my things had been lost or injured. With the camel came a letter from the captain of the *Bureau Arab* strongly advising my immediate return, on account of the disturbances at Zergoun; but Mohammed overruled this, deeming that it would be better to stay in safe quarters until the country was quiet. Accordingly, we remained with the Mzab for three weeks, during all which time we were fed and lodged gratis, at the different towns we visited, viz:—Mellika, Bou Noura, El Ateuf, Benuisguen. These towns are all in the same oasis, and the dry course of the river winds between them. Bou Noura is a heap of ruins; half the town has been dismantled, and the crumbling, unroofed, long-deserted houses have grown brown like the rocks which surround them. On the other hand El Ateuf and Benuisguen are in better preservation, and contain some shops or magazines where it is possible to buy European products. Benuisguen has long been the rival of Gardaia, and that its inhabitants still aspire to the chieftainship of the oasis was proved by a new wall, which we found then constructing, and which affords one instance of the intestine rivalry which has rendered every stand against the French abortive.

Of course I lost no opportunity of taking observations on the avifauna of such a little-known district. I was particularly struck with the green Egyptian bee-eaters (*Merops superciliosus.*) They seemed to affect the graveyards. Two of the handsomest chats which I met with in the course of my rambles were common at this oasis:—*Dromolea leucopygia*, the white-rumped rockchat, and *Dromolea leucocephala*, the white-headed rockchat, not so

There is less fault to find with the sketch and outline, but even supposing that the picture does represent the true Falco lanarius of Schlegel, it will be found on referring to the accompanying letterpress, that there is no reason to suppose that he either drew or coloured from a specimen killed in England.

much in the gardens, as in the "weds" and on the walls. They enter towns freely and perch upon the flat-roofed houses.

We did not start upon our return journey until the last day of the month. One of the chiefs was good enough to accompany me home, and I further availed myself of the convoy of two Spahis, who had been sent with letters from Laghouat.

The first day's journey lay through the stony Chebka Mzab, (where among mountains utterly sterile and bare of herbage, our cavalcade trod foot-sore and weary,) and the only rare bird seen by me was a Houbara bustard; its flight is almost like a bird of prey. It is the falconer's favourite quarry, and defends itself by ejecting a slimy fluid. When the Chebka Mzab was past we again entered upon the sandy prairie which stretches right to Laghouat, and I had further opportunity of examining the dayats which had so much interested me.

It was just the period of migration, (May 2nd,) and wherever there was water, they were teeming with animal life. It was as if all the Spring migrants of Southern Europe had been compressed into fifty acres. Beneath every jujube tree—at every thicket—were massed and congregated all manner of rare birds:—pied flycatchers, (*Muscicapa luctuosa*,) hoopoes, (*Upupa epops*,) doves, (*Columba turtur*,) woodchats, (*Lanius rufus*,)—warblers without end, seeking shelter from the burning midday sun. The neophron (*Neophron percnopterus*) and the raven (*Corvus corax*) perched upon the taller terebinths. Different sorts of sandpipers flew before us mingling with noisy shrikes (*Lanius dealbatus.*) Dozing Little owls (*Athene meridionalis*) dashed out from the deep foliage and hid themselves again.

I suspect that not a few birds are tempted by the water and rich foliage to remain and rear their progeny in these dayats. This is the country to which the Arabs apply the term Sahara. I know it is the Great Desert which is so marked in English maps, but this is the true Sahara—the habitable country which ends where all regular supply of water fails. We rode into Laghouat at 8.30 on Thursday morning; it was nearly four weeks since I had seen a European. I heard on all hands of the camel razzia at Zergoun. I might almost say it had created some uneasiness. I was not sorry to take the first "courrier" and return to Algiers, which I did without further incident, and thence by the usual route to England.

IV.

ON GROWTH AND REPRODUCTION IN THE LOWER FORMS OF VEGETABLE LIFE.

By F. Kitton, *Vice-President.*

Read 23rd September, 1870.

"The desire, which tends to know
The works of God, thereby to glorify
The great Workmaster, leads to no excess
That reaches blame, but rather merits praise
The more it seems excess . . . .
For wonderful indeed are all His works,
Pleasant to know, and worthiest to be all
Had in remembrance always with delight."—*Milton.*

The object of my paper this evening is to give, as briefly as possible, some idea of the nature of the vegetable cell, to trace it from its simplest state to the filamentous and frondose algæ, thence to the higher forms of cryptogamic life, returning again to its existence as a simple cell, in those remarkable forms known as diatoms and desmids.

It would be impossible in the time you would feel disposed to allow me, to enter into a minute description of genera and species. I shall, therefore, as far as time permits, endeavour to describe the remarkable phases connected with the growth and reproduction of the vegetable cell.

To those unacquainted with the minute organisms requiring the aid of the microscope for their study, the remarkable phenomena I am about to describe may appear more like fiction than fact, but those here who, like myself, have used that instrument for many years, will confirm me in the truth of what I am about to state.

The life history of the photophyta does not present any difficulty to the microscopic observer; they occur in such abundance that patience alone is required to trace their growth from the spore to the perfect form.

The question is often asked, what are diatoms? This query, like many others in natural history or science, is more easily asked than satisfactorily answered. The inquirer might be told that they were a species of unicellular algæ, capable of secreting silex: this reply, although perfectly correct, would not probably enlighten the questioner. He might also be told, in simpler language, that they were plants—a reply that would probably be met with by an incredulous "oh!" To those unacquainted with the simpler forms of life, roots, stems, and leaves are always supposed to be as necessary to constitute a plant, as organs for locomotion, sight, and hearing, and certainly a mouth and stomach, would be considered necessary to constitute an animal. In both cases the supposition is incorrect; the simplest forms of plants exist without leaves, stems, or roots, and are, nevertheless, as truly plants as those simple organisms which are destitute of feet, eyes, ears, mouths, or stomachs, are animals.

In order to explain what diatoms are, I will, with your permission, endeavour to describe, in as simple a manner as possible, the plant cell, and if I can succeed in making this understood, I think you will be inclined to admit that diatoms belong to the vegetable kingdom.

The vegetable cell may be looked upon as a membranous vesicle filled with a fluid resembling the sap fluid of larger plants. The walls of the cell consist of two layers; the external portion differs from the internal in composition and structure. The internal cell is called the primordial utricle, or first formed cell; its existence is necessary to the vitality of the cell; it is thin and invisible when in contact with the external wall, but under certain changes which take place in the development of the cell, as by the expulsion of its contents, it becomes apparent. Chemical analysis shews it to be distinctly albuminous, in this respect resembling animal tissues. The simplest form of vegetable cell is well illustrated in the *Torula cerevisiæ*, commonly known as the yeast plant, and is found so abundantly in yeast, that it may be said to consist almost entirely of this minute fungus: it is to the present time a disputed point

as to whether fermentation is produced by the yeast plant, or the yeast plant the result of fermentation. Torula may possibly be only one of the phases assumed by the simple cell. The heterogenists have succeeded in producing the forms known as Torula Leptothrix and Bacteria; but passing by the question as to the truth, or otherwise, of heterogeny, we will avail ourselves of the facts they have accumulated.

The earliest stage of Torula is that of a minute spore, or conidium averaging about the 7000th of an inch in diameter, (the diameter of the human blood disc is a 3200th of an inch, about double the size of torula spores.) It would require 49,000,000 of torula spores to cover a space equal to a square inch; or if one spore is magnified 400 diameters, it would appear about the $\frac{1}{250}$ of an inch in size, an inch enlarged to the same extent would be equal to eleven yards. The spore consists of a membranous sac, containing a soft homogeneous fluid mass, which is protoplasm; this protoplasmic mass is composed of nitrogen, carbon, oxygen, and hydrogen. When a spore comes in contact with any nitrogenous matter, it begins to develope, and in the course of a few hours fermentation has set in, and a series of bead-like filaments may be seen; these have been produced by the adhesion of the new formed cells to the parent cell. This cohesion only continues during fermentation; when that ceases, the cells separate, and cell division stops. Professor Huxley states in a paper read in section D of the British Association last session, that from conidia are developed Torula and Bacteria, and these are further developed into Penicillum or mould.

Many of the algæ may be obtained from every wayside ditch, and if attentively examined, will be found to consist of a congeries of simple cells, sometimes placed side by side, and forming leaf-like expansions, or united in a single series, forming the thread-like filaments, so common in aquaria as to be considered a pest. The rapidity of growth in the algæ is very remarkable; little puddles of water formed by the rain in a few hours are filled with confervoid growths; a damp surface is frequently all that is necessary to produce an abundant crop. If a small portion, about the size of a pin's head, of *Oscillatoria limosa*, the black slime so common on damp surfaces, be placed in a white saucer with a little water, and exposed to the light, in the course of an hour or two filaments half

an inch or more in length will be found radiating from the original speck.

The mode of growth in the algæ consists in the division and sub-division of the parent cell. When a fragment is placed in a growing slide, and examined from time to time with a microscope, the colouring matter in the cell will be found gradually to separate, and a septum is formed. We have now two perfect cells: this process is repeated with startling rapidity. If the cell belongs to a filamentous species, it divides transversely only; if it belongs to one of the frondlike species, it divides laterally as well as transversely—this is well shewn in the elegant *Phyllactidium pulchellum.*

The algæ, as I before observed, possess neither leaves, flowers, nor seeds; the method of their reproduction is one of the marvels that the microscope has revealed to us. If we examine a few filaments of Zygnema, (a very common conferva,) we shall probably detect two filaments, connected by button-like projections, on the edge of the cell, and we may also see that an alteration has taken place in the colouring matter of the two opposing cells; it has assumed a globular form, and passes through the aforesaid projections—the two masses meet and intermingle, and form the sporangium; shortly a movement will be seen, and a number of minute oval bodies, with two or more tails, make their appearance; these are zoospores, and it is truly wonderful to observe their animal like movements, sometimes apparently fixed by the tails, and swaying to and fro like miniature balloons, preparatory to an ascent—now perfectly motionless—now gyrating like a top—now starting off with the rapidity of an express train. After the lapse of a short period the spore becomes languid, and motion ceases, and death has apparently claimed it for its own, but if we watch it attentively, we shall find that it is about to enter a new phase of existence; motive power, indeed, no longer exists, but vitality is still there, and active—it gradually lengthens and expands, the cell is formed, and presently division takes place, and what before appeared to be an animal, has become a true plant.

The green colour of stagnant water is generally occasioned by the presence, in countless myriads, of zoospores. Reproduction by means of zoospores is not peculiar to the algæ; it has been found that liverworts, ferns, and other forms belonging to the class cryptogamia, are produced from them. It may be useful, as shewing

the close relationship existing between the simple cell, and the higher and more complex forms belonging to the cryptogamia, if I give a brief description of the reproduction of a fern. It is hardly necessary for me to allude to the well known brown patches on the back of the fronds; everybody knows that they are spore cases and spores, and that from these spores ferns are produced. They are not, however, the immediate progenitors of the fern; when the spore falls on a suitable surface, it begins to grow. The first indication of vitality is a slight enlargement, and presently one or more root-like processes are thrown out from the internal cell wall; these absorb moisture, and the opposite wall of the cell enlarges, self-division takes place, and a new cell is formed, which again divides, and an organism is produced scarcely to be distinguished from a marchantia—this is termed the prothallium. A further development now takes place—two processes are produced, (the analogues of the reproductive organs in flowers,) termed antheridia and archegonia—one of the cells of the prothallium gradually enlarges, and protrudes; this is at first filled with the green colouring matter; in a short time a small free cell is formed within, containing granules and a mucilaginous material —these are again developed into fresh cells—it at last separates from the prothallium, and becomes an independent organ. The cells now increase in size, and contain, when perfectly developed, a single spiral filament, with six vibratile cilia; these escape from the cell, and rapidly rotate, thus resembling zoospores in their apparent animality—they are technically known as antherozoids: the mother cell is termed the antheridial cell. The second process, called the archegonium, is produced by the swelling out of a portion of the external layer of the prothallium. At the base is an enlarged cell, containing the germ cell; at the top of the archegonium, when fully developed, is a small aperture, through which the antherozoids penetrate, and fecundate the germ contained in the germ cell, which rapidly becomes the primordial cell of the new plant; cells begin to form and subdivide, and gradually differentiate into special organs as roots, stems, and leaves.

I would now call your attention to the resemblance, on the one hand, to the reproduction of the simple vegetable cell, by a ciliated motile spore, and on the other, to the flowering plants; we may compare the prothallium to the flower—the antheridine cell to a

stamen—the antherozoid to a pollen grain—the archegonium to a pollen tube, and the germ to the ovule.

Before quitting the non-silicious algæ, I must allude to the desmidiæ. The members of this family bear a great superficial resemblance to the diatomaceæ, but if carefully studied, important distinctions may be detected. The desmids do not secrete silex; self-division takes place longitudinally in diatoms, transversely in desmids. Diatoms are found in equal abundance in fresh and salt water—desmids in fresh water only.

The desmids resemble diatoms in being unicellular, rarely forming permanent filaments, the non-filamentous forms varying greatly in contour—surface of cells sculptured. The commonest form of desmid belongs to the genus closterium, and resembles a cucumber in miniature. Species of this genus, particularly *C-lunula*, may be found in every ditch or bog pool. In this species the interesting phenomena of cyclosis or circulation may be easily observed: at the apices of the frustule are two transparent spaces, within these minute granules will be seen circulating, and if attentively observed, this circulation may be detected over the whole internal surface. A slight progressive movement has been seen in some of the fusiform species, but it is always very languid. The colouring matter (endochrome) in the desmids appears to be the same as the chlorophyl in the larger plants, and on examination by the spectroscope, the absorption band peculiar to the latter material makes its appearance.

The reproductive power lies in the endochrome, and certain changes take place in it previous to the separation of the frustule, and the formation of the sporangium. The external wall of the cell is tenacious, flexible, and not easily ruptured. Mr. Ralfs says that silica is sometimes present, but I have never been able to detect its presence.

Increase by self-division takes place in the desmidiæ; the frustule separates transversely, and a new half is gradually produced. In Micrasterias this first appears like a little knob or button; this, in course of a few hours, increases in size, and deep indentations make their appearance, and the new half soon becomes a fac-simile of the older portion.

Reproduction in the desmidiæ takes place in the following manner. When two frustules are in proximity, they mutually

divide, and empty themselves of their contents, which coalesce, and form a globular sporangium ; this, in some genera, is smooth—in others, it is covered with long spinous projections ; this sporangium, according to Hoffmeister, is not a single cell, but is composed of a number of cells, each of which assumes the form of the parent frustule.

The absence of silex, and the delicate nature of the frustule, prevents its preservation in any of the numerous fresh water deposits generally so rich in diatoms. One genus of desmids has, however, been supposed to have a fossil representative, viz., the so-called Xanthidium, so common in flint, (it, however, more resembles the sporangium of the genus Cosmarium than the recent forms of Xanthidium.) These forms were supposed by Ehrenberg to be remains of desmids, but as flints usually contain remains of foraminifera and bryozoa, indicative of marine origin, and the desmidiæ are, as I before remarked, found only in fresh water the theory that they belong to the genus of desmids known as Xanthidium must be given up. The Xanthidium-like bodies in flint, are perhaps the remains of the gemmules of some sponge-like body, originally forming the nucleus of the flint.

We will now proceed to the description of those remarkable forms of plant life called diatomaceæ. The non-filamentous species were considered by the early observers to belong to the infusoria—a term still retained by some authors, although the majority of forms described by them are not found in infusions. Ehrenberg has described some of them in his Infusionsthierchen ; he not only overlooked their affinities to the algæ, but even thought he saw organs of locomotion and digestion, and called them polygastrica, or many-stomached, and, I believe, he still persists in their animal nature. He asserts that he has been successful in feeding them with colouring matter, (carmine or indigo,) but as no other observer has succeeded in doing it, I am inclined to believe that he made a scientific use of his imagination, or, in other words, fancied he saw what he wished to see. He says the colouring material was imbibed through what he calls the central umbilicus ; in this he was decidedly mistaken, as there is no aperture through which any substance, fluid or solid, could pass ; the umbilicus, on the contrary, is a thickening of the cell wall. The modern arrangement of the diatomaceæ is as follow :—Class, cryptogamia ; sub-class,

algæ; natural order, diatomaceæ; plant, a frustule, consisting of a unilocular, or imperfectly septate cell, invested with a bivalve silicious epidermis; gemmiparous increase by self-division, during which process the cell secretes a more or less silicious connecting membrane; reproduction by conjugation, and formation of sporangia.

Before proceeding further, I may mention that the desmidaceous and diatomaceous cells are termed frustules, and when that term is used, a cell is to be understood. The diatomaceæ are distinguished from all other species of algæ by the power of eliminating from the surrounding water the silex held in solution. This power exists in a high degree in the diatomaceæ; and when we consider that ordinary water contains but an infinitesimal proportion of silica, it must excite our astonishment that a minute protoplasmic mass, enclosed in a cell, should possess the power, not only to eliminate so small a quantity, but also unmixed with other matter held in solution with it, and this not deposited in an amorphous state, but forming elegant designs in or on the surface of the valve. Surely chemical action is not sufficient to account for it, and we are compelled to acknowledge that even as in the highest organisms, so also in the lowest, there exists a mysterious principle called life, defying our utmost efforts to detect or control it; it is as much beyond the power of man to make a diatom, as to make the gigantic oak.

Owing to the indestructible nature of the silicious frustule, diatomaceæ are often found in a fossil state, forming strata of considerable thickness. The city of Richmond, Virginia, is built over a stratum of diatomaceous remains eighteen feet in thickness; this deposit, according to Professor Rogers, belongs to the Miocene period, and so far as I am aware, it is at this period diatoms made their first appearance. Ehrenberg, in his Mikrogeologie, figures a form as occurring in the chalk which he calls a diatom, belonging to the genus Navicula, but it certainly does not belong to that genus, nor does it possess any diatomaceous characteristics.

The sudden appearance of these organisms in the Miocene period has always struck me as being remarkable, and the majority of the genera and species found in these deposits have never ceased to exist up to the present time; in fact, scarcely a fossil genus but has its representative still living. Some genera of

diatoms, like those larger plants, seem ubiquitous; they are found existing in equal plenty amid the snows of the Arctic regions, the heat of the Tropics, and the pancake ice of the Arctic and Antarctic seas. Others are limited to very small areas; for example, we have living in Ormesby Broad a small species, which has never been found in any other locality; another species occurring in a fossil state in Franzenbad, in Bohemia, has been found in great abundance in a ditch near the Berney Arms, and so far as I am aware, nowhere else. Some genera are only found, in any quantity, on the sand ripples left by the retreating tide; others form part of the surface flora of mid-ocean, and appear to be the food of the salpæ and noctilucæ; and the student availing himself of the stomach contents of those organisms, adds many rare forms to his collection. The salpæ, noctilucæ, &c., are eaten by fish—these again form the food of the various species of marine birds, the producers of the enormous deposits of guano. These deposits yield up their diatomaceous riches to the careful manipulator, and our little diatom, after undergoing such strange vicissitudes, is at last entombed in Canada balsam, and placed among the choice slides of the microscopist.

The diatomaceous frustule may be compared to an ordinary pill-box, in which the bottom has been replaced by a lid; the two lids are termed valves—the body of the box the connecting zone or cingulum—the surface of the valve is called the side view—that of the cingulum, the front view. In an early stage of growth the cingulum is very narrow, and, I may here remark, that this is the only part of the frustule that really grows; the valves never increase, but, on the contrary, decrease in diameter as reproduction proceeds. The cingulum increases in breadth only, and being of later formation, is less firmly siliceous than the valves; in its earliest stage of formation the frustule is probably little more than a membranous sac, and when this membrane is exposed to the action of water, the secreting process at once commences. The cell membrane upon which the silex is deposited, is perhaps the analogue of the primordial utricle of the ordinary vegetable cell. That such a membrane exists, has been conclusively proved by an experiment instituted by Professor Bailey; he subjected the frustules of recent diatoms to the action of hydrofluoric acid, and dissolved away the silex, leaving an elastic membrane unattacked

by the acid. The outline of the valve is extremely varied; it may be circular, triangular, quadrangular, pentangular, semicircular, wedge-shaped, fusiform, or wandlike. Some genera secrete a semi-gelatinous thread, and become parasitic upon larger plants. The cell contents consist of a golden brown endochrome, and sometimes two or more oily globules may be observed; cyclosis has been detected in several species when stimulated by light and warmth. That the colouring matter or endochrome is identical with that in the desmids, and the chlorophyl in the larger plants, is, I think, satisfactorily proved by spectrum analysis, the absorption band occupying the same position as the chlorophyl band.

The most remarkable phenomenon connected with these organisms is the power of locomotion, and the means by which it is accomplished have not as yet been made out. This movement is most conspicuous in the bacillar or wand-shaped forms, and consists of a series of jerks; it has been used as an argument in favour of their animality, but if attentively studied, it will be found to bear little resemblance to that of even the lowest animal organisms. If its course is impeded by any obstacle, it does not move on one side, but remains motionless for a short time, and eventually goes back by a similar series of jerking motions. This movement has been supposed, by some authors, to be produced by the expulsion of minute currents, but unfortunately for this theory, the minutest particles of matter are not disturbed by the diatom, unless actually touched by it. Professor Smith has timed the rate of progression in several species, and he found that the most rapid moved over $\frac{1}{2000}$ of an inch in a second, or rather less than an inch in three minutes, and the slowest $\frac{1}{34000}$ of an inch in one second, or nearly an hour to accomplish one inch.

At the risk of being tedious, I will, with your permission, say a few words on the reproduction of these organisms. You will, perhaps, remember I stated that the cingulum is the only part that grows; within this, two other valves are found, and when this has taken place, the cingulum separates, and we have now two new frustules. Under favourable circumstances, this goes on with great rapidity, but as every new frustule is formed within the old, a gradual decrease of size takes place, and at last self-division ceases, and the species would die out, did not a reproductive process, similar to that in desmidia, place two frustules approximate,

and a union of the contents takes place. A sporangial frustule is produced, much larger than the parent frustule; this sporangial frustule divides, producing other frustules, as before described, and in this manner are accumulated the vast deposits previously mentioned.

The fossil remains of the diatomaceæ are sometimes used in the arts as a polishing powder, under the name of tripoli. Another and more extraordinary use is made of them by savage tribes, viz., mixing them with flour in the time of dearth, and from this circumstance, the German microscopists call these deposits Bergmehl and Essebar Erde. It is scarcely possible that any of the cell contents remain in the organisms found in these deposits, and they must, therefore, be perfectly useless for the purpose of nourishment.

I again allude to the power possessed by vegetable organisms of secreting silex: this, as you are aware, is not confined to the simple types I have been endeavouring to describe, but is possessed by many of the more highly organized forms, as the horsetails, grasses, &c., and, apparently, the leaves of some plants are able to do so even when detached from the stem.

I have lately received from Dr. Lowe, of Lynn, a paper on some silicified forms in mud from the Zambesi; these forms are not peculiar to the Zambesi—they may be found in various fresh water deposits. Ehrenberg has figured, under the name of Phytolitharia, several of these forms, supposing them to be distinct organisms. Dr. Lowe has, however, been able to see them in situ, and they prove to be cells belonging to some thick-leaved plant. Now, as no known plant possesses siliceous leaves, the cells must have become so after the leaves had fallen into the water; and, as some of the cells retained the remains of chlorophyl, it is not too much to suppose that they eliminated the silex somewhat as the diatom does, and must have done it rapidly. If these organisms had been only siliceous casts, their formation might have been accounted for by the cell walls acting as a dialyser, and separating the silica in a colloid state from the surrounding water, but this is not the fact—the cell walls are silicified, the interior remaining hollow as before.

This power of appropriating silex from the surrounding waters is possessed in a far greater degree by plants than animals, and

these of the lowest type, viz., the polycystina and sponges—the former investing the sarcodous mass with a silicious carapace, of marvellous beauty—the latter strengthening the horny matter with spicules of various shapes, or, as in Euplectella, weaving one of the hardest and most obdurate of substances into a framework of surpassing elegance. The elimination of silex is not confined to the protophyta; the grasses, canes, &c., do so, and deposit it in various forms on the exterior of the stems, or in the form of scales on the leaves, and even the petals of the flowers. The *Deutzia scabra* is a familiar instance of this. Another substance, even more common than silica, viz., lime, does not, as far as I am aware, form any part of the structure of plants, from the lowest to the highest, excepting a genus of marine algæ, the Corallina—and species of the genus Chara, are sometimes found covered with a calcareous crust, but this is not essential to their well-being. Raphides and sphæraphides may also be cited as evidences of lime being taken up by plants, but these again appear to be of no importance to the welfare of the plant; but if we turn to the animal kingdom, lime plays an all-important part in its economy—lime forms the humble home of the foraminifera, and it constitutes the principal portion of the mammal in its highest state of development.

Ladies and gentlemen, I have endeavoured, as briefly as possible, to convey to you some idea of what a diatom is, and its claims to a place in the vegetable kingdom, and in order to render this claim intelligible, I have thought it desirable to give a short account of the vegetable cell in its various forms; and I think you will see that a desmid and a diatom are, if I may use the expression, merely arrested states of vegetable life, that is to say, the cells exist apart, and do not differentiate into various special organs, consequently the life of one cell does not necessarily depend on that of its neighbour. This is a peculiar characteristic of the lower cryptogamia, for although many of the lower forms of flowering plants continue to live if cut into very small pieces, *Anacharis alsinastrum*, for example, the cells of which it is composed never exist apart; but when we ascend higher in the scale of vegetable life, the cell is still less capable of self-existence, and special conditions have to be observed, to enable detached portions to vegetate: it will not do to cut indiscriminately—a piece of

bark will not grow, neither will the stem, if deprived of its bark.

The study of the lowest forms of life still occupies the minds and time of our greatest biologists, both at home and abroad; and I would recommend all those who possess a microscope to study the life history of one of the numberless forms of animal or vegetable that may be found in every drop of stagnant water. There is at present too much desire among those who have an instrument to collect objects that are pretty, thus making natural history subservient to the microscope, instead of using it as an adjunct to the study of natural history; and I cannot help thinking that if used for the latter purpose, the naturalist who has devoted his leisure to the study of the larger forms of life, will not despise those who make use of the instrument for the study of minute organisms. They may appear trivial, and not worthy of attention, but as it has been wisely said, "in every object there is inexhaustible meaning: the eye sees in it what the eye brings the means of seeing." To Newton, and Newton's dog Diamond, what a different pair of universes, while the painting on the optical retina was most likely the same! And let us, as students of nature, bear in mind Galen's aphorism, "Naturam maximé admiraberis si omnia ejus opera perlustraris."

V.

ON CERTAIN COAST INSECTS FOUND EXISTING INLAND AT BRANDON, SUFFOLK.

By Chas. G. Barrett.

Read 29th November, 1870.

It is a fact well known to Entomologists, and probably to Naturalists generally, that the sandhills which partially line our coasts form the exclusive habitat of many species of insects of various orders, and that these species are seldom, if ever, known to wander from the sands, even to as short a distance as a mile, or it would almost be safe to say a hundred yards.

Of such, among the Lepidoptera, are several species of Noctuæ

belonging to the Genera Agrotis, Leucania, Mamestra, &c., two or three Geometræ, a few Crambidæ and Phycidæ, and a number of Tineina, especially of the large genus Gelechia. These insects shelter themselves during the day at the roots of the rough grasses and stunted plants that grow on the sands, and especially under the overhanging edges of the hills, whence the sand has fallen away, leaving the roots and herbage hanging down; but always carefully avoiding exposure to the wind. So much is this the case that an experienced Entomologist upon arriving at a range of sand-hills, knows at a glance by the direction of the wind where to look for the insects.

The larger and stronger species fly at night, the smaller ones in the afternoon and evening, when the weather is moderately warm and still, but many of them will not stir on the wing except on the calmest evenings, the species of the genus Gelechia in particular being so excessively sensitive to wind, that in order to dislodge them from their hiding places among the grass, furze, or moss, it is only necessary to blow sharply, with the breath, among it, when the little creatures come hurrying out, and dart away into some sheltered spot at once, not hesitating, occasionally, to settle on the clothes of their tormentor, but always carefully choosing the sheltered side.

Now it happened that early last June I arranged to meet one of our Vice-Presidents, Mr. De Grey, at Brandon, in Suffolk, for a day's collecting. Our sport was capital—indeed I have had the pleasure of exhibiting here on a former occasion, some of the rarities which I then captured for the first time—but among the insects we took were five species, (which I beg now to lay before you) namely, *Mamestra albicolon*, *Anerastia lotella*, *Gelechia desertella*, *Gelechia marmorea*, and *Gelechia distinctella*, four of which are considered to be most exclusively coast-sandhill insects, and the fifth, *Gelechia distinctella*, is scarcely ever met with in any different locality.

I have no doubt that some of the members present, especially those who are also Geologists, are well acquainted with the peculiar soil of Brandon, and the adjoining country for some distance. But for the information of those who are not, it is necessary that I should say, that it is a loose light sand, precisely such as is found on the North Denes at Yarmouth at the present time.

About its origin, I have consulted one of the best practical Geologists of this county, a gentleman well known to you, and am informed by him that there is no doubt that this tract of country was actually a range of *coast* sands, at a comparatively recent point of the Post Glacial period, while the great valley of the fens was still submerged. This range of sands, however, does not appear to extend anywhere near to the present coast. The nearest sea is the Wash, upwards of twenty miles away, and the Eastern coast with its belt of sandhills is forty miles distant, the intermediate country being, in both cases, of a totally different character.

Although the Post Glacial epoch is, I believe, Geologically speaking, a very recent one, the actual length of time since passed is so great, that I presume few Geologists would venture to compute it, even in thousands of years. The occurrence, therefore, at the present time of these coast insects, on this ancient sea-shore, is a circumstance of considerable interest, particularly as they appear to be by no means scarce there—indeed *Gelechia desertella* swarms in hundreds in the rough fields and among the stunted furze bushes —and the question naturally arises, by what means they became settled in so congenial a spot. The immediate answer to be expected is "By migration," and abundant theories instantly crop up of chance specimens carried across country the whole distance by storms of wind. I am, however, from knowledge of their habits utterly unable to accept this solution, especially in the case of the weakly constructed *Anerastia lotella* and the little Gelechiæ. I hold it to be physically impossible for their delicate frames to survive such treatment.

The "blown across" theory may possibly hold good sometimes in the case of strong winged, day flying insects, such as the butterflies, which, provided the sun be shining, are ready to brave a considerable amount of wind, but with insects whose special aim is to avoid it, and whose instinct in foreseeing changes of weather is so fine as never to seem at fault, such a solution is utterly untenable. Moreover, the "blown across" theory is only applicable to the comparatively level surface of the sea where the wind has free course. In crossing a country covered with scattered trees and with occasional hills and other inequalities of surface, the disturbing currents caused by them would soon and certainly precipitate such matters to the ground, or enable them to reach it.

To suppose that ordinary migration or spread of species would explain the difficulty is out of the question, since I have already shown that it is contrary to the habits of the species to travel on to uncongenial soils, where, even if pressed to do so by excess of numbers, they would be unable to exist.

Nobody will of course venture to suppose that there has been a special creation for this small tract of country, and we are therefore, as I think, driven to the conclusion that the species in question have occupied this suitable ground, from the time of the close of the Post Glacial period *at least*, and that they have remained unchanged in form, and even in colour, all through the changing conditions of life occurring during the upheaval of the fen valley, and the consequent alteration of our coast line, and particularly those caused by the change from the saline influences of the neighbouring sea, to those of a warm inland district.

One slight change of habit is apparent, due doubtless to the increased temperature. All these species were out on June 4th, desertella in swarms; and a week later lotella was common and albicolon getting worn, while at the same time albicolon and desertella were just beginning to appear at Yarmouth, and the other species were not to be found there till a fortnight later, *July* being their time of appearance on the coast.

It would now be very interesting to ascertain whether *Eubolia lineolata*, *Leucania littoralis*, *Agrotis valligera*, *cursoria* or *ripæ*, all of them inhabiting our present coast sands, were also still to be found in what may probably have been their ancient haunts.

A small scrap of additional evidence has come to hand since this paper was written. In a list of Lepidoptera, contributed by Mr. De Grey to our county list, is the name of *Gelechia pictella*, a more delicate species than either of those I have mentioned, and one which almost exclusively frequents coast sandhills, found also at Brandon.

December 20th.

Since the paper read at the last meeting was written, I have received some valuable confirmatory evidence. The Rev. H. S. Marriott, of Wickham Market, and Rev. H. Williams, of Croxton, inform me that they find *Eubolia lineolata* commonly on the grassy heaths, and *Agrotis valligera* flying in Lucerne fields round Thet-

ford, besides meeting with the larger species which I mentioned; and Mr. De Grey tells me that he has taken *Agrotis cinerea* and *Gelechia vilella*, (both of them much rarer sandhill insects,) at Brandon, and *Gelechia marmorea* as far away as Tottington, on the Merton estate, to which place the drift sand extends.

These further observations enable me to bring forward another very interesting point, which I felt hardly justified in deducing from the data in my possession a month ago. It is this—most of these species belong to large genera of closely allied and abundant species, (Agrotis, Mamestra, Gelechia,) genera such as have been pointed out as most likely to produce new species by natural selection—dominant groups, in fact. These species, however, in spite of their isolation and alteration of condition, are as true and as clearly defined as those of our present coast.

VI.

ON THE ABUNDANCE OF LITTLE GULLS ON THE NORFOLK COAST IN THE WINTER OF 1869—70.

By H. Stevenson, F.L.S.

Read 20th December, 1870.

It is rarely a year passes that is not at one period or other remarkable for some ornithological occurrence of special interest—either the advent of a new or an extraordinary excess in the number of some other species, commonly looked upon as a rare or uncertain visitant. Thus, of late years, we have had an invasion of sand-grouse, a plethora of waxwings, shorelarks, and storm petrels; during the present autumn a surfeit of quails, and in the winter of 1869—70, such an influx of little gulls as had probably never been known up to that date. Judging from former records of specimens obtained, this small and very elegant species has been observed occasionally on our coast, the stragglers procured from time to time being, almost invariably, young birds, but

supposing even that a few—mingling with the large flocks of common and black-headed gulls, which in autumn and winter frequent our shoals, sandbars, and tidal estuaries—may have annually visited us, still their appearance in February, 1870, both here and in more northern counties in such extraordinary numbers, is a fact worthy of special record.

In the *Zoologist* for March, 1870, (p. 2056), I stated that a little gull, in immature plumage, had been sent me from Salthouse on the 23rd of October, 1869, and that another, in similar plumage had been also killed at Blakeney on the 30th of the same month; both of these, as is commonly the case, were solitary specimens, and no more appear to have been remarked until about the end of December or beginning of January, when another immature bird was shot somewhat inland at Gooderstone, near Fakenham, and preserved by Mr. Ellis, a birdstuffer, at Swaffham. The weather up to that time had been mild and open, but from the middle to the end of January we experienced severe frost and snow. With the 1st of February, however, came a few warm sunny days like a foretaste of spring, and then again, on the 6th, the wind veered to the N.E. with heavy snow storms on the 8th and 9th, followed on the night of the 12th and throughout the following day by a biting wind frost, more severe during the short time it lasted than had been experienced for many years.* On the 13th the wind from the N.N.E. blew a heavy gale, drifting the frozen snow like sand, in places sweeping it clean off the roads, and in others heaping it up above the banks and hedges.

It was just at this time, storm-driven and suffering from the severity of the weather, that the main body of little gulls appeared on our coast, and of the numbers which fell victims to the gunners between Lynn and Yarmouth, the larger portion were procured between the 12th and 14th, and others during a period extending from the 10th to the 28th.

On the 11th, as stated by Dr. Lowe, in the *Field* of February 26th, a flock of at least a dozen were seen in Lynn Harbour, sheltering from the gale outside, of which several are, no doubt, included in the following list, supplied me by Mr. Wilson, bird

* Mr. Cordeaux, in the "Zoologist" for 1870, remarks "the 12th, 13th, and 14th of February were the roughest days I ever recollect on our Lincolnshire marshes."

preserver, of that town:—February 11th, two shot in Lynn Harbour; 12th, one on the Estuary Bank; 14th, two ditto; and one in Lynn Harbour; 15th, one on the Estuary Bank. All these were in full adult plumage, five males and two females. About the same date Mr. Baker, a bird preserver at Cambridge, received three adult specimens from Hunstanton, where a gunner is said to have shot thirteen in one day, but considering them too small to make plumes for ladies' hats! threw them all away. Mr. Micklefield, of St. John's College, Cambridge, also killed three at Hunstanton the same week, a male and female adult and an immature male, and some eighteen or twenty were seen. Mr. Baker, although too late to procure any himself, believes that he saw two or three flying inland when travelling by rail to Hunstanton on the 19th.

On the 12th I received an adult male and a male in immature plumage, from Salthouse, both shot on the previous day, and another adult male was killed at the same place on the 10th. On the 12th, also, Mr. J. J. Winter, of Norwich, shot an adult male on Cromer Beach, the wind, as he tells me, blowing a heavy gale at the time, and many large gulls were driven in by the storm, but no more little gulls appeared amongst them. On the 14th, Mr. H. Upcher received an adult male from Cley, and on the 15th, an immature female from Salthouse; and the same day an adult female from Sherringham Beach. A pair now in my collection, male and female, adult, were also killed at Hasborough on the 15th.

At Yarmouth the large number procured were nearly all killed between the 12th and 14th, but the market being somewhat glutted, they were still offered for sale up to the 19th and 20th. As far as I could ascertain at the time, at least twenty specimens were shot on the beach during the height of the gale, of which six couples, all adult birds came under my notice, and some were, I believe, sent up to Leadenhall Market, where, from first to last, about thirty specimens were received, chiefly from the Eastern Counties. A pair of adult birds, killed at Hickling, near Yarmouth, on the 17th, were the only examples, to my knowledge, which in that locality were not shot on the beach. Amongst the birds sent to our Norwich bird stuffers, three were from different localities in Suffolk—Wendling, Beccles, and Lowestoft—but all these were amongst the latest birds killed; indeed, the last that I

saw in the flesh was shot on Gunton Beach, near Lowestoft, by Mr. Fowler's gamekeeper, on the 18th, when others were seen, possibly passing further south after the storm had abated.

Altogether, as far as one can judge from fairly reliable "hearsay" evidence, over sixty specimens were killed in this county; forty-two I can vouch for, having handled most of them myself; and judging from the various records in the *Field* and *Zoologist*, Bridlington Bay, on the Yorkshire coast, appears to have been the only other locality in which these gulls appeared in any numbers,* and there also the same wholesale slaughter awaited them as on our own inhospitable coast. Mr. Cordeaux, (*Zoologist*, p. 2081,) on the authority of Mr. Richardson, of Beverley, states that twenty-nine little gulls, nineteen adult and ten immature birds, were shot near Bridlington early in February, and these, from Mr. Boynton's statement in the *Field* of February the 26th, seem to have appeared simultaneously with the large numbers that visited Norfolk, and were driven in by the same severe easterly gales.

The few specimens of this gull which in previous years have been procured in Norfolk, have appeared both in autumn and winter, from August to the end of January, but extraordinary as was the influx on this occasion, it was attributable, I think, far more to accidental circumstances than to any unusual abundance of the species during the previous nesting season. With gulls, as with most wild fowl, the young birds are more accessible, and as a rule, are procurable earlier in the season than the old ones, which are "driven in" only by stormy or frosty weather. Thus the three immature birds shot in December and January, represented the ordinary stragglers from the main body of migrants, which, probably in most seasons, desport themselves off our northern coasts, and regulating their movements by the mildness or severity of the weather, pass on, almost unnoticed, to more southern quarters. The eggs of this species have been lately received by

* The few notes of the occurrence of stragglers in other parts of England are only such as are ordinarily met with during the autumn and winter months. An unusual number of these gulls were shot at Bridlington, Filey, and Flamborough, on the Yorkshire coast, in October, 1868, as recorded by Mr. J. H. Gurney, jun., in the "Zoologist" for that year, but at that time I believe only one specimen was procured in Norfolk.

my friend, Mr. Dresser, from Lake Ladoga, where they nest in great numbers; and, as at present it is not known to breed anywhere further to the north or west, we may presume that those which, in autumn and winter appear on the coast of Great Britain, form part of that colony, and that migrating in a westerly rather than a southerly direction, they have passed from the Baltic into the North Sea. In this instance, however, the main body of them appear to have been suddenly driven by the irresistible force of the gale upon our shores and estuaries, and thus afforded a chance to our local collectors, which, except under similar circumstances, may not occur again.

The great predominance of adult birds, amongst the specimens procured, still further marks the accidental character of their visitation, the proportion being—amongst such as I can speak of with certainty—six immature to twenty-nine fully adult; but it is difficult to account for the great predominance of males, as proved by dissection, the females presenting about the same proportion in numbers to the males, as the young to the old. In plumage the young exhibited the usual variations, from the mottled plumage of the bird of the year, with its brown head and collar, the grey of the back sprinkled with brown, and the dark primaries but sparingly relieved with white, to that more mature and interesting stage, when the head and back have assumed the grey tints of the adult plumage, and the grey and white are gradually extending to the secondaries and primaries. In this stage, however, each wing is barred with brown as in the young kittiwake, and the tail is still broadly tipped with the same colour. The old birds, one and all, presented the exquisite contrast of grey and white, that marks the winter dress of this species in both sexes, the crown and back part of the head smoke grey with a dark spot below each ear covert; the sides of the neck and breast, back, and upper surface of the wings, pure French grey, relieved by a white margin to the tips of the primary and secondary quills. The under surface of the wings dark slate grey, showing the same white edging, and the tail and under parts, generally, pure white, with the breast and vent in most specimens, when freshly killed, suffused with a lovely tint of rose colour. But one bird out of all I examined in this grey plumage, exhibited the slightest variation from these general features of the adult dress; but in this instance a female, in my

own collection, killed at Hasborough, the plumage is particularly interesting as showing the last trace of immaturity in the primary quills. Each of these feathers, though broadly tipped with white, has a patch of black of more or less extent forming with the wing closed, three alternate bands of black and white towards the extremity of the feathers, but in this transition state, the gradual encroachment of the pale grey and absorption, as it were, of the dark patches, by an actual change of colour in the feathers, and not by moulting is very remarkable; a process, moreover, which is clearly perceptible in far less mature specimens. The tail feathers in this bird are pure white, but the feet and legs were somewhat less vivid in colour than in other adult specimens.

In the adult bird the beak is dark brown, becoming reddish brown on the lower mandible; inside of the mouth rich salmon colour; feet and legs vermilion red, inclining to orange in some cases. In the young bird the beak is almost black, throughout; the inside of the mouth lighter in tint than in the adult; legs and feet livid pink. The irides in both old and young dark brown, but no colouring round the eye-lid at this season of the year.

The stomachs of some of those dissected contained remains of small fish, shrimps, and sand worms, with sand and gritty substances. In the stomach of one were five sticklebacks, some of which could be identified as the ten-spined species; in another was a small fragment of chalk with seaweed attached, and something very like a minute portion of mutton fat. Examples in the flesh, weighed by Mr. T. E. Gunn, varied from three ounces in immature birds to four and a half ounces in adults.

VII.

FAUNA OF NORFOLK.

Part I. Mammalia and Reptilia.

By Thomas Southwell.

Read February 28th, 1871.

Whilst it is the duty of a Natural History Society to endeavour to popularize the study of nature, and by every means to awaken an intelligent interest in the minds of those who have disregarded the wonders which surround them, it is not less incumbent upon such a society, by carefully compiling lists of the Fauna and Flora of their immediate district, to assist in furnishing materials for works of greater pretensions and more comprehensive scope. It is impossible for the author of a history of any branch of natural science to make himself minutely acquainted with the productions of every locality, or to trace out and eliminate species of doubtful authority, but by availing himself of the observations of many naturalists, condensed in the form of local lists, materials are placed at the disposal of the master builder which will enable him to construct a faithful history of the habits, frequency, and geographical distribution of the subjects of which he treats. We think, therefore, no apology is needed from the Norfolk and Norwich Naturalists' Society for endeavouring to compile faithful and accurate lists of the natural productions of the County, accompanied by such remarks as may be considered desirable, on the rarer species under consideration.

As might have been expected from a County which has produced so many naturalists of note, many lists have appeared from time to time, amongst which, those of Sir Thomas Browne, Sheppard and Whitear, C. and J. Paget, Gurney and Fisher, Mumford, and Stevenson, are of great value, particularly Mr. Stevenson's most

exhaustive history of the "Birds of Norfolk;" but in only one of these (C. & J. Paget's "Natural History of Yarmouth and its Neighbourhood") has the plan included a general list of the several departments into which the animal and vegetable kingdoms are divided; and this exception applies but to a limited district—added to which the constant changes which are taking place in the physical features of the County involve corresponding changes in its Fauna and Flora, and render frequent revisions necessary. This want, a Committee of the Norfolk and Norwich Naturalists' Society, assisted by many gentlemen resident in the County, are endeavouring to supply, and I have now the pleasure of submitting to the Society the portion which has been committed to my care, viz., the Mammalia and Reptilia; this will be followed from time to time by the remaining portions for publication in their transactions.

In a highly cultivated County like Norfolk, where those animals not actually domesticated, or preserved by the sportsman, are regarded as "vermin" and ruthlessly destroyed whenever opportunity occurs, it is not to be expected that a great number of species will be found; but even the quiet which is maintained in our woods and coverts during the breeding season is favourable to the increase of some species, and the large tracts of reed-beds in the "Broad Districts," and on the margins of our sluggish rivers, afford protection and abundance of food for others, particularly for the Otter, which is perhaps more frequent than from its retiring habits and stealthy movements is generally supposed. There are two families, however, which are particularly worthy of attention—viz., the Cheiroptera and Cetacea; of the former, fifteen species are described as British by Bell, but we are only able to record five as occurring in this County. Our extended coast line, the most easterly sea-board of the island, has produced only eight well-authenticated species of the Cetacea out of a total of thirty described as British, by Dr. Gray; and although the majority of the species are of great rarity, it is probable the number recorded as belonging to Norfolk might be increased, and light thrown upon this interesting but obscure order, were those which occasionally come on shore, or get entangled in the shallows off our coast, more carefully examined. The reptiles do not receive the attention to which their great beauty and interesting

habits entitle them; there is also the charm of novelty, and the hope of discovering something before unknown, with regard to their economy, to act as an incentive. In the aquarium and fern-case they may readily be studied and soon become most interesting pets. It is impossible to read Mr. Higgenbottom's admirable life history of the British Tritons* without seeing at once how much may be done for science by the careful study of a single family. I regret I am able to give little more than a dry list of the ten species of Reptiles found in Norfolk.

I have to record my obligations to Mr. J. H. Gurney for his kind assistance, and much valuable information to be found embodied in the list which follows; also to Mr. Stevenson, who placed his notes, extending over twenty years, at my disposal; the Rev. H. T. Frere, of Burston Rectory, Mr. W. M. Crowfoot, of Beccles, Dr. Lowe and Mr. E. L. King, of Lynn, and Mr. F. Norgate, of Sparham, have also supplied me with notes from their own particular districts, for which I beg them to accept my thanks. To Professor Flower, of the Royal College of Surgeons, London, my best thanks are due for his kind advice and assistance, particularly in the difficult Order Cetacea, rendered notwithstanding his pressing professional engagements.

MAMMALIA.

1. Vespertilio noctula (Schreb). High-flying Bat.

Not uncommon throughout the County.

2. Vespertilio pipistrellus (Geoff). Pipistrelle Bat.

Common.

3. Vespertilio nattereri (Bell). Reddish-grey Bat.

Bell (*Brit. Quad.*, 1837, p. 42) mentions having seen specimens of this Bat, belonging to Mr. Yarrell, from Colchester and Norwich. Two in Mr. Stevenson's possession were killed at Framingham Pigot, near Norwich.

* Ann. and Mag. Nat. Hist., 1853, Vol. XII, S. S., p. 369.

4. Plecotus auritus (Geoff). Long-eared Bat.

Not uncommon throughout the County. A cream-coloured variety was killed near Norwich in 1870.

5. Barbastellus daubentonii (Bell). Barbastelle Bat.

Mr. Gurney has taken this Bat once at Easton; it has also occurred at Framingham Pigot, and several times at Beccles. Mr. Crowfoot found one on a wall at Ellingham, on November 2nd, 1870, and believes this species to be common in the neighbourhood of Beccles.

6. Erinaceus europæus (Linn). Hedgehog.

Common.

7. Talpa vulgaris (Briss). Mole.

Common. Cream-coloured varieties are not infrequent. Mr. F. Norgate of Sparham, informs me that a large rusty-white variety was common at Oby; about ten years ago a shepherd sent him five males, they were cream-coloured above, rusty-yellow beneath, larger than the common mole, and seemed to have been fighting. Some of them had old scars and new short fur growing up.

8. Sorex araneus (Linn). Common Shrew.

Common. Local name "Ranny."

9. Sorex fodiens (Pall). Water Shrew.

Messrs. Paget (*Natural History of Yarmouth*) say this species is found in "marsh-ditch banks," and that it is "rather rare." Rev. R. Lubbock (Fauna of Norfolk) says it occurs, but not so generally as the common shrew. I have never met with it in Norfolk, nor has Mr. Gurney, who, however, once saw one from Oulton, near Lowestoft. The Rev. H. T. Frere saw either this or the next species in a pond at Roydon Hall a few years ago, but although he watched it for some time, he was unable to capture it for identification.

10. Sorex remifer (Geoff). Oared Shrew.

First made known as a British species from an individual taken by Dr. Hooker, in Norfolk. Mr. Gurney has met with this species at Keswick and Stoke Holy Cross, it has also occurred at Gillingham, Fakenham, Sparham, and Framingham.

11. Meles taxus (Flem). Badger.

At the commencement of the present century, the Badger was not uncommon in Norfolk; it is probable the aboriginal race is now extinct, and that those occasionally met with are either stragglers or descended from a stock introduced in consequence of their usefulness in forming earths for the foxes. In 1834, Messrs. Paget wrote—"Thirty years ago these were common, especially about Bradwell and Browston [Suffolk], but they are entirely extirpated." I find the following instances of the occurrence of the Badger in Norfolk: 1857, February 12th, adult, killed in the railway cutting near Brundall. 1860, March 9th, old female, at Hickling. 1862, January 4th, one taken alive at Intwood. This is the one referred to by Mr. Gurney, (*Transactions Norfolk and Norwich Naturalists' Society*, 1869-70, p. 25), as having been dug out of its burrow at Intwood. 1864, February 11th, an adult at Melton; and 1865, July 26th, a young male at the same place; 1868, one at Somerton. Mr. F. Norgate, writing in December, 1870, says: "About four years ago a gamekeeper told me he dug a badger out of a hole in the parish of Sall, (or Heydon?) and in a branch of the same hole was a nest of three young rabbits, alive."

12. Lutra vulgaris (Erxleb). Otter.

The otter is found occasionally on all the streams in the county, but its great stronghold is in the broads, where it is probably more numerous than is generally supposed; its retiring habits and the silent manner in which it glides into the water upon the first alarm enable it easily to escape detection. When the snow is on the ground their "seals" are often observed. In Mr. Stevenson's notes, kindly placed at my disposal, I find mention of no less than forty otters sent up to Norwich for preservation, between the years 1852 and 1867, and a bird stuffer in this city told me that in one year sixteen passed through his hands alone. The weight of a full grown Norfolk Otter appears to be from 18 to 28 or even 30 lbs, and the length from 44 to 48 inches; one fine fellow, killed during the present winter, on the ice at Ranworth, is said to have weighed 30 lbs., and measured 4 ft. 9 in. in length. The female does not reach so great a weight as the male. Mr. Gurney gives some interesting particulars of the habits of the otter in the *Transactions of the Norfolk and Norwich Naturalists' Society*, for 1869-70, p. 24.

13. Mustela vulgaris (Linn). Weasel.

Common. The female is locally known as the "Mouse hunter." The weasel climbs trees with great expertness, in seareh of food or to eseape pursuit. Mr. Gurney saw one whieh, when pursued, climbed an oak tree, and eurled itself up on a braneh fully thirty feet above the ground; he remarks, "that it seemed to elimb as well as a squirrel."

14. Mustela erminea (Linn). Stoat.

The stoat in Norfolk is ealled the "lobster," which it is suggested may have originally been "leapster," and have arisen from its habit of progressing by a sueeession of leaps or bounds; another suggestion is that it derives its name from the red eolour of its fur. It is frequently found in the full white winter dress in Norfolk.

15. Mustela putorius (Linn). Poleeat.

Although generally met with, by no means eommon in Norfolk. About Diss, the Rev. H. T. Frere finds it common; he says, "they seem to leave the lower grounds about Oetober. I onee eaught seven, two old ones and five young, in a barn at Roydon. On two or three oecasions I have turned out burrows on the Roydon fen, whieh have eontained eels and frogs, generally half decomposed. I saw the traeks of several in the last snow."

16. Martes foina? (Gmel). Common Marten?

Paget, writing in 1834, says, "the marten was formerly found at Herringfleet, but is now extremely rare." Mr. Gurney was informed by an old woodman that "Marten Cats" were found in Brook woods "during the latter part of the last eentury," and adds, "it is probably impossible now to aseertain to which of the two raees of martens found in Great Britain those formerly inhabiting Norfolk belonged."

17. Vulpes vulgaris (Briss). Fox.

But for the proteetion afforded by sportsmen the fox would long ago have been extinet, as it is, frequent importations are neeessary to keep up the stock; it eau, therefore, hardly be said to exist in a state of nature. Probably the foxes found in Norfolk, previously to the re-establishment of the fox-hounds, were only stragglers. Mr. Stevenson tells me he was informed by Mr. Thomas Edwards,

that when the fox-hounds were given up in Norfolk, some of the foxes were trapped and sent into Leicestershire, Bedford, &c. Many of these, having been previously marked, were again trapped in Norfolk. Daniel, in his "Rural Sports," Vol. 1, p. 272, mentions a similar instance; foxes taken at Whittlebury Forest, and sent up to London after escaping from the hounds, were again trapped in their old haunts, and in one instance this occurred three times. The fourth time poor Reynard was killed, bearing upon him the signals of his former escapes. Mr Daniel also mentions the fact of a fox which littered in a hollow tree, twenty feet above the ground; and I am informed, that some of the foxes at Westacre, which I believe owe their origin to the continent of America, do not take to *earths*, but ascend fir trees, and lie on the top branches all day, thirty feet above the ground.

18. Phoca vitulina (Linn). Common Seal.

Not uncommon along the coast, particularly in the Estuary of the Ouse. Sir Thomas Browne mentions a seal killed at Surlingham Ferry, "having continued in the river for divers months before."

19. Phoca hispida (Cuv). Pagomys fœtidus (Gray). Floe-rat.

In 1846, Mr. Gurney purchased a seal in the Norwich Fish-market, which was obtained upon the Norfolk coast; its skull, he informed me, was presented to our Museum, and as he was uncertain as to the species, he considered it worth investigating. Upon examining the skull, I found it differed in several respects from that of *Phoca vitulina*, I therefore submitted it to Professor Flower for identification, who expressed his opinion that it belonged to an individual of this rare Arctic species. On so competent an authority, I have much pleasure in adding this species to the Norfolk list, and in recording what I believe to be the first instance in which it has been recognized as occurring on the coast of Great Britain.

20. Sciurus vulgaris (Linn). Squirrel.

Common. Messrs. Paget include the *Dormouse* in their list of the mammalia found near Yarmouth, but as I am unable to confirm this, either from my own observation or through correspondents, I can only conclude it has vanished from its old haunts, and re-

luctantly omit it from this list, calling attention to the subject as worthy of investigation.

21. Mus messorius (Shaw). Harvest Mouse.

Somewhat local, but not uncommon. Mr. Norgate finds it frequent at Sparham, and has taken four or five nests in one day. At Gillingham, Mr. Crowfoot has taken its nests in the tall sedges by the side of the river Waveney, also in the marram grass on the beach at Kissingland, almost within reach of the sea spray. Two females brought forth young ones in captivity in the Lynn Museum.

22. Mus sylvaticus (Linn). Long-tailed Field Mouse.

23. Mus musculus (Linn). Common Mouse.

Both common.

24. Mus rattus (Linn). Black Rat.

Messrs. Paget in 1834, state "it still remains here though its numbers are gradually decreasing." Mr. Lubbock, in 1845, says it is "still occasionally found in the City of Norwich." Twenty years ago I saw one which was killed in the coal-house at the Lynn Subscription Library. It is now extremely rare, if not quite extinct, in this County.

25. Mus decumanus (Pall). Brown Rat.

Common. Cream-coloured and pied varieties sometimes occur.

26. Arvicola amphibius (Desmar). Water Vole.

Common in marshes and low ground. Mr. T. E. Gunn records the occurrence of the black variety of the Water Vole at Earlham in the summer of 1865 : *Zoologist S. S.*, p. 152.

27. Arvicola agrestis (Flem). Field Vole.

Common. Mr. F. Norgate found the nest of this species containing six young, which were blind and naked, at Sparham, on the 27th of March ; it consisted of a ball of grass placed in a slight depression of the ground. Mr. Gurney saw a vole which was taken from a kestrel's nest at Earlham, and which, upon a cursory examination, appeared to him to be Mr. Yarrell's Bank Vole, (*A pratensis.*) As this species has not been observed in Norfolk, he thinks the subject worthy of attention. The Bank Vole recorded in the *Zoologist* for 1865, p. 152, is an albino variety of A. amphibius with malformed incisors.

28. Lepus timidus (Linn). Hare.

Common. In Mr. Stevenson's notes several instances of the occurrence of a very beautiful variety of the Common Hare, with "fur like chinchilla," at Burnham Thorpe are recorded. As these notes occur in 1859, 1864, and again in 1866, it would seem to indicate something like a permanent variety in that locality. Mr. F. Norgate also mentions a similar variety, "light grey, very like the Alpine Hare in the transition state from summer to winter coat," as having been met with at Great Witchingham and West Lexham. He has also seen a hare with a black back at Sparham, and Mr. Gurney mentions a still more remarkable variety, perfectly black, killed at Denham, in Suffolk: (*Tran. N. & N. Nat. Soc.* 1869—70, p. 26.) Parti-coloured varieties are occasionally met with.

29. Lepus cuniculus (Linn). Rabbit.

Very common. A beautiful variety known as the Silver Sprig has long been established in some localities, particularly on Thetford warren; black varieties also occur, and Mr. Gurney shot a rabbit on Corton Denes, Lowestoft, which was decorated with alternate black and grey markings like a cyprus cat.

30. Balæna mysticetus (Linn). Right Whale.

Messrs. Paget mention "a small one taken near Yarmouth, July 8th, 1784." In an editorial note to Sir Thomas Browne's "Account of Fishes, &c. found in Norfolk and on the coast," (*Wilkin's Edition*, 1835, vol. 4, p. 326,) it is stated, a whale, (species not given,) fifty-eight feet long, was cast ashore at Overstrand about 1822, and another went spouting past Cromer in the autumn of the same year.

31. Physalus antiquorum (Gray). Razor-back Common Fin Whale.

Messrs. Paget say—"Balæna physalis, fin-backed whale, has several times been seen and taken in herring nets."

1842, August 27th. One was taken in the Estuary of the Ouse, near Lynn, which measured forty-two feet in length.

1851, January 25th. Another taken in the same place measured eighteen feet. (Qy. Balænoptera rostrata.)

1857, January 12th. (Circa). One stranded on Winterton beach and killed by the fishermen measured forty-five feet. The skull of this specimen is preserved in the College of Surgeons' Museum.

1858, November 3rd. One taken off Wainfleet, on the Lincolnshire side the entrance to the Wash, measured thirty-two feet.

32. Balænoptera rostrata (Gray). Pike Whale, Lesser Fin-Whale.

A whale, probably of this species, is mentioned in a note to Sir Thomas Browne's list, as having been cast ashore and killed at Runton, near Cromer, towards the end of 1829. It is described as twenty-four feet long, nose very sharp and pointed, nearly black on the back and white below in folds. Baleen nearly white.

In November, 1860, an adult male of this species was stranded on Overstrand beach; it measured twenty-five feet in length. The skeleton was presented by Mr. J. H. Gurney to the College of Surgeons' Museum, where it now is, and a full description is given by Mr. W. H. Flower in the *Proc. Zool. Soc.*, May 24th, 1864. Mr. Flower considers thirty feet the maximum length this species attains.

33. Physeter macrocephalus (Linn). Northern Sperm Whale.

Sir Thomas Browne says:—"A Spermaceti whale of sixty-two feet long, near Wells; another of the same kind, twenty years before [June, 1626] at Hunstanton; and not far off eight or nine came ashore, and two had young ones after they were forsaken by the water:" (*Wilkin's Edition*, vol. 4, p. 326.) I can find no modern record of the occurrence of this species on the Norfolk coast. In the Norwich Museum are skulls of Delphinus euphrosyne (Gray) and D. delphis, both probably obtained on the Norfolk coast, but I can find no history of either recorded. Sir Thomas Browne says of the latter species:—"sometimes taken, but many confound it with the porpoise."

34. Lagenorhynchus albirostris (Gray). White-beaked Bottle-nose.

Captured off Yarmouth in 1845, described, with plate, in *Ann. and Mag. of Nat. Hist.*, vol. 17, p. 21. Skull in Norwich Museum.

35. Hyperodon butzkopf (Lacep). h. rostratum (Gray). Bottlehead.

Under the head of "Delphinus bidens," Messrs. Paget say:— "A large one caught in a herring-net, November, 1816; a smaller specimen about twenty years before." On the 22nd September, 1858, one of these whales was stranded on the "Ferrier Sand," at the entrance to the Ouse, which measured twenty-eight feet eight inches in length. Mr. E. L. King also informs me that two others of this species were taken on the 23rd September, 1867, near the same place; the larger one, a female, measured twenty-six feet eight inches; the smaller one eighteen feet six inches.

36. Orca gladiator (Gray). The Killer, Grampus.

Sir Thomas Browne mentions one measuring about sixteen feet in length, taken at Yarmouth about 1658. In July, 1823, a specimen, weighing four cwt., and eleven feet long, was found alive on Yarmouth beach: *(Paget)*. In 1830 one was taken in Lynn Harbour, which measured twenty-one feet: *(Loudon's Mag. Nat. Hist.*, vol. 5.) And Mr. T. E. Gunn, in the *Zoologist S. S.*, p. 1927, records one being brought into Yarmouth Harbour on the 25th of June, 1867, which weighed fourteen cwt.

37. Phocæna communis (Lesson). Porpoise.

Common along the coast, sometimes coming up into the harbours.

REPTILIA.

1. Zootoca vivipara (Wagl). Common Lizard.

Frequent on heaths, hedge-banks, and dry places. Local name "Swift."

2. Anguis fragilis (Linn). Slow-worm.

Not uncommon on heaths and in dry woods. The Rev. H. T. Frere finds it very common at Burston, and remarks a curious partiality displayed by it for some particular spot. "Every year," he says, "I see one or two close to one of my gates, and again on a particular grave in the Church-yard, in neither case is the favourite spot more than a square yard." In Norfolk, Mr. F. Norgate says, the slow-worm is called the "glow-worm," the real glow-worm being called the "glaze-worm."

3. Natrix torquata (Ray). Common Snake.

Not so common as formerly, but still abundant in places. This species takes to the water readily and is a capital swimmer, it is said to swim across Fritton Broad, which is nearly a mile in width. Mr. Gurney has frequently found the remains of toads in snakes which he has dissected.

4. Pelius berus (Merr). Viper.

Frequent. Heaths and waste places. A red variety occasionally occurs.

5. Rana temporaria (Linn). Common Frog.

Common. The edible frog has been found at large in Norfolk, and claimed as an indigenous species, but there does not seem to be sufficient evidence to support the claim. Large numbers were imported and turned loose by Mr. George Berney in 1837, 41, and 42, previous to which time there is no certain evidence of their having been met with.

6. Bufo vulgaris (Laur). Common Toad.

Common.

7. Bufo calamita (Laur). Natter-jack Toad.

More local than rare, being found abundantly in many localities in Norfolk.

8. Triton cristatus (Laur). Great Water Newt.

Common. Locally the Tritons are called "Efts."

9. Lissotriton punctatus (Bell). Common Smooth Newt.

Common. Mr. Norgate has found them at night-time in winter by the road side "apparently migrating." Mr. Gurney sends me the following note on this species :—"Although this reptile may usually be handled with impunity, it is sometimes the fact that its skin possesses a noxious property which communicates a painful stinging sensation to the hand and arm of a person handling it, which does not abate for several minutes and seems very similar to that produced by handling the common jelly fish and other medusæ, some of which are more noxious than others.

"In the spring of 1869 a well-marked instance of this phenomenon in the Common Smooth Newt came under my notice, and I suspect that it may be more developed in the breeding season than at any other time."

10. Lissotriton palmipes. Palmated Smooth Newt.

Mr. F. Norgate has found this species at Sparham.

VIII.

Remarks on Mr. Leigh Hunt's "Birds of Thetford," as published in his History of "The Capital of the Ancient Kingdom of East Anglia."

By H. Stevenson, F.L.S.

It is greatly to be regretted that when, through the suggestion of Mr. Thomas Southwell, the members of the Norwich Naturalists' Society are endeavouring to collect materials from all parts of the County for the publication of correct lists of its Fauna and Flora, a work of so much pretension as the above, and devoted to the history of so important a locality, should, as far as the natural history portion is concerned, fall so far short of the requirements of the present day. That Mr. Hunt has laboured long and zealously to complete his self-imposed task there is no question, but in a work of this description, comprising so many different topics, historical, antiquarian, geological, and zoological, the author, unless possessed of super-human capabilities,—in short, an "Admirable Creighton" in literature—must needs fail in those departments with which he is least acquainted; but which, by a division of labour, as in Stacy's and White's Histories of Norfolk, might have afforded reliable information.

I shall here deal simply with the Ornithological portion of the chapter (xxvi.), which Mr. Hunt has devoted to "The Natural History of Thetford;" but, inasmuch as the author, in a foot note, expresses himself as "largely indebted" to the *Birds of Norfolk* "for many of the *facts* supplied in the text," for the credit of that publication alone, I feel bound to notice the *fictions* which have been circulated in this.

Preparatory to commencing what he terms "a complete list" of the various kinds of birds in that neighbourhood, "together with their nomenclature, under the heads, *common*, *native*, *migrants*, *rare*," Mr. Hunt remarks, "by this arrangement, the reader, learned or unlearned in the science, will possess a guide to the Ornithology

of the district, which, till very recently, was not obtainable but after a wearying pursuit and study." With this promise, at least, of completeness and accuracy, we come to the list of "Birds common at Thetford," divided under two distinct heads, *Natives* and *Migrants*, but strangely enough this "complete list" terminates abruptly with the Columbidæ; Partridges and Pheasants, even in that highly preserved district, are omitted, and the whole of the Grallatores and Natatores are summed up, afterwards, in a few lines of general comment.

If we examine this list, however, as far as it goes, conspicuous by their absence amongst the *natives*, are the Robin, Blackbird, and Hedge Sparrow, whilst in the list of migrants, I look in vain for the Swallow, Swift, House and Sand Martin, Ring Ouzel, Hobby, Merlin, Shorteared Owl, Sedge Warbler, Garden Warbler, and Grey Wagtail. Others may possibly be omitted, but these occur to me most prominently as I write. Even the common Sparrow forms no part of the list itself, but, in a separate paragraph we read, "These, with the sparrow tribe, *Passer montanus* and *Passer domesticus* complete (?) the list of common and well known species of birds." Thus making *Passer montanus*, the Tree Sparrow, and the ordinary House Sparrow equally common, although the former is, I have no doubt, not less scarce and local in its habits about Thetford than in most other parts of the county. I am well aware of the difficulty of dividing our so-called "British Birds" into two such arbitrary groups as natives (residents) and migrants, many exceptional cases presenting themselves requiring separate classification, or more minute subdivision: but why the Kestrel and Sparrow Hawk should rank amongst migrants *only*, and the *rare* Goshawk be placed (though under the head of migrants), amongst the birds "common at Thetford;" why the Red-backed Shrike, Spotted Flycatcher, Cuckoo, and Tree Pipit, which all breed with us, should be entered solely under the head of migrants, whilst the Nightingale, Blackcap, Whitethroat, Chiffchaff, Willow Warbler, Redstart, Yellow Wagtail, &c. are ranked both as natives and migrants, is as remarkable as that the Missel Thrush should not be considered as much a *native* as the Song Thrush, or the peculiarly British Pied Wagtail (*Motacilla yarrelli*) should be made a non-resident migrant. Again, though the Stonechat, Whinchat, Barn Owl, and Tawny Owl are, I believe, correctly

classed, as *natives* and *migrants*, yet the Skylark, Titlark, Chaffinch, Starling, Greenfinch, Hawfinch, Jay, and even the Rook, which all receive accessions to their numbers in autumn and winter, from more northern localities, figure only under the head of natives.

Passing on from the list of "Birds common," to the list of "Birds rare about Thetford," and which comprises, as Mr. Hunt describes it, those "migrants whose nests are seldom found amongst us, and those that never breed in this district," I am as little able to reconcile his statements with facts. The Peregrine Falcon is stated, and correctly so, to appear "*annually* in spring and autumn on its migratory course." Then why not have placed it in the former list, instead of the Goshawk, which is scarce and accidental? The Honey Buzzard, according to Mr Hunt, is "occasionally met with in all the summer months, and *regularly* visits us [Thetford] in autumn, but it does not breed here." The first part of this paragraph is certainly correct as regards the county of Norfolk, but I know of no record of this species having been killed about Thetford, and consequently for its *regularly* visiting that locality in autumn, I should extremely like to know Mr. Hunt's authority. The Wood Warbler, again, appears amongst the rarities, yet is described as "a *regular* summer visitant, though not numerous," and being strictly an arboreal species, it was needless to add that it "*mostly* inhabits our woods." In like manner the Woodlark, which, though in small numbers, breeds regularly in certain localities in the neighbourhood of Thetford (being now-a-days almost entirely confined, through enclosure and cultivation, to the western side of the county) figures in this instead of the previous list, and is described as placing its nest "in similar situations to the Skylark." A strange comment upon the peculiar nesting habits of this particular species.

As before remarked, the Grey Wagtail, which regularly visits the banks of the river "Thet" in spring and autumn, is not included in the list of "natives and migrants," but the Grey-headed Wagtail, we are informed, is "*occasionally* seen on our warrens," though the statement is further qualified by the remark that "it is a rare bird in this district." So rare that at present only some half-dozen specimens are known to have occurred in Norfolk, and those, with but one exception, by the sea coast.

Scarcely less startling, also, is the announcement that Richard's

Pipit has "*occasionally* been seen both here and by the sea-coast." Will Mr. Hunt kindly supply the authority for this statement, as at present I am aware of but five examples of this rare Pipit having been seen in Norfolk, all of which were shot near Yarmouth. The Rock Pipit, included in the same paragraph, as "occasionally seen" about Thetford, may certainly have appeared there on its migratory course, as it has in the vicinity of Norwich, and the fact, if well authenticated, would be interesting; as well as further information as to the Lesser Spotted Woodpecker breeding and remaining, throughout the year, in that locality. Why the familiar Wryneck should rank with the Hoopoe and other accidental stragglers it is difficult to say, or why the Kingfisher should be classed in a similar manner, though described as "*now* frequently observed by our rivers, both in winter and summer, and generally breeds here." Considering its great persecution of late for the plume trade, I should have presumed that at Thetford, as elsewhere, this beautiful species would be found more scarce *now* than formerly.

Not a line is devoted to the past history of the Great Bustard, as a denizen of that very portion of the "Breck" district, nor is Mr. Bartlett's specimen of the Little Bustard, killed on the Warren, and still preserved at "The Canons," recorded amongst the rarities of that neighbourhood. Instead, however, I find amongst the brief notices of Grallatorial species the following strange announcements with reference to both the familiar and rarer kinds. Pallas's Sand-Grouse, unknown at Thetford, and (with the exception of a single bird killed near Lynn, in 1859) unknown in any part of Norfolk till the spring of 1863, and in no instance since that date—according to Mr. Hunt, "*occasionally* visits this locality." The Dotterel (*Charadrius morinellus*), a mere passing migrant, which breeds nowhere in England, is described as a "summer visitor, *occasionally* remaining to breed," whilst the Ringed Dotterel (*Charadrius hiaticula*), the most remarkable bird on the Thetford warren, owing to its habit, from time immemorial, of quitting the seashore in spring to rear its young far inland upon these dreary wastes, is described by this local historian as "an *occasional* summer visitant, and builds *in the fens*." The same authority, moreover, informs us that the Kentish Plover, Little Ringed Plover, (which has never occurred in Norfolk), and the Sanderling, all essentially shore birds, are "rarely seen here," but under what accidental circum-

stances, if at all (?) is not stated, and in like manner the Turnstone and Oyster Catcher are said to be "rarely found to visit this district."—So rarely, that I scarcely hesitate to assert they never have!! The Lapwing which, though in greatly diminished numbers, breeds annually on the warren, is only said to do so "*generally*," and the Norfolk Plover or Stone Curlew, which also still breeds there—as it did two hundred years ago, when Sir Thos. Browne of Norwich received one, in the flesh, "from about Thetford," and forwarded a drawing of it to his friend and brother naturalist, John Ray—is alluded to in the briefest form.

This fine species, however, is amply avenged for any slight experienced in the natural history portion of this volume, since in the chapter, (p. 265), on "Fossil remains found at Thetford," Mr. Hunt first quotes, as follows, from the work of Thomas Martin, "The historian of Thetford:"—

"Mr. Ray, in his preface to his *Collection of English Words*, printed in London, 1674, makes mention of a stone curlew, [Sir Thos. Browne's] which was found near Thetford, it had a remarkable eye, somewhat resembling that of a green plover."

And then adds, in a foot note,—by way of explanation and apology for Martin, whose "attempt," as he describes it, "in this important and interesting branch of science was so little successful," and whose "failure may be in great part accounted for from the fact that the science itself, in his time, was little known or understood:"—

> This story of the "Stone Curlew" with its "remarkable eye" is a most marvellous one, and I fear, not founded upon careful observation. No doubt it was a peculiarly shaped flint, of which, there are a great many in our chalk pits. It must have been a remarkable eye that saw the fossil *curlew*.

Further comment is unnecessary when an author's knowledge of his subject thus falls short of the intelligence of any local shepherd or warrener.

XI.

MISCELLANEOUS NOTES AND OBSERVATIONS.

On the pellets thrown up by Rooks.—The fact that hawks and owls, indeed, all members of the raptorial order,—having no true gizzard, throw up, in the form of pellets, the indigestible portions of their food, is well known; but that this system is adopted by the rook (and I have reason to believe by the jackdaw as well) will probably be received by our members as a new light, in the economy of so familiar a species.

When at Cromer, during the months of July and August, 1870, my attention was first drawn to this point by Mr. H. H. Upcher, who brought me from Sherringham several large, light-coloured pellets, which he had picked up on the cliffs in that neighbourhood, and which consisted, chiefly, of the husks of barley upon which the rooks had recently been committing much depredation. Naturally supposing that if these pellets were really ejected by rooks, the habit would by no means be confined to the birds of one locality, I searched the margins of the lighthouse cliffs, at Cromer, and there found dozens of them, always within ten yards of the edge of the cliff, and in such spots as I had seen daily frequented by rooks in some numbers. The largest quantity lay within two or three hundred yards of a barley field, on the Northrepps estate, and the feathers, both large and small, strewed about wherever pellets were visible, identified the rooks satisfactorily with these post-prandial deposits. The birds evidently, after a hearty meal of grain, retired to the smooth soft turf on the edge of the cliffs, and there lazily digested their food, other *excreta* invariably lying in juxta-position; whilst their leisure moments were devoted to the toilet, as shown by the feathers strewn around, and which, from the moulting condition of the birds, had been preened pretty freely from all parts of their plumage. Besides the

barley husks that formed the main portion, these pellets contained pebbles, some of large size, fragments of insects, chiefly wing-cases of beetles and in some instances (those taken at Cromer) minute portions of white egg-shells ; but from finding, close by, evidences of a recent picnic where hard boiled eggs had formed part of the fare, I have no reason in this instance, and so late in the season, to impute egg stealing to the birds in question.

On showing these pellets to a very observing gamekeeper on the Northrepps estate, he at once recognized them by the name of rooks, "Quids," and expressed his belief that wood-pigeons ejected similar though smaller pellets. It seems strange that this habit of so common a species should be so little known, another proof at least that British Ornithology is not an exhausted subject ; but with the exception of a note in the "Field," of August 11th, 1866, I know of no allusion to this fact in any work on Natural History.

Mr. James Barnes, however, the writer in the "Field" above alluded to, says : "I have for many years observed the rooks gleaning from our corn-fields and meadows immense quantities of food, secreting more than they can swallow in a pouch below the beak. They return to their roosting trees about five or six o'clock every evening, and there, amidst much noise and chattering, eject pellets of indigested food, consisting of the husks of corn and grass, earwigs, beetles, legs and wings of various moths, stones, pieces of lime, &c." Some of these pellets sent to the editor also contained numerous cherry stones, snail shells, skins of wireworms, and bones of a small quadruped, perhaps a shrew-mouse.

I have never met with these *debris* in any rookery, when shooting the young birds in spring ; but possibly the coarse and more miscellaneous substances that form their autumn diet, obliges them, at that season more particularly, to adopt this method of easing their stomachs. The pellets I examined measured generally from two inches to two-and-a-half inches in length, shaped some what like a boy's "tip-cat," the circumference in the middle being within $\frac{1}{8}$th of an inch of the length. I have since found a tame jackdaw disgorge a portion of its very miscellaneous food in similarly shaped pellets, though very much smaller, and most probably the same habit occurs with that species in a wild state.

Mr. Upcher tells me he had once a tame jackdaw which took a

fancy to certain entomological specimens kept in his room, and if a drawer was left open where they were pinned out, he would swallow them, pins and all, but the remains were always thrown up afterwards in the pellet form.

Abundance of Quails.—The chief point of Ornithological interest, in Norfolk, during the past year, has been the extraordinary number of quails met with by sportsmen in the early part of the shooting season, exceeding anything of which we have any previous record. Of late years this species has unquestionably decreased in this county, except in the now drained district of our western fens, but during the summer and autumn of 1870, they would seem to have been scattered over the entire county, and in the fens alone at least two or three hundred birds were killed and over a thousand eggs taken.

From the records of late in Natural History Journals it is evident that this extraordinary influx was by no means confined to Norfolk, and an effort has been made by the Editor of the "Zoologist" to obtain, if possible, a "census" of the quails observed during the past year throughout the United Kingdom, in order to form some idea of the numbers bred in this country, and of their general distribution. As shown by Mr. Dix's note in the "Zoologist," (*S. S.*, p. 2394,) the numbers killed in Pembrokeshire and Cardigan far exceeded even those in Norfolk, but certainly no other counties have afforded any similar returns. As to the cause of so extraordinary a flight of these continental migrants, alighting on the shores of Great Britain and remaining also to breed in such unprecedented numbers, I cannot at present venture to hazard an opinion.

Henry Stevenson.

Notes from New Zealand. Taranaki.—The story you refer to about our small birds having diminished in consequence of being stung by bees, is not substantiated. This much is true, that many tribes of birds, such as bell birds, green paroquets

(fantails), fly-catchers (nearly allied to tomtits,) have disappeared almost entirely, and also the tui or parson birds are very much diminished. I believe it to be owing to climatic changes. The year of the war appeared the silver eye or blight bird, and they have come every winter (till this, in which few have arrived) in immense flocks, feeding on the apple trees. They are pretty birds, very active, like the long-tailed tomtit of England, but are allied to the canary, and breed by thousands in the Chatham Islands. This last summer for the first time a species of swallow was seen here, and went away. They evidently come from the Middle Island, like the silver eye, for they were seen by a passenger on the route on a steamer. It is very true that bees have increased enormously in the bush; but I cannot believe they have stung the birds in the bill, as reported, or starved them by eating up all the honey in the millions of honey-producing trees in the forest. The great fire, I wrote about three years ago, nearly destroyed them; four days dense smoke from burning evergreen trees, severely tried human lungs, so the bees must have suffered also, to say nothing of their homes being reduced to ashes for miles of country. Before the war, in 1860, there were thousands of swarms in the bush, and nearly everybody in the country kept ten to fifty hives, and used the honey instead of sugar for all purposes, yet the birds did not diminish nor did I ever hear of any one finding a bird suffering from a bee-sting, or a rata tree without honey in its flowers! I suspect that terrestrial commotions have, for a time, at least, altered our climate. Since our last great earthquake our winds have altered in intensity, frequency, and direction. Report states that a great disruption of Antarctic ice has taken place, which to me explains the frequency of penguins, mostly young, being among the rocks here, and the capture of two sorts of seals—the common seal and sea lion, both young—close to the town, though they have never been seen since this was a settlement. The natives say they were common before the Europeans came, and they still call certain rocks on the beach by the names of the sort of seal that once frequented them. Our earthquake troubles are not over, and Tongariro has emitted enormous quantities of ashes, cinders, and black smoke. It is said all the fish have been poisoned in one of the lakes at the foot of the mountain.

Cuttle-fish, like the minaur on the coast of Normandy, have been thrown up with eight arms four feet long, and a single row of suckers the size and shape of liqueur glasses with the foot broken off; were any boys to be caught while bathing by one of these larger ones (small ones are common and used for bait) they would be certainly drowned; for it is not easy to paralyse by cutting the ganglion at the junction of the arm with the head, as they do at Granville, (Normandy.)

Further accounts indicate that many of the birds above spoken of are returning to their old quarters during the past year.

—— —— *in a letter to the President.*

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