TRANSACTIONS

OF THE

Norfolk and Norwich

NATURALISTS' SOCIETY.

VOL. X.—Part II.

1915—16.

Edited by the Honorary Secretary.

NORWICH:

Printed by A. E. Soman & Co.,

1916.

(Issued to the Members for the year 1915-16.)

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1913 Williams Miss Margaret, Norwich
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1899 Woodward Dr. Henry, F.R.S., V.P.Z.S., F.G.S., *Hon. Mem.*, 13, Arundel Gardens, Notting Hill, W.
1907 Wormald Hugh, M.B.O.U., Heathfield, East Dereham
1911 Worthington R., Lowestoft
1903 Wright Miss Helen, Beech Close, Newmarket Road, Norwich
1902 *Wyrley-Birch W. E. G., West Bilney Lodge, King's Lynn

Y

1915 Yarmouth Free Library
1899 Young J. J. Baldwin, M.A., M.B.O.U., 25, Bank Street, Sheffield

The Treasurer in Account with the Norfolk and Norwich Naturalists' Society, Year ending April 27th, 1916.

Dr.

1915—16.	£	s.	d.
To Subscriptions	47	5	0
,, Additional Payments for Notices	0	4	0
,, Sale of "Transactions"	0	18	0
,, Sale of "Flora of Norfolk"	1	8	10
,, Transferred from Special Publication Fund	21	1	6
,, Transferred from Life Membership Fund	32	0	0
,, Interest on Life Membership Fund	1	4	1
	£104	1	5

Cr.

1915 16.	£	s.	d.	£	s.	d.
By Balance due to Bank				2	7	10
,, A. E. Soman & Co., Printing "Transactions," including "The Diptera of Norfolk and Suffolk"	67	17	6			
,, Goose & Son, Sundry Printing, Stationery, &c....	4	13	6			
,, W. Haydon, Bookbinding	3	4	9			
,, Fire Insurance	0	15	3			
,, Aircraft Insurance	0	15	0			
,, Postages	4	16	6			
,, Year Book of Scientific Societies	0	6	4			
,, Carriage of Parcel	0	9	2			
,, Norfolk and Norwich Library, for use of Room...	3	3	0			
,, Assistant Secretary's Salary	5	0	0			
				91	1	0
				93	8	10
,, Balance at Messrs. Barclays' Bank				10	12	7
				£104	1	5

SPECIAL PUBLICATION FUND.

Donations—	£	s.	d.
J. H. F. Walter, Esq.	8	8	6
Miss Alice Geldart	5	0	0
Robert Gurney, Esq.	3	1	6
J. H. Gurney, Esq.	2	9	6
Sir Eustace Gurney	1	1	0
Dr S. H. Long	1	1	0
	£21	1	6

	£	s.	d.
Transferred to General Account	21	1	6
	£21	1	6

LIFE MEMBERSHIP FUND.

1915.	£	s.	d.
To Balance in Norfolk and Norwich Savings Bank	52	0	0
,, Composition for Life Membership	6	0	0
,, Interest to November 29th, 1915	1	4	1
	£59	4	1

1915	£	s.	d.
By Transferred to General Account for Printing "Diptera"	32	0	0
,, Interest transferred to General Account	1	4	1
,, Balance in Norfolk and Norwich Savings Bank ...	26	0	0
	£59	4	1

ROBERT GURNEY, *Hon. Treasurer.*

ADDRESS.

Read by the President, MR. H. J. THOULESS, *to the Members of the Norfolk and Norwich Naturalists' Society, at their Forty-seventh Annual Meeting, held at the Norwich Castle Museum, May 11th, 1916.*

LADIES AND GENTLEMEN,

AT the last meeting of this Society, held a year ago, my predecessor in this chair mentioned his unique position in having to report that no meetings of the Society had been held during his year of office, and he expressed a hope—in which we all, I am sure, most heartily joined—that such a thing would never occur again. Unfortunately, during the past Session it has again been impossible for us to hold our monthly meetings: therefore I too have nothing to record with regard to the work of the Society.

During the year we have lost by death ten of our members, among them being Sir Peter Eade, M.D., who was one of the original founders of the Society, and who held the office of President in 1886-7; and Mr. John T. Hotblack, who held the same office in 1899-1900. We have lost two Life Members (Sir Thomas Fowell Buxton, Bart., and Mr. H. E. Dresser) and one Honorary Member (Mr. M. C. Cooke). I must also mention Mr. Jas. Mottram, who was one of the most regular attendants at our monthly meetings, and whose genial presence will be much missed when they are renewed, which we trust will be at no distant date.

INSECTS IN THEIR RELATION TO MANKIND.

It is customary on the occasion of the Annual Meeting of this Society for the retiring President to offer a few remarks relating to a subject connected with Natural History to which he has given some special attention, and as the study of Entomology has always interested me, and been the chief pursuit of my hours of leisure, I have selected, as a subject most suitable for consideration during the few minutes it will be my privilege to address you, the importance of the accurate and systematic study of Insect Life and its bearing on the health, happiness, and welfare of humanity. I do not propose on this occasion to deal with Entomology from the point of view of a hobby ; I will only say that even in this aspect Entomology is in the highest degree important. There is no greater relief from the worries and stress of ordinary daily life than a visit to marsh or wood in search of one's insect friends ; it adds a new interest to every country stroll, and makes a holiday doubly enjoyable.

In seeking for and collecting insects, it is obvious that to be successful one must observe their habits and their life-history, and this has paved the way for the more scientific study of those insect problems with which the human race is now faced. Without doubt practical science will be called upon to take a predominant place among our educational subjects in the future, and I venture to suggest that the practical and scientific study of Entomology must not be lost sight of in this connection. The ignorance at present existing around us with regard to insect life is quite astonishing. It is hard to persuade the ordinary person that the house-fly never grows up into a bluebottle, or that the large moth that flies through the open window on a summer evening is not intent on biting holes in the household clothes ; and how often do we find anyone whose house is troubled with flies or fleas who knows in what part of the premises these insects breed and multiply ?

In order that we may realise the stupendous influence that insects have on human life, I propose to bring to your notice a

few of the points on which we find men and insects in direct antagonism—and men are not always the victors. There are vast tracts of country on the globe, often exceptionally rich and fertile, in which white men cannot permanently live, and where even the native races only maintain their existence with difficulty, entirely as a result of insect plagues.

Fortunately, in this country the competition is not so severe; in fact, there are few regions on the earth in which vegetation is abundant, in which hostile insect life is so easily held in check, the comparative scarcity both of species and individuals being probably due to the fact that within a period very recent from a geological point of view our islands were more or less completely glaciated, thus destroying to a great extent, if not completely, our native fauna. When a normal climate again prevailed, the country was restocked from Continental Europe, where climatic conditions are altogether different from those on our islands, and comparatively few have been able completely to adapt themselves to the altered circumstances. As a result, insects are most abundant in the South-East of England, where the climate most closely resembles that of the Continent, and become fewer as we approach northward and westward, reaching their minimum in Scotland and Ireland.

We have, of course, the advantage, in common with all the colder regions of the earth, of a long period of winter, when vegetation is dormant. This naturally checks the undue multiplication of insect life; but it alone is not sufficient, for in most of the sub-Arctic countries of the world mosquitoes occur in vast numbers during the short summer period and are a most intolerable pest.

It is, however, in tropical and sub-tropical countries that the most serious struggle takes place between men and insects. In regions where the temperature is always favourable for active insect existence, and where vegetation abounds, they are able to produce an uninterrupted succession of broods during the year and are humanity's most serious foes. We must remember that insects are in the struggle for existence the most successful class of animals: they far outnumber, both in

species and individuals, any other class, except the lowly-organised microscopic forms. Their adaptability to their environment is marvellous; they are found everywhere on land and in fresh water; their food ranges over every imaginable description of organic material, living or dead; they are extremely prolific, and often multiply with such bewildering rapidity that man needs the utmost vigilance to keep certain harmful species within reasonable bounds. If it were not for the fact that they have many natural enemies, and especially that vast numbers of insects feed on other insects, it is questionable whether man could exist at all.

The first and most obvious danger from insects is in connection with man's food, and the crops which he cultivates to supply his various needs. There is absolutely nothing that is safe from their attacks, and in spite of every care a very heavy toll is paid year by year to these insidious foes. John Curtis wrote many years ago, in his well-known book, "Farm Insects," as follows: "Insects annually consume an amount of produce that sets calculation at defiance, and, indeed, if an approximation could be made to the quantity thus destroyed, the world would remain sceptical of the results obtained, considering it too marvellous to be received as truth." This is as correct to-day as in Curtis' time. We have, however, learned much with regard to their life histories, and are therefore better able to deal with the trouble, but much still remains to be learned.

Probably if one were asked to name the most destructive insect the world produces, the first answer would be "The Locust." Possibly it would not be wholly correct, but at the same time there is no parallel to the destruction wrought by a swarm of locusts, so sudden and so complete. We are told in the wonderfully graphic and poetical description of an invasion of locusts given us by the prophet Joel—"The land is as the Garden of Eden before them, and behind them a desolate wilderness." When they settle down on a tract of country they do not leave it until they have devoured every green leaf of tree and herb, leaving it as bare as if it had been destroyed by fire. Locusts are nothing more that gregarious grasshoppers; most

of them, like the ordinary European *Œdipoda migratoria*, or the Eastern *Œ. cinerascens*, are larger than any species we possess in Britain. Small species may, however, be equally destructive if sufficiently plentiful, as in the case of the North American locust, *Caloptenus spretus*.

In the Old World, locusts range from Spain and the South of France in the west, through Southern and Central Russia, to China; and most districts south of this line are at times subject to their ravages. When the Island of Cyprus was taken over by the British in 1878, it was found that locusts were extremely plentiful and destructive. Steps were taken by the Government to reduce their numbers, and in one year it is estimated that something like 1,300 tons of locust eggs and twenty-two thousand millions of the insects were destroyed in that island.

At the present time the country most subject to the attack of locusts is South Africa, where *Pachytilus sulcicollis* is a terrible pest to agriculture. It occurs in vast swarms, often with a frontage of 15 to 20 miles and a depth of 60 to 70 miles. As they fly, the sky is blackened and the sun almost blotted out. The female produces two or three little packets, each containing 40 or 50 eggs, which she lays in the ground. They do not hatch until the rainy season commences, when vegetation is plentiful; the larvæ then appear in vast swarms, and are as destructive as the perfect insects. Steps are now taken by the South African Government to cope with the pest. There is a central bureau in which a record is kept of the progress of each swarm; farmers are warned of their approach, and are able to take steps beforehand for dealing with an invasion.

The world's great food crop, wheat, is subject to the attack of many insect foes; its roots are frequently damaged by wireworms, which are the larvæ of various skipjack beetles, chiefly the three species of Agriotes—*A. obscurus*, *A. lineatus*, and *A. sputator*. The leaflet issued by the Board of Agriculture informs us that the chief culprit among these beetles is without any doubt *Agriotes lineatus*; but I scarcely think it can be the case in Norfolk, as I have collected beetles

here for many years and have seldom met with it, although the other two species are common. Not only wheat, but also nearly every cultivated crop falls a victim to these voracious larvæ; they are particularly difficult to deal with, as they live for at least three years underground, and, feeding as they do equally well on anything growing on the land, no relief is obtained by the usual rotation of crops. I may mention that the term "wireworm" is often rather loosely applied, and may include a great variety of underground feeders, such as the larvæ of various species of daddy-longlegs (Tipula), and even the larvæ of the cockchafers (*Melolontha vulgaris*, *Rhizotrogus solstitialis*, etc.

The most noted pest of wheat, and one of the rivals for the unenviable position of the most destructive insect in existence, is the Hessian Fly (*Cecidomyia destructor*), a minute, gnat-like creature, one-tenth of an inch in length. Its ravages are not confined to wheat, as it sometimes attacks barley and rye, but wheat is its favourite food. It appears to be indigenous to Europe, but has now spread to every part of the world, the pupæ being carried about in the straw used for packing goods, etc. The name Hessian Fly was given to it by the Americans, as they believed—apparently with good reason—that it was introduced to the New World by the Hessian troops who were landed near New York in 1776, with straw used for their bedding. It there found a most congenial home, and has since taken a terrible toll of the grain crops, especially of the United States, sometimes to the extent of 50 per cent. It was very prevalent in 1900, when the damage in that country was estimated at £20,000,000; but even this was exceeded last year (1915), when the whole district west of the Mississippi had the most severe visitation on record.

The fly occurs in this country, and in 1886 and 1887 was reported in 30 counties, but not in sufficient numbers to do serious damage. Very little has been heard of it here during recent years, but at any time it may increase in numbers, and careful watch should be kept for a creature with such appalling possibilities of mischief.

The egg is laid on the young leaves, and the resulting larva, a white, legless maggot, travels down the leaf and takes up its position between the leaf sheath and the stem of the plant. Here it feeds on the surrounding tissues until full-grown, when it changes to a pupa, from which the fly emerges in due course. There are from one to six annual broods, according to the temperature.

When the ripened grain is harvested and stored it is still subject to many enemies. The most troublesome are the two species of Grain Weevils (*Calandra granaria* and *C. oryzæ*). The latter was originally known as a devourer of rice, as its name implies, but I have several times met with it plentifully in wheat and maize. The females of both species bite a hole in the grain of corn and deposit an egg. The little white larva devours the substance of the grain and then changes to a pupa in the interior. The perfect insect appears about ten days later. They are extremely prolific, and the amount of damage done is often prodigious before the mischief is suspected, as the infected grain appears sound to the eye, whereas it is nothing but a shell.

The so-called Weevil of the sailors (*Anobium paniceum*) is not actually a weevil at all, but is very closely related to the Death-Watch Beetles. Its larva feeds on every description of dry vegetable or animal material, such as grain, meal, flour, ginger, and skins. It is prevalent in ship's biscuit, and causes much trouble, especially when this is kept for a considerable time for use during long voyages. The commonest Death-Watch Beetle is *Anobium domesticum*, which is responsible for most of the damage done to worm-eaten furniture in our houses. It attacks wood of almost every description, especially pieces in any way soft or sappy, and particularly beech, which seldom long escapes its attentions. The beetle is dark brown in colour and about one-sixth of an inch long. The eggs are generally laid in the old burrows, and produce white curved larvæ, which feed on the surrounding wood and gradually reduce it to a mass of dry dust; they pupate in the wood, from

which they emerge only in the adult stage, when they produce the small round holes we so often see in old wood.

It is not dead wood only that is attacked by beetles; many feed on the living tree. In Britain most mischief is done by *Hylesinus crenatus* and *Scolytus destructor*, the former to ash trees and the latter to elms. The life history of these and allied species is of great economic interest, as the ravages that the beetles commit are often most serious, whole avenues of fine trees being sometimes ruined by their devastations. There are at present some ash trees on Earlham Road, Norwich, which have been attacked by Hylesinus; one is already dead, and a similar fate will probably in course of time overtake the remainder. In the case of both these species the female beetle bores a straight gallery between the bark and the wood, laying eggs as she progresses. Each young larva starts feeding at right angles to the parent gallery, but still in the same layer. The result is that each brood absolutely destroys a considerable patch of the vitally necessary cambium structure of the tree. In course of time these patches coalesce, cutting off the circulation of sap, with fatal results to the tree.

Very destructive beetles are the various species of Dermestes; the larvæ of *D. lardarius* feed on ham, bacon, dried meat, horns, skins, etc., and do much mischief where food products are stored. Another species, *D. vulpinus*, prefers hides and furs, and is very plentiful in the London warehouses. Professor Westwood mentions that at one time the London merchants offered a reward of £20,000 for an available remedy, without, however, a satisfactory result.

Before leaving the beetles I must mention one which is at present causing a greater pecuniary loss than any other, namely, the Cotton-boll Weevil (*Anthonomus grandis*). This is one of the newer pests, as it was not until 1885 that it was noticed, in Mexico, feeding on cotton. In 1892 it was detected in Texas, and has since spread over almost the whole cotton-growing region of the United States. The loss it has caused has been enormous, and urgent steps have been taken by the American Government to deal with the pest, but so far without much

result. It is said to be the most serious danger that has ever threatened any agricultural industry, and it is feared that in many districts the cultivation of cotton must be abandoned. The mother weevil bites a deep hole in the unopened flower bud, for which purpose her long rostrum is admirably adapted, and deposits an egg therein. The resulting larva feeds on the anthers and other portions of the flower, preventing its further development. There are generally four generations of these weevils during the year, and it is estimated that the progeny of one pair may amount to three millions in a single season. In the autumn the superfluous beetles take to flight and migrate in vast flocks in search of fresh feeding-grounds. They are able to travel great distances, and one can readily understand how it is that they have so rapidly overrun the whole cotton-growing area of America.

The genus Anthonomus, to which the Cotton Weevil belongs, has a very wide distribution, and several of the species occur in Britain. One of them, *Anthonomus pomorum*, the Apple-blossom Weevil, is numbered among our orchard pests. Its life history is very similar to that of the Cotton Weevil, but on account of the limited period during which its ordinary food, the apple, is in blossom, it is restricted to one generation during the year. The beetle appears during the first warm days of early spring, and bores a hole with her rostrum in the unopened buds of the apple, or occasionally pear, and deposits one egg in each blossom. The larva attacks stamens and carpels and soon causes the petals to wither, when the flower bud changes to a rusty hue and decays. The perfect weevil appears in about three weeks, escaping through a hole which it bores through the petals.

We have not in this country leaf-eating insects sufficiently plentiful seriously to menace our forests and woods, but on the Continent of Europe and in North America it is far otherwise. It is a curious fact that the most troublesome species in both the Old and the New World are familiar British insects, but in these islands they show little disposition to increase unduly. The Gipsy Moth (*Liparis dispar*) is one of the worst culprits.

The larva feeds on every kind of tree and bush. In France and in Central Europe in some seasons it is terribly destructive, stripping the fruit and forest trees of their leaves. Its worst ravages have, however, been in America, to which country it was taken about 1869 in the course of some experiments made for the purpose of discovering a substitute for the silkworm, as that insect was then in danger of extermination by disease. Certain of the Gipsy larvæ escaped from captivity, and the species rapidly increased in its new home, and about 1889 was recognised as a pest of the first magnitude, woods and orchards over a wide area being completely defoliated. Many millions of dollars have since been spent in America in dealing with this species, but it appears to be able to hold its own in spite of all attempts to exterminate it.

In Britain it was formerly locally common in the fens of Norfolk and Cambridgeshire, but now appears to be extinct in this country, in spite of the fact that large numbers of bred moths were turned out at various times, before it became illegal to do so. Mr. C. G. Barrett quotes in the Lepidoptera Supplement of our Transactions (1873-4, page 14) a most interesting account of a visit by Curtis to Horning about 1830, when he discovered this species plentiful on *Myrica Gale*.

A second moth I will mention is *Porthesia chrysorrhœa*, the Brown-tail Moth. The larva of this species, like its common relative *P. auriflua*, the Gold-tail Moth, ordinarily feeds on hawthorn, but in favourable seasons invades the orchards, sometimes, especially in France, to such an extent as seriously to damage the fruit-trees. This, like the Gipsy Moth, is rare in England, except on the coast of Kent and Sussex, where occasionally it is fairly plentiful. I have twice met with it in Norfolk, but have not seen it alive for many years. This species, too, by some means was introduced into America with most disastrous results, and rivals *Liparis dispar* in the mischief it has caused in that country.

A third moth with a bad record is *Liparis monacha*, the Black Arches, or, as it is called by the Board of Agriculture, following its German name, the "Nun Moth." This is fairly

common in woods over the south and centre of England, but is never very abundant. Its larva is a very general feeder, and is one of the few species which thrive equally well on broad-leaved and coniferous trees. Its depredations have been most serious in the spruce and larch forests of Southern Germany, where, during recent years, many thousands of acres of forest have been entirely destroyed.

I have mentioned these three moths as they have been selected for special treatment by the Board of Agriculture and Fisheries under powers conferred upon them by the Destructive Insects and Pests Act of 1908. The Board has made an Order requiring the occupier of premises to notify the presence of any of these species to an inspector appointed for that purpose. I cannot think the selection is a very happy or practical one: all three species have occurred sparingly in this country from time immemorial and show no tendency to increase. We have some really destructive moths, but there is no legal obligation on the part of the occupier to notify their presence or to take any steps to prevent their increase. The specimen of *Liparis monacha* which I have included among my exhibits was found by me sitting on the hedge-bank of a Devonshire lane last August. If I had been the occupier of the premises I should have been required under a penalty of £10 to notify the fact to an inspector, who would have been obliged to report to the local authorities in order that the matter might be investigated. In this case probably there would have been little result, as the neighbourhood might have been searched for days without a second specimen being seen.

The first insect to receive attention from Parliament in this country was the Colorado Beetle (*Doryphora decemlineata*). It had long been known as a destructive insect in the United States, both the beetle and its larva feeding on the leaves of the potato. Living beetles were accidentally introduced into this country in 1877, and a Destructive Insects Act was hastily passed for its benefit. It is, of course, right that every precaution should be taken to prevent a destructive insect obtaining a footing in this country, but probably the danger

is not great, as there is little tendency for American insects to become naturalised here. It is rather remarkable that whereas in America the most troublesome insect pests are species introduced from Europe, the reverse is not the case; the only notable exception being the Phylloxera of the vine, which is supposed to be a native of the United States, although it is rather a curious fact that it was not known there as a destructive insect until it was re-introduced from France. We are rather disposed, unjustly, to attribute our pests to America, as, for instance, in the case of the Woolly Aphis of our apple-trees (a species allied to the Phylloxera), which we call American Blight, although it is indigenous to Europe.

One very troublesome American insect was introduced to South Africa during the Boer War from Argentina, and has since spread considerably, and seems destined to become the greatest household pest there, as is already the case in the warmer parts of the United States. I allude to the Argentine Ant (*Iridomyrmex humilis*). They have been known in the United States for about twenty years, but only recently have become widespread and really troublesome. Their nests are in fields and gardens, but they invade houses in myriads and swarm over every kind of foodstuff. They are an intolerable nuisance to human beings, as they crawl all over one's body, biting viciously with their powerful mandibles. They do much damage to fruit and crops, and in addition have the unfortunate habit of cultivating Aphides and scale insects, for the sake of the sweet juices they obtain from these creatures. The ants not only protect them from their enemies, such as ladybirds, but in stormy weather construct shelters of earth to preserve them from harm. They also carry the pests from plant to plant, materially increasing their opportunity for mischief. The relation of our British ants to Aphides is a subject that deserves the closest attention. The life-history of many of our Aphides, which are probably our most destructive insects, is not altogether clear; how the mature females reach in spring the trees and bushes on which they feed is not known. It is strongly suspected that these insects have been cherished

during the winter by the ants, and that they carry them to a favourable situation to commence their destructive operations in the spring. I may mention that the Argentine Ant has several times been accidentally brought to Britain, and only last year was recorded from Enfield and Eastbourne.

The War is bringing very prominently before us another aspect of insects in relation to human affairs, namely, insects as human parasites. One soon discovers, on talking with men who have returned from the fighting line, that the prevalence of insect pests is one of the most serious troubles to which they are exposed. It is one of the attendant horrors of war, and has always been so. It implies no lack of personal cleanliness or attention; it is a necessary result of the peculiar conditions under which men live when carrying on a campaign. I was assured by a man on leave only a few days ago that the insect vermin troubled our soldiers more than the Germans. Not many species of insects are parasitic on human beings, but they are often plentiful as individuals, as under favourable conditions they multiply with prodigious rapidity. The best-known of these parasites and the one whose attentions it is most difficult to avoid is the Flea, well called *Pulex irritans*. It is not the only Pulex which will at times attack human beings, although it is the species of which man forms the usual and natural host. The majority of mammals, and many birds, are infested with fleas, but on account of the peculiar life-history of these insects they are almost entirely associated with animals which have a permanent home to which they retire for rest. Fleas are parasitic in the perfect state only, their larvæ feeding on decaying animal and vegetable material; therefore animals such as horses, oxen, deer, sheep, and goats, which in a state of nature would lead wandering lives, are almost entirely free from fleas, as in their case there would be little opportunity for the insects to reach their host on attaining maturity. Contrary to popular ideas, no flea is attached to monkeys, although in captivity the human flea will occasionally attack them. Monkeys often appear to be searching for vermin, but certainly it is not fleas they are seeking.

The human flea deposits its eggs all the year round, unless the weather is very severe, when it becomes torpid. It lays little batches of from one to five eggs, generally in the crevices between boards of the floor. These hatch in a few days into elongated white legless larvæ, which move about actively with the help of a series of bristles with which their segments are furnished. They are unable to take liquid food, but have a pair of powerful jaws, with which they eat any scraps of organic matter they meet with, such as lint, feathers, dead flies, or gnats. After feeding for about twelve days they spin a little cocoon, in which they pupate, and a few days later appear as perfect fleas. Under these circumstances, one can readily see the great advantage of adding such a material as carbolic acid to the water with which floors are washed, as it renders any material which may collect between the boards unpalatable to Pulex larvæ. In the case of the Cat Flea, the procedure is slightly different, as the eggs are laid among the hairs of its host; these adhere lightly and are easily shaken off and distributed. Cat Flea eggs may often be seen in considerable numbers on Pussy's favourite cushion; they have the appearance of minute oval pearls.

Fleas have the power of living, if necessary, for very long periods without food, and will often swarm in empty houses. Unlike the majority of parasites, fleas will often readily pass from one kind of host to another; thus *Pulex canis* and *P. felis*, which are ordinarily found on dog and cat respectively, will frequently attack man. It is even said that, in America, the former is more troublesome than *Pulex irritans*. In this propensity lies a great source of danger, as it has been shewn, as the result of the most careful investigation, that one of the most dreaded diseases, Bubonic Plague, is mainly carried to man by the instrumentality of fleas, which have bitten diseased animals, generally rats, and on their death have migrated to human beings. It is many years since we had a serious outbreak of plague in this country, but all through the Middle Ages epidemics occurred from time to time, the most serious being in 1349, in which year at least one-half of the population

of the country died of plague. The last great epidemic of this disease in England occurred in 1665, in London, when 70,000 persons succumbed in that city. Although we have been, to a great extent, free from the disease in this country for so long, terrible outbreaks have taken place in recent years in China, India, and elsewhere, and under favourable circumstances it may again invade Europe with its old violence. Several deaths from plague occurred in Suffolk in 1910, but fortunately the danger was recognised in time, and prompt measures were successfully taken to prevent its spread.

The rat has been associated with plague from early times. It was noticed that before an epidemic occurred among human beings there was great mortality among the rats, and we find that when this occurred special efforts were made to reduce their number. Thus, Defoe records that during the great plague of 1665 a prodigious number of rats were destroyed by poison. They suspected that the infection was conveyed from rat to man, but were unaware of the means by which it was carried, and it has only been shewn during recent years beyond doubt that the flea is responsible. It has been found experimentally that the human flea is capable of carrying the disease from man to man, but it is thought that in practice this does not often occur; it is brought mainly from the rat.

In the home of the plague in the warmer parts of Asia the Black Rat (*Mus rattus*) is the means of spreading the disease. This is essentially a domestic species, living in houses in the closest association with man, which circumstance adds greatly to the danger. This species abounded in England during the Middle Ages, but is now scarce in this country, its place being taken by the Brown Rat (*Mus decumanus*), which first made its appearance here about the middle of the 18th Century. This latter is a far larger and more objectionable creature, but at least it has the advantage that it avoids the company of man as far as possible, and ordinarily only visits houses for marauding purposes, preferring to live in sewers, fowl-houses, or grain-stacks. Under these circumstances the danger of infection is much less than in the case of the Black Rat. Our

comparative freedom from Plague in this country during the last two centuries appears to be in no small measure attributable to the disappearance of the Black Rat; it is the species which ordinarily makes its home on board ship, and travelling from port to port is liable to carry plague infection with it, and although individual specimens doubtless frequently land on our shores from vessels, for some mysterious reason they appear to die out without being able to make their way far inland.

The great conveyer of plague in India and the East is a flea called *Xenopsylla cheopis*, which was originally described from Egypt but is now found to be the commonest rat flea in all the warmer parts of the earth. It does not flourish in temperate and cold climates and is rare in England. It is a small species and very pale in colour. The flea that commonly infests our rats is *Ceratophyllus fasciatus*, a species considerably larger than the human flea. If we were unfortunate enough to have a visitation of plague, this species would without doubt be the carrier of the disease from rat to man. The two specimens exhibited were from a black rat I captured in Norwich, but they equally occur on the Brown Rat. The exact method by which the infection of plague is transmitted is not absolutely clear. Unlike many diseases which are known to be carried by insects, the Plague bacillus does not appear to require the flea in which to undergo any part of its life cycle. Probably the disease organisms are carried mechanically in the fæcal matter which the flea always voids while feeding, and they are unconsciously inoculated into the puncture the flea has made by the scratching of the victim in attempting to allay the irritation which the bite sets up.

There is an American flea which is more truly parasitic than those to which we are accustomed. It is called the Chigoe or Jigger (*Dermatophilus penetrans*). It has been introduced into Africa, where it has spread from the West Coast to the East. Very strict precautions have been taken to prevent its introduction into India, as it would be a terrible pest among the bare-footed millions of that country. The female

Dermatophilus embeds itself beneath the skin of its host, generally around the nails of the toes, causing a painful swelling. The tip of the abdomen is left projecting and the eggs are dropped as the host walks about. The resulting larvæ do not feed on blood, but, as in the case of the ordinary fleas, on decaying organic matter.

Far more troublesome to our men in the trenches than the fleas are the various species of lice. Three species are known to be parasitic on human beings—*Pediculus capitis*, *P. vestimenti*, and *Phthirius inguinalis*. Unlike the fleas, they are true parasites during the whole course of their existence, feeding on the blood of their host from the time they leave the egg until the end of their life. Lice are restricted to mammals and to one species only; they appear unable to exist on any other. The so-called lice of birds are not closely related, and are feather-eaters and not blood-suckers like the true lice. Lice are very widely distributed, and it is a curious fact that they vary in colour, being white, yellow, orange, brown, or black, according to the colour of the skin of the races of men they infest. The commonest of the species, at least in England, is *Pediculus capitis*, which occurs among the hairs of the head. The little pear-shaped eggs are laid singly, and are glued to the hairs of the host. They are more often seen than the adults, and persist long after hatching. When present in numbers they give the hair the appearance of being singed. The larvæ exactly resemble their parents except in size, and commence at once to feed on blood; they moult three times and attain maturity in about 18 days.

The species, however, which causes most trouble to our soldiers is *Pediculus vestimenti*—the Body Louse—which is a larger and more robust species than *P. capitis*. It only visits the body for the purpose of feeding, its habitat being the clothing which is in contact with the skin, and it is on this clothing that the eggs are laid. When feeding it remains anchored to the garment and does not voluntarily leave it. It has been found that newly-hatched larvæ perish in a day and a-half unless they can obtain food, and, unlike most parasites,

lice quickly die if not regularly fed. Under these circumstances one can readily see that they cause little trouble where the garments can be frequently changed and washed—conditions impossible to an army in the field.

The third species, *Phthirius inguinalis*, is smaller than the two others. It is much wider and has larger claws, and is supposed to bear a resemblance to a crab, from which circumstance it obtains its common name of Crab Louse. Like *P. capitis*, it is attached to the body of its host and not to his clothing. Lice are not only disgusting pests, affecting the health by causing loss of rest, but they are known to be carriers of most serious diseases, especially the dreaded typhus. During the present war this disease has caused much mortality, especially in the Serbian Army and in the German prison camps, and an outbreak has always coincided with an abnormal abundance of lice.

Another parasite which has troubled our soldiers, especially when living in wooden huts, is the Bed Bug (*Cimex lectularius*). Unlike the other parasites we have considered, which during the Middle Ages were much more plentiful in this country than at present, the Bug is a comparatively recent importation, and appears to have reached our shores from the East during the 16th Century, and even later was long restricted to seaport towns. The English word Bug is much older than the insect, and originally implied something mysterious and terrible. From the fact that this name was given to the insect, one can realise the horror with which the new household pest was viewed.

The body of the bug is extraordinarily flattened, enabling the insect to pass readily into crevices of boards or furniture. In such a situation it remains hidden during daylight, not emerging, as a rule, until late at night, and disappearing before daybreak. The bug has no fixed period of the year for breeding, except that it becomes dormant when the weather is very cold. It lays batches of from 5 to 50 pearly-white eggs in the crevices in which the insect hides. The larvæ are shaped like their parents, but are at first very small and pale

yellow in colour. Their rate of growth depends entirely upon the food supply available. They feed once only after each moult, and unless they do so the following moult is indefinitely postponed. Under favourable circumstances they moult each eighth day and attain maturity after five moults. Bugs can live a very long time without food, and if confined in a box will often remain alive for a year or more. Like fleas, they sometimes swarm in empty houses, waiting for an opportunity of obtaining food. As is the case with almost all parasitical insects that feed on blood, however, the female is unable to produce fertile eggs except after a full meal.

More dangerous to health than the insects just mentioned are the various species of Diptera, or two-winged flies. Vast numbers are blood-suckers, and many more are mechanical carriers of disease. This latter aspect of danger from flies was forced upon us during the South African War. We all remember the terrible devastation among our soldiers owing to enteric fever, which caused more deaths than the weapons of the enemy. Careful investigation showed that the fever was spread mainly by flies, which alighted on infected material, portions of which they carried on their feet to the food supplies, or direct to healthy persons. The experience gained in the South African War led to very stringent precautions being taken in the greater war now raging. Flies have been plentiful enough in the trenches, but in the Western theatre of war, at least, enteric has not been very prevalent.

It is not under war conditions only that flies are a nuisance and a danger; they have been shewn to be great carriers of disease in all parts of the world. In this country they are responsible very largely for the spread of that most fatal disease of children, infantile diarrhœa. The mortality from this disease is chiefly restricted to the months of July, August, and September, and this peculiarity was formerly attributed to the high temperature then ordinarily prevailing; but it has long been known that a spell of hot weather early in the summer has not the same fatal effects. It has now been shewn that the prevalence of the disease is dependent, not on the temperature,

but on the abundance of *Musca domestica*, the common House Fly. This species is seldom seen in this country between October and June, but becomes very plentiful about the middle of July, continuing so until the first chilly days of Autumn, when they appear to lose their vitality and die in large numbers, often owing to the attacks of a parasitic fungus called *Empusa muscæ*.

So little has the true nature of the House Fly been understood, that, at least until quite recently, it has been afforded some amount of protection in the household; children have been warned not to kill flies, as they were harmless and useful creatures, and so little attention did they receive that, in spite of their abundance, practically nothing was known of their breeding habits. When we became alive to the terrible possibilities for evil lurking in the fly, investigation was set on foot to learn more of its life-history, and we now know that it breeds in accumulations of putrid and decaying animal and vegetable matter, such as house refuse, stable manure, and garbage generally. The eggs are laid in this material, and under favourable circumstances hatch in a few hours into maggots. These become full-grown in about three days, when they change into brown, barrel-shaped pupæ. From these, in a further three or four days, the perfect flies emerge. These spend the remainder of their existence in flying alternately between the scenes of filth and putrefaction in which they breed, and the pantry, often ending their existence by drowning in the household milk, which circumstance appears to be the most usual method by which the infection of infantile diarrhœa is conveyed to children. It is often said that flies play a very useful part in the economy of nature as scavengers, but it cannot be too strongly insisted upon that in a civilised country this work should not be left to the flies; to do so is to risk the health and welfare of the community.

As the House Fly does not possess a biting mouth, it is unable to introduce disease germs direct into the blood, but in the case of the numberless blood-sucking flies a fresh and a very serious danger arises, as they can do so with the utmost

facility, and it has been proved without doubt that this is the means, and the only means, by which many of the most fatal diseases are spread; and this knowledge has completely revolutionised our ideas with regard to these diseases and our methods of combating them. It was some 40 years ago that a suspicion was first aroused that mosquitoes were responsible for transmission of disease, and it may be interesting to recall the circumstances, especially as they paved the way for far more important discoveries which followed in connection with the transmission of malaria, yellow fever, and sleeping sickness.

There is a common tropical disease called Filariasis. In bad cases the limbs of the sufferer permanently swell to an enormous size, when it commonly goes by the name of Elephantiasis. It was found that the blood of persons suffering from this disease contained an enormous number of extremely minute worm-like creatures, and it was later discovered that these were the embryo or larval forms of a parasitic worm which took up its abode in the lymphatic vessels of the human subject. This worm is called *Filaria bancrofti*, after its discoverer, and is comparatively large, being three to four inches in length. Careful observation shewed that the minute larval worms did not continue their development in the blood in which they were found, but were evidently waiting transmission to a fresh host; but there was nothing to shew by what means this transmission took place. One very curious point was noticed, that the parasites were only present in the blood near the surface of the body during the night; they were absent during the day, evidently retiring then to the larger and deeper blood-vessels. This suggested the possibility that the carrier was a night-feeding mosquito. Careful observation proved this to be the case. A small species closely related to our common house gnat, and called *Culex fatigans*, was examined, and in its stomach the parasites were found; here they rapidly increased in size and developed a further stage towards mature worms.

It will be remembered that in 1893 the late Mr. H. D.

Geldart exhibited before this Society some slides of Filariæ found in the blood of a Norwich gentleman who had resided in India, and read a paper describing fully the life-history of the parasite, which paper was published in Vol. V. of our Transactions. It was thought at that time that the next stage of the worm's life was passed in water, the gnat going to a pond to lay her eggs and ultimately falling in and dying. It was stated that the worms escaped from the body of the dead mosquito and swam about in the water until they were swallowed by man, in whose body they reached their final stage, when eggs were laid which produced another generation of Filariæ in the blood. It is now known that the disease is not transmitted with drinking water, but that the parasites, after developing in the body of the mosquito, travel through its muscles to the proboscis, from which they pass direct into the blood of the next man from whom the mosquito takes a meal.

As I have already mentioned, when it was shewn beyond reasonable doubt that mosquitoes transmitted filariasis, it was suggested that possibly they might be responsible for spreading other diseases, and especially that most terrible of all human diseases, malaria, and this has been found actually to be the case. In order to realise the importance of this discovery, one must remember that malaria in one form or another is stated to produce half the entire mortality of the human race, being responsible for something like five millions of deaths per annum in India alone. It has withheld from civilisation some of the richest and most fertile tracts in the world, and has rendered permanent colonisation of tropical regions almost impossible for the white races. It has now been ascertained that there is only one method by which this disease can be introduced into the human system, and that is through the bite of an infected mosquito belonging to the genus Anopheles. Why it is not carried by the closely-allied genera, which are equally bloodthirsty and apparently equally well suited for the purpose, is not known, but apparently the parasites do not develop in the digestive organs of any mosquito other than a species of Anopheles.

How little the nature of malaria was understood even twenty years ago can be seen in the descriptions of the disease then written. It was universally stated to be caused by inhaling the poisonous vapours which arise from the soil in certain districts. It will be remembered that the late Mr. Thomas Southwell read before this Society in 1884 a description of the Fen-lands, which was published in Vol. III. of our Transactions. He mentions the prevalence of ague, which is but another name for malaria, from which he had himself suffered, when a boy, at Lynn in 1841. Following the ideas then universally held, he attributed this special outbreak to the cutting of a canal diverting the river Ouse near the town. He states:— "Marshes are not as a rule dangerous when abundantly covered with water, and it is only when the water's level is lowered, and the saturated soil is exposed to the drying influence of a high temperature and the direct rays of the sun, that the poison is evolved in abundance; the circumstances were therefore at that time most favourable for the dissemination of the malarial germs, not only the freshly-turned soil and margins of the cut being exposed, but also the old bed of the river, which took many years to drain and bring into cultivation."

There is no more interesting record of practical entomology than of the steps which were taken to prove absolutely that man could live unharmed in the most malarious districts provided he was protected from the attacks of Anopheles, and on the other hand that a bite from an infected mosquito would cause malaria in a region where malaria did not ordinarily exist. I do not propose to give any details of these experiments, as the matter was most fully and ably dealt with by our Honorary Secretary shortly after they took place, and full particulars will be found in Vol. VII. of our Transactions. The experience of the last 16 years has shewn us the vast importance of our knowledge of the method by which malaria is spread, and in many places marshes have been drained and other methods adopted in the neighbourhood of towns in which the disease prevails, whereby the number of mosquitoes has

been reduced. Precautions have, moreover, been taken to prevent the insects entering the houses, and as a result the mortality from malaria has locally been enormously reduced. I will mention as a case in point the City of Washington, which was formerly notoriously malarial. Near the city were extensive marshes in which Anopheles abounded. These marshes have now been drained and the breeding-places of the mosquitoes destroyed, and as a result malaria has practically ceased to exist there.

Malaria formerly extensively prevailed in this country, but has practically disappeared within very recent times. Whatever the cause may be, it is not the absence of *Anopheles maculipennis*, the special carrier of malaria in this part of the world. My experience is that this species is not uncommon, even in Norwich. The two specimens I am exhibiting were caught in my own house on the same day two or three weeks ago. I made a short stay last August in the village of Exminster, in Devonshire, and there I found this species abundant. On one occasion I counted six specimens in the booking-office of the railway-station, which is situated on the borders of the Exe marshes, and in the house where I was staying they could always be found. In fact, I went round each day with a net to destroy them, as, quite independently of malaria, they are most bloodthirsty creatures, inflicting a painful and troublesome wound.

I do not think it is sufficiently realised that there is a real danger of a recurrence of malaria in this country. It formerly was a terrible scourge, and may be so again. Certainly large numbers of our soldiers will return home with malarial parasites in their blood, and as the parasites remain alive for many years, these men will be a source of danger if resident in a district where Anopheles is plentiful. This has happened recently in parts of Holland, where malaria is much more common than formerly.

In connection with the occurrence of malaria in Britain, it is interesting to recall that on one occasion, at least, it profoundly affected English history, in causing, at a very critical moment,

the death of Oliver Cromwell, who had previously suffered very severely from this malady in both his Irish and Scotch campaigns.

Another terrible disease, for whose spread a mosquito is exclusively responsible, is yellow fever, and, curiously enough, it is one species only, the notorious Tiger Mosquito (*Stegomoyia fasciata*), easily recognised, as its names imply, by its conspicuously striped appearance. Unlike Anopheles, which is a night feeder, Stegomyia bites equally by day and night. It is plentiful over the whole tropical region of the earth, and is essentially a household species, living in human dwellings and feeding by preference on human blood. The larvæ, like all Culicidæ (the family to which gnats or mosquitoes belong) are aquatic. Those of Anopheles prefer clear pools, whereas Stegomyia is found in any odd receptacles for water around or even in the house; water-butts, tins, jars, or troughs are their usual breeding-places, and it is astonishing how small a hollow filled with water, perhaps by rain, will soon be tenanted by numberless Stegomyia larvæ.

The specimens of Stegomyia I am exhibiting came from Pará, a town formerly subject to serious visitations of yellow fever, but, thanks to the precautions taken since the method of infection was discovered, no case has originated there since May, 1911. The same result has occurred in Havana, New Orleans, and other towns where formerly the disease was rampant. The plan adopted is to reduce the number of mosquitoes by destroying the breeding-places of the larvæ and isolating yellow fever patients in mosquito-proof hospitals, thus preventing the insects becoming infected.

The most striking experiment which has ever been made in dealing with insect pests has recently been carried out by the American Government in connection with the cutting of the Panama Canal. It is notorious that the French failed to carry out the scheme, not so much on account of the engineering difficulties, as from the terrible mortality among the men engaged in the work through malaria and yellow fever—a mortality they were unable to combat, as at that time the

method of infection was unknown. When, in 1904, the American Government took the matter up, one of their first steps was to deal with the insects carrying these diseases. It was a matter of great difficulty, as the district involved, 500 square miles in extent, is largely covered with swamp and forest and rank tropical vegetation, and has a climate admirably suited for the rapid multiplication of mosquitoes. Over 1200 men were employed on this work alone, at an annual cost of 2,000,000 dollars, being more than 5 per cent. of the total cost of the Canal. This army of men was employed in seeing that no water about the dwellings was left exposed, in destroying the natural breeding-places of the mosquitoes by drainage or spraying with petroleum, and in burning the rank herbage among which the adult insects rest. The result was eminently successful, and yellow fever has been practically exterminated in the Canal zone, and malaria has been much reduced. Yellow fever occurs in the tropical parts of America and in West Africa, but is unknown in Asia. If the disease were by any means carried to that continent the result would probably be appalling, as Stegomyia abounds there in the warmer regions.

Another disease directly traceable to fly infection is the terrible sleeping sickness, but in this case the carriers are not gnats, but biting flies, similar to house flies in appearance, belonging to the genus Glossina, and called by the natives Tsetse Flies. Unlike Anopheles and Stegomyia, which are more or less cosmopolitan insects, the various species of Glossina are restricted to Western and Central Africa. Sleeping sickness has been known to exist in various places in West Africa for more than two hundred years, but its seriousness was not recognised until recently. Not many years ago Africa was peopled by innumerable hostile tribes, and travelling from one region to another was difficult and dangerous. Under these circumstances the disease remained within local limits; but when the continent came under European influence and travelling became general, sleeping sickness spread rapidly, and now it is devastating the country.

At first it was thought that one species only, *Glossina palpalis*, was capable of carrying the disease, and as this is very local in its distribution, and is only found in the neighbourhood of water, although its larva is not aquatic, it was hoped that the disease could be kept in hand by removing the whole native population from the so-called "Fly belts." Good results followed this course in Uganda and elsewhere; but the disease continued to spread, and soon Nyassaland and Rhodesia were badly attacked. It was found that here the blood parasites were not identical with those previously investigated; they were both minute, free-swimming Protozoa called Trypanosomes, but were evidently distinct, although closely-related species, and were equally pernicious. Representatives were sent by the Liverpool School of Tropical Medicine to Rhodesia to study the matter on the spot, and after much work they discovered that the carrier of the disease was another species of Tsetse Fly (*Glossina morsitans*). Unfortunately this fly is not confined to the neighbourhood of water like *G. palpalis*, but is much more widespread, being found over the whole country between the Sahara and Zululand, although more commonly in some districts than in others.

The Trypanosome causing sleeping sickness is not restricted to man; a bite from an infected fly transmits the disease to most domestic animals, especially horses, donkeys, goats, and dogs, causing an enormous mortality among them. The parasites are also present in the blood of a very large proportion of wild animals of every description, from elephants and lions to rats and mice, and are especially plentiful in the various kinds of antelopes. Whether the wild animals suffer seriously from the presence of the parasites in their blood is doubtful; the important point is that a suitable Glossina biting one of them becomes infective to human beings. There is no doubt that the sleeping sickness problem in Africa is a desperate one, and there appears little immediate prospect of a satisfactory solution. We cannot, as in the case of yellow fever, isolate the patients and prevent the flies becoming infected, as there is an inexhaustible source of infection available in the wild and

domesticated animals. It has even been suggested that the whole of these should be destroyed, but there are obvious objections to such a course, even if it were possible, and it is by no means certain that this would effect a cure. We cannot, as has been done with Stegomyia and Anopheles, by drainage or otherwise, destroy the breeding-places of the larvæ, as the Tsetse Fly nourishes its young within its own body, and the larva does not leave its mother until full-grown, when it at once pupates among dead leaves, in crevices of bark, or in any other suitable position into which it can crawl. Very careful investigation is being carried on with regard to the prevention of sleeping sickness, and it is most earnestly to be hoped that satisfactory results will follow. It certainly seems that the Tsetse Fly is at present the most serious insect danger facing the human race, and there is a real risk that it will cause almost a depopulation of a vast part of the African Continent.

In addition to these widely-distributed diseases, which are known to be spread more or less exclusively by insects, there are many mysterious local diseases in various parts of the world which are almost certainly transmitted in the same way. One of the most remarkable is the Verruga fever of the Peruvian Andes. It only occurs here and there among the deep valleys on the Pacific slope of the mountains, but in its special haunts it is terribly fatal. The wonderful Oroya Railway, which is carried from Callao and Lima directly over the Andes, up the great ravine formed by the Rimac River, traverses country in which verruga is especially prevalent. During the building of this line over 7000 workmen lost their lives mainly from verruga. The great bridge illustrated in View 15 of the booklet exhibited crosses the Verruga Ravine which has given its name to the disease; here the mortality is especially great. The actual carrier of verruga is uncertain, but there can be little doubt that it is a local species of fly or tick, for although extremely prevalent and infectious in certain places, it never spreads, and persons suffering from the disease, on leaving the locality, never transmit it to others. Ticks rather than flies have been suggested, as Tick Fever, a similar disease attacking cattle

AVOCET TURNING HER EGGS
Photo A. Burdet

AVOCET ON NEST
Photo A. Burdet

all over the world, is known to be carried exclusively by ticks.

In the limited time at my disposal I have only been able to touch on a few of the points in which insects come into conflict with man. I need not remind you that insects may be looked upon in another aspect. There are beneficial as well as harmful insects; they fertilise our fruit-trees and our flowers; they provide us with silk and honey, lac and cochineal, and are useful in countless ways. The point on which I wish to insist is that whether as enemies or friends, they deserve our closest study, and that in order to hold our own we must give them more attention than we have done in the past. Entomology has already furnished us with many surprises; can we doubt that many more are awaiting those who seek for them?

II.

A VISIT TO A DUTCH SANCTUARY, WITH NOTES ON THE BIRD-LIFE OF TEXEL ISLAND.

By Matthew Vaughan, M.A., M.B.O.U.

No lover of Nature can turn over the pages of a work like Lubbock's "Fauna of Norfolk" without feelings of the keenest regret that many of the most interesting birds that he describes are either extinct or on the verge of extinction, and this regret becomes all the greater when he reflects that this extinction has been brought about in many cases not by the advance of civilisation but by the destructive action of man. It is true that some species, like Savi's Warbler (*Locustella luscinioides*) and the Black Tern (*Hydrochelidon nigra*), have disappeared with the draining of the Fens, and however much we may lament their loss, we cannot help feeling with Charles Kingsley that it is "right and good that the great Fen should

have become instead of a waste and howling wilderness a Garden of the Lord"; but on the other hand there are spots in these islands where we might still listen to the boom of the Bittern (*Botaurus stellaris*) or watch the Ruffs (*Machetes pugnax*) at play in the springtime on their "hills," had not these birds been exterminated by wanton and persistent persecution.

When it is almost too late, men have awoke to a sense of their responsibility, and have begun slowly to realise the truth that the fauna and flora of their country are a national asset, a sacred trust committed to their hands, and that they are in duty bound to hold this trust for the benefit of generations yet to come. With this end in view, laws have been passed in these islands, in many countries in Europe, and in the United States of America, and this legislation has been attended with beneficial results, but far more good has been effected by the efforts of private individuals or of societies, who have established sanctuaries and appointed watchers to guard certain areas during the breeding season. As the result of these efforts, to quote but one or two instances, there are now flourishing colonies of Terns on the Farne Islands and many parts of our coasts, while in its last haunt in this Kingdom, the Red Kite (*Milvus milvus*), which a few years ago was represented by two, or at the most three, pairs, is recovering its numbers and extending its breeding range, so there is some ground for hoping that this noble species may hold its own in these islands for many years to come.

The idea of establishing sanctuaries does not seem so popular with Continental nations, but, as a striking exception to this rule, a Society was started in Holland a few years ago which is doing admirable work and is worthy of the support of all lovers of birds. This Society, the Vereeniging tot behoud van Natuurmonumenten in Nederland, has for its object the protection of almost the last breeding-grounds in North-West Europe, in which some of the most interesting birds, which were once common in our Fens, have found a retreat from the greed of the collector and from the inroads of the agriculturist.

Rightly assuming that all Naturalists worthy of the name are inspired by common interests and common aims, the Society has thrown open its door to all ornithologists, irrespective of nationality, the only condition of membership imposed being that an intending candidate must prove to the satisfaction of the Society that he is a lover and protector of birds, and not a collector sailing under false colours. The members of the Committee, which directs the policy of the Society, have given practical proof of their ability to do so by the great judgment they have shown in the selection of areas in which sanctuaries have been established. The most important area over which the Society exercises jurisdiction is the Naardermeer, a large mere some fifteen miles from Amsterdam, and it is no exaggeration to say that it is at once the most extensive and most interesting sanctuary for birds in North-west Europe.

As the writer and a friend had the good fortune to pay a visit to the Mere, it is possible that a short account of the visit may be of interest to ornithologists, especially as the sanctuary is now so strictly preserved that no one who is not a member of the Society is allowed admission within its precincts, while members are only granted this privilege once a year. It was with feelings of the keenest anticipation that we left Amsterdam by the steam-tramway one morning towards the end of May, 1914. We were going to gaze on scenes that had long passed away in these islands, and we hoped to see for the first time some species of birds whose acquaintance less fortunate ornithologists can only make in the pages of Yarrell or within the walls of the South Kensington Museum. The day was not an ideal one for watching birds. The genial warmth of the preceding week had given way to biting cold, and gusts of wind, accompanied by heavy showers, swept over the levels of the marsh. On either side of the line, far as the eye could reach, stretched a dreary expanse of meadow-land, the monotony of which was only varied by occasional clumps of trees, or the typical tower of a Dutch church, whose massive structure stood out in striking relief on the horizon. Herds of black-and-white cows were feeding on all sides on the marshes, but it was in

vain that we looked out for any sign of bird life from the windows of the train. The only birds we saw during a journey of an hour were two solitary Lapwings (*Vanellus vanellus*), the last survivors of the multitudes which once swarmed in these marshes, as they did in our Fens and Broadlands a few generations ago.

When we alighted at Hakkelaarsbrug, which, as a Dutch friend truly remarked, "is difficult for English people to pronounce in perfection," to our dismay there was no keeper to meet us, but a friend in need appeared on the scene in the person of a kindly Dutchman, who went a mile out of his way to escort us to the keeper's cottage, which stands by the side of the Mere. As the Secretary of the Society had not arrived, we presented our credentials to the keeper, Jan Hackmer, who with true Dutch hospitality signed to us to enter his cottage, where we found his wife preparing a cup of coffee for her guests, which was very acceptable after the journey. Old Jan was a fine specimen of a hardy weather-beaten Dutch peasant; though he had passed the span of life allotted to mankind by the Psalmist, his eye was not dim neither was his natural strength abated, and his prowess at the oar in the teeth of an adverse wind might have excited the envy of many a younger man. His surroundings reminded us vividly of Lubbock's description of the Broadsman as he found him three generations ago. First as keeper and then as watcher, his whole life had been spent by the side of his beloved mere; for towns and dwellers in the towns he had the supremest contempt, and what he did not know about the mere and its inhabitants was not worth knowing. Some thirty years ago an attempt was made to drain the mere, but for once in a way, as all lovers of birds will be glad to hear, Nature proved too strong for man and the attempt resulted in failure. For three winters in succession, after the mere was drained, the floods got the mastery and water covered all the reclaimed land. It was obvious that further engineering operations would involve an expense that would bring no adequate return, so man had to confess that he was worsted in his struggle with Nature and

that the wisest course was to bow to defeat and allow the old order of things to prevail. Traces of the engineer's work can still be seen in the long channels which at places intersect the Mere. Far as the eye can reach, stretches an illimitable expanse of waving reeds, traversed by narrow channels, in many cases overgrown with a mass of matted water-weed and fringed with stately bulrush and yellow iris, while here and there clumps of ragged robin lend a touch of colour to the scene. On one side the beds of reeds give place to wide lagoons, which call to mind the scenery of Broadland, the main channel bearing a striking resemblance to Whiteslea Sound, which forms the highway between Hickling Broad and Heigham Sound. The Mere, which covers an extent as big if not bigger than Whittlesea Mere in days of yore, offers an inviolable sanctuary to many species of birds. It can only be explored by means of a boat, and all boats are in the charge of old Jan, who is the personification of honesty, so there are no weak points in the line of defence. Even if he could secure a boat, a stranger would soon lose himself in the impenetrable maze of reeds and see nothing, as the birds are decidedly patchy in their distribution. One railway passes right through the heart of the Mere, and another skirts one side, but the inhabitants, with the familiarity bred of contempt, pay no more attention to the sound of a passing train than do the Pink-footed Geese (*Anser brachyrhynchus*) in the marshes at Holkham. We had not to wait long at the cottage before the Honorary Secretary of the Society appeared, and it is a pleasure, no less than a duty, to put on record our sense of gratitude to him for accompanying us on this visit. It is not every secretary who will get up at five a.m. and travel more than a hundred miles to act as interpreter and guide to two foreigners, and a better could not be found. Like many Dutchmen, he had a sound knowledge of English, was an excellent ornithologist, and withal a most genial companion. Without his aid, the stream of information which poured from old Jan's lips would have been entirely lost to us.

It was decided that we should first make the acquaintance of

the Marsh-Harriers (*Circus æruginosus*). There were seven pairs in the precincts of the Mere, and the keeper knew of the nests of two. So we got into the boat and the keeper rowed down one of the channels, which followed the line of an old drain, till we came to a narrow opening in a thick bed of reeds. Up this we drove the boat by sheer force through a mass of tangled vegetation till we could go no further; then, taking off boots and stockings and tucking up our trousers as far as they would go, we followed the keeper, sometimes wading up to our knees in the icy water, sometimes treading delicately on the stumps of last year's reeds, which hurt our bare feet shrewdly, till we reached a comparatively open space where the footing was firmer. In the midst of this was the Marsh-Harrier's nest, a rough platform of reeds raised about a foot above the surface, and in the nest were three eggs and one young bird not long hatched, while overhead circled the mother bird protesting indignantly against the violation of her privacy. Among the reeds which surrounded the opening, a small colony of Bearded Tits (*Panurus biarmicus*) had taken up their abode. They seemed to have no fear of man, and an interesting sight it was to watch them at a distance of a few yards climbing up the reeds and to listen to their well-known clinking note. It was obvious that there was a nest concealed somewhere at the bottom of the reeds, but the most vigorous search failed to discover one. The approach to the other Harrier's nest was a much simpler affair. We merely had to row up another channel, land on the bank, cross twenty yards of quaking bog, and there was the nest quite in the open. In this case the nest was made of a species of water fern, and in the nest were two eggs, two nestlings, and the remains of a young Coot (*Fulica atra*), a diet for which the baby Marsh-Harrier seems to have a special liking, and as the Coot is a common bird, a little thinning can do the species no harm. The Marsh-Harriers were much in evidence during the day. Sometimes they might be seen sweeping with steady flight just over the tops of the reeds, quartering the rushy coverts for their prey in true Harrier fashion; at other times they would forsake the marsh

SPOONBILL AT NEST

Photo A. Burdet

MARSH-HARRIER WITH YOUNG

Photo A. Burdet

Black Tern at Nest
Photo A. Burdet

Common Tern at Nest
Photo A. Burdet

and soar higher and higher in ever-widening circles, till they were almost lost to sight, just like a pair of Common Buzzards.

A generation or so ago the Marsh-Harrier must have been as common in Holland as it was in Norfolk in the days of Lubbock, when every pool in Broadland had its pair; but in Holland, as in these Islands, "the curse of his race was on him." One spring many years ago the keeper told us that he had destroyed no less than ninety-two Marsh-Harriers, receiving thirty cents as blood-money for each bird slain. What was the object of this senseless persecution it is hard to imagine. In the keeper's opinion the "brown chicken robbers" were not as black as they were painted. They lived on excellent terms with the Spoonbills (*Platalea leucorodia*) and Black Terns (*Hydrochelidon nigra*), though they were the sworn foes of the Black-headed Gulls (*Larus ridibundus*), and so successfully did they prosecute their feud that they had almost, if not quite, destroyed a colony of these birds which was flourishing a few years ago. Be that as it may, not one Black-headed Gull did we see that day.

One of the main objects of our visit was to inspect the colonies of the Spoonbill and Purple Heron (*Ardea purpurea*), but so rigidly are these birds now protected that members of the Society are not always taken to the breeding-ground, but have to be content with a distant view of the birds as they pass to and fro over the Mere. We have to record with gratitude that an exception had been made in our favour, and that old Jan had received special instructions that we should be allowed to inspect a nest of the Purple Heron and have a look at the breeding haunts of the Spoonbill. The breeding-ground was some distance from the nest of the Marsh-Harrier. Whatever may have been the case formerly, the Purple Heron does not now nest in company with the Spoonbill. The two species now have separate breeding-grounds which they keep carefully to themselves. After proceeding for some distance down one of the main channels, we turned aside into a narrow dyke, on either side of which rose an impenetrable wall of reeds. As we advanced, the growth of reeds gradually became thinner,

and before we could realize what was in store for us we were in the midst of the stronghold in the recesses of which the Purple Heron rears its young. It was the wish of the Society that the birds should be disturbed as little as possible, so we had to be content with a brief view, but the scene was one which a lover of bird life will not readily forget. At a short distance could be descried three or four nests, consisting, as far as we could see, of a rough pile of reeds resting on a platform of similar material, with their blue eggs quite visible to the eye, while on every side the startled birds with hoarse squawks rose into the air, the red tints, from which the bird has gained the name of Roodreiger or Red Heron, showing out conspicuously in the sunshine. At the same time, the brief gleam of sunlight roused into activity a large colony of the Karakiet or Greater Reed-Warbler (*Acrocephalus arundinaceus*), and all naturalists will appreciate the delight with which we watched for the first time these fine birds at one moment pouring forth their harsh notes from the top of a bulrush, at another flitting stealthily from reed to reed. This was the only spot at which we heard the Greater Reed-Warbler really hold forth, but it would be unreasonable to expect Reed-Warblers to show themselves to advantage on the afternoon of a cold and gusty day.

A short row then brought us to the nursery of the Spoonbills. As is well known, this handsome bird once nested in trees in this county, but has not done so for quite two hundred years, and the reason is not far to seek. Sir Thomas Brown tells us that they came in March, and were shot by fowlers, "not for their meat, but for the handsomeness of the same." One after another their haunts in North-West Europe have disappeared; the Horstermeer was drained thirty years ago, and now only two "isles of refuge" remain, the Naardermeer and another mere in North Holland in the hands of a private owner, who guards it with jealous care. Old Jan was full of information about the Spoonbills, and he said he could remember the time, fifty years ago, when it was one of the commonest birds on the Dutch meres. According to him a thousand pairs once nested

on the Naardermeer; about five thousand eggs were sold every season for cooking purposes; some five hundred young birds were disposed of yearly, there being a demand for them on the part of private collectors and zoological societies; while, to make matters worse, rat traps were often set to catch old birds. In fact, the Spoonbill was persecuted in the same thoughless way that the Avocet (*Recurvirostra avocetta*) was in Norfolk at the beginning of last century. No wonder their numbers waned, and, when the mere was drained, they deserted their old haunts. However, after the attempt at draining had proved a failure, they returned (though in greatly reduced numbers) to the strongholds where their ancestors had bred from time immemorial. One would have thought that the survivors of such persecution would not have been afflicted with nerves, but the keeper assured us they were most touchy birds, strongly resenting any attempt to interfere with their domestic arrangements in the breeding season. It was only a year or two ago, he told us, that in their breeding place in North Holland a small colony deserted their nests and left their young to starve merely because a watcher paid too frequent visits to see how his charges were faring. The stronghold that the Spoonbills have now selected to rear their young is an admirable one—a promontory of reeds stretching out into a lagoon to which all access is impossible except by boat, and, as no one is allowed to land or inspect the nests, they can now breed in peace without their privacy being intruded on. We were rowing round the promontory at a respectful distance, when all of a sudden many of the birds took fright, rose into the air and flew round us, their white plumage glistening in the sunlight in striking contrast to their black legs and dark bills. It seemed almost uncanny that not a sound proceeded from their ranks, till we remembered that with the Spoonbill silence is "not a virtue but a necessity." Here and there a young bird could be descried peering over the side of its nest at the unusual sight of an intruder on their solitude. The colony now consists of about fifty pairs and, though they are carefully protected and are said to have two broods a year, the rate of

increase is slow. It is hard to suggest any definite reason for this, but the Secretary seemed to think that persecution during migration was the cause. Three years ago sixty young birds were ringed in September, and during October no less than twenty were killed, the records coming chiefly from France, Portugal, and Spain. If the birds are persecuted like this every autumn it is not to be wondered at that their numbers increase slowly, but, with the strict protection granted them now, the question of their extermination has passed out of the range of practical politics. During the day we noticed a pair of Great Crested Grebes (*Podiceps cristatus*), some Common Terns (*Sterna hirundo*), and Black Terns, two or three pair of Lapwings, a solitary Cormorant (*Phalacrocorax carbo*), numerous Reed-Buntings (*Emberiza schœniclus*), Wild Duck (*Anas boschas*), and one or two Gargeneys (*Querquedula querquedula*), and we caught an occasional glimpse of the Common Reed-Warbler (*Acrocephalus streperus*), but the Warblers as a rule refused to face the gusts and sulked in their retreats among the reeds. In some respects the variety of species was not as great as might have been expected, and it must be admitted that it is hard to understand the principles which regulate the distribution of birds in the breeding season. Though the conditions seemed all that could be desired, we saw no Ruffs and no Snipe (*Gallinago gallinago*), and were told that they never bred in the neighbourhood of the mere. The latter bird appears to be scarce in many parts of Holland in the breeding season. Many were the likely swamps that we have explored in Texel, but in vain have we listened for the "hum of the dropping snipe." In one corner a pair of Black-tailed Godwits (*Limosa limosa*) were nesting, but that was looked on as an exceptional occurrence, though the bird breeds in numbers in some parts of Holland. To the stranger the mere appeared a very paradise for ducks, but no Tufted Ducks (*Nyroca fuligula*), Shovellers (*Spatula clypeata*), or Pochards (*Nyroca ferina*), were to be seen anywhere, and the only species that regularly breed there are the Wild Duck and Gargeny, though Common Teal (*Querquedula crecca*) appear in thousands in th

Winter time, and in the recesses of the mere is a decoy which is still worked with satisfactory results. In Holland the industry of the Decoy man still enjoys the protection of the law, and to fire a gun within a thousand yards of a decoy is a punishable offence. The Cormorant, we believe, does not now nest on the mere though it used to be very abundant on the Horstermeer. Savi's Warbler (*Locastella luscinioides*) which, as Professor Newton tells us, was only recognised as a yearly migrant to our Fens a few years before its haunts were destroyed by drainage, breeds here in considerable numbers, but we had not the good fortune to hear its reeling note or to inspect its compactly-made nest.

We were returning along one of the main channels delighted with the result of our visit, when, without saying a word, Old Jan suddenly turned the boat up a narrow dyke, which stood at right angles to the main channel, and before we had gone a hundred yards, we came to a opening in the reeds, not more than forty yards square, covered with Water Cabbage, the chief nesting-place of the Black Tern. This sanctuary is rarely disturbed, so we highly appreciated the privilege of being allowed a look. Within this narrow space were to be seen many nests of the "Blue Darr" neatly poised in the centre of the plant which floated on the surface of the water, some twenty of them containing their complement of three eggs. The birds had only just begun to lay, but, later on in the season, about a hundred pairs of Terns might be found breeding in these restricted surroundings. It may be interesting to note that in a certain polder in Texel, where a few pairs of these birds breed, the eggs are often laid on the comparatively firm soil of the meadow or polder, though there is a lagoon at no great distance which seems adapted to their habits, but perhaps the absence of the Water Cabbage in the lagoon would account for this peculiarity. Be that as it may, a notice board at the approach of the lagoon with "verboden to gang" prevented a satisfactory solution of the problem.

At intervals during the day the love note of the Bittern (*Botaurus stellaris*) came booming from an impenetrable bed

of reeds, but the sight of a Bittern in broad daylight was a piece of luck almost too good to hope for. The keeper's cottage was already in sight, when a sudden exclamation from him caused us to look round. We jumped up, glasses in hand, and there, not more than a hundred-and-fifty yards off, were a pair of Bitterns, just risen a short distance above the reed-bed. For a few minutes we had them under observation, and we had the good fortune to witness what appeared to be a love display on the part of the Bittern. When at the top of his flight, the bird which we took to be the male would face the female and suddenly stretch out his head, a motion which stiffened his crest and ruff, then, dropping his legs straight, he would sink four or five feet with wings extended; at another time, he would pirouette in mid-air opposite his mate. The performance lasted only a short time and we should have liked to have seen a repetition of it, but it came as the climax to a most successful day. The Bittern is now a very scare bird in Holland and probably not more than two or three pairs breed on the mere. It may be doubted whether it was ever as common as it was in the Fens of West Norfolk, where, in 1853, an old keeper assured the late Professor Newton that his grandfather never considered his Sunday dinner complete without a roast Bittern on the board.

Space will only allow a passing reference to the good work which the Society is doing in Texel. Some years ago, while pointing out how the Avocet had been banished from these islands by senseless persecution, Professor Newton drew attention to the fact that the same persecution was going on in Holland and Denmark, and gave it as his opinion that it would probably lead to the extinction of the species in both countries before long. Whatever may be the case with Denmark, it is pleasant to be able to record that in Holland, at any rate, the Professor's forebodings have not been fulfilled. It is true that many of the breeding haunts of the Avocet have disappeared before the process of draining and agriculture, and that the island of Texel is its last great stronghold in North-western Europe, but it may be said with equal truth that this species is

Bittern on Nest

Photo A. Burdet

Young and eggs of Bittern

Photo A. Burdet

more than maintaining its ground there. Without going into unnecessary details, naturalists will be glad to hear that the most flourishing sanctuary for these birds is in the hands of the Society, and that it is most effectively watched by a farmer whose house commands an extensive view of the breeding ground. As a proof that this species is still fairly common on this island, the writer may be allowed to say that one day at the end of April, from the shelter of a bank, he counted a flock of no less than two hundred, and it is to be hoped that all naturalists will co-operate with the Society and with the Dutch Government in the preservation of this most interesting bird.

Another species, inseparably connected with memories of the past, the Black-tailed Godwit, still holds its own in Texel. It is a most adaptable bird and seems able to reconcile itself to the new order of things. Though naturally associated with the swamp and the fen, it can make itself equally at home in the better-drained pasture lands, and its characteristic cry, "grutto, grutto," from which the Dutch name for Godwit is derived, may still be heard in many parts of the island. To give one instance of its powers of adaptation, the writer once found in the same day one nest in a quaking bog, and another on the top of a dry sandhill at a considerable distance from any water.

No better station can be found than this island for watching the migration of the Bar-tailed Godwit (*Limosa lapponica*). It seems to lie directly on the line of its passage to the breeding grounds on the tundras which fringe the Arctic Ocean. On almost any day in May the observer can get a good idea of what Godwit day was like on Breydon Flats in the good old times, but in Texel the Godwit is to be found on migration not only along the coast, but in the meadows and polders inland. Two extracts from our log will enable the reader to form some idea of the numbers of Godwits which pass over this island during May :—"May 5th, 1913. Brisk wind from the east, nearly high water, and the sea wall proved an admirable vantage ground from which to watch the flocks of waders feeding on the water's edge as they came in before the rising

tide. In less than one mile of coast we must have seen more than four hundred Godwits. At one point a low ridge of sand jutted out at right angles to the shore, so creeping round we crouched behind it till the incoming tide brought a flock of about one hundred Godwits almost within gunshot. The flock was constantly being joined by fresh arrivals, some of which seemed to be dropping from the skies. Apparently unconscious of our presence, right in front of us was a large flock of Godwits, exhibiting a striking difference in size, with their plumage in all stages of development, some, probably adult males, in their nuptial attire of deep chestnut red, others with the breeding plumage less matured, while the majority were still wearing the sober hues of their winter garb. A few Knots (*Tringa canutus*) in their breeding plumage of russet red, and two solitary Grey Plovers (*Squatarola squatarola*), a study in silver grey and jet black, lent a touch of variety to as pretty a picture of bird life as the naturalist is often privileged to see. We gazed on this interesting sight till the advancing tide drove us from our shelter, then, turning inland for about a mile, we came to a large meadow closely cropped by sheep. There to our surprise was another flock of Godwits at least two hundred strong, and as far as could be judged the proportion of birds in their breeding plumage was rather higher." "May 27th, 1914. Bright day, stiff wind from the east. Flocks of Godwits resting in the meadows and polders all over the centre of the island. We could not have seen less than seven hundred birds, but the ground did not admit of a very near approach. The biggest flock consisted of about a hundred and seventy birds, and, as was only to be expected at this time of the year, a far larger proportion (probably fifty per cent.) had assumed the handsome attire of chestnut red." It must be admitted that these were two red-letter days, and of course some local knowledge was necessary, but, given the requisite knowledge and just a suspicion of luck, an observer would be unfortunate who went out any day in May without seeing Godwits either in the act of migration or taking a rest on their voyage to the distant tundras of the north-east.

Short-eared Owl on Nest

Photo A. Burdet

Young short-eared Owls

Photo A. Burdet

No account of the work the Society is doing in Texel would be complete without a passing allusion to that most interesting bird the Ruff (*Machetes pugnax*). Once so marked a feature of Fen life that Ruffs and Reeves were known by the name of "Fen poultry"—and it is said that mothers would often check the wrangles of their children with the remark, "Now, you children, you mustn't fight like a flock of Ruffs"—this species has been practically exterminated in these islands by the combined efforts of the fowler, the collector, and the gourmand. Their habits have been so well described by Montagu, Woolley, and Lubbock that little or nothing remains to be said on the subject, but one or two small points may, perhaps, be worth recording. So far from shifting their hills from season to season, which appears to have been the habit of the Ruff in Norfolk, the writer was struck by the fidelity with which these birds returned to the same hill year after year in Texel. Privacy does not always seem to have been an object, and sometimes little or no attention was paid to the presence of man. One hill was not far from a homestead, on the top of an ancient dyke along which was a right-of-way, another on a main road which intersected the largest polder in the island. A large stone by the roadside served to mark the spot, and a congregation of Ruffs might always be seen at play just opposite the stone in the middle of the road. In Texel this bird cannot be called very vigilant and impatient of approach. When engaged in the tournay their tameness is almost ridiculous. On many occasions the combatants allowed the writer and his friend to crawl up and watch them at a distance of not more than twenty yards, and one day when a lad on a bicycle rode right through them, some of the birds did not deign to take the least notice of the intruder, while others flew away for a short distance, only to return before he had gone a hundred yards. The lists covered so small a space that a Lincolnshire fowler could easily have captured the whole assembly with one sweep of his net. It is rather curious that a Ruff with a pure white frill, which Lubbock considered to to be the rarest colour, is by no means an unusual sight in

Texel. The Ruff can scarcely be said to be holding its own in Holland, and when one takes into account the constant persecution to which this species has been subjected, especially in the breeding season, the wonder is that it has not become extinct.

Large numbers used to be sent over to the London markets every Spring, perhaps because in the old times no banquet was complete without a course of fatted Ruffs, and it is to be feared that this senseless traffic has not been entirely suppressed, as it was only last May that a friend saw many trays filled with Ruffs exposed for sale in a poulterer's shop in the West End, though he was unable to find out the locality from which they came. The Ruff is still a fairly common bird in Texel, if you know where to look for it, but it must be admitted that the birds do not resort to the hills in the numbers they did a few years ago. As far as Texel is concerned, it is not easy to point to a definite reason for this. The birds are not molested to any extent during the breeding season, but the Secretary seemed to think that a good many nests were destroyed by cattle, and that, owing to the gradual draining of the polders, the area of ground suited to their wants became less and less every year. In a word, we must face the fact that the Ruff is the child of the wilds and the fen, and is doomed sooner or later to disappear before the advance of drainage and agriculture.

There is no lover of nature who will not wish the Society "God speed" in its effort to preserve the old order of things, and to promote a healthy public opinion on the subject of bird preservation, and to these efforts the Dutch Government has given its hearty co-operation. Stricter laws are now in force for the protection of birds and their eggs, and the long range of sand dunes, which skirt the western side of Texel, are now a sanctuary, where no one can enter without a permit from the Government, a privilege which it is not easy to obtain, and where many interesting birds like Montagu's Harrier (*Circus pygargus*) and the Short-eared Owl (*Asio accipitrinus*) can rear their young in peace. It is, alas, too true that, in the words of a well-known writer, the modern condition of our fenland is to the

Male Montagu's Harrier at Nest
Photo A. Burdet

Female Montagu's Harrier at Nest
Photo A. Burdet

ornithologist, fond of ancient memories, almost "the abomination of desolation," but in the more favoured country of Holland, at no great distance from our shores, there are still spots where the eye of the naturalist can be gladdened with a picture of bird life, such as once existed in our fens and broadlands, when Lubbock wrote his Fauna and Montagu made his celebrated tour to South Lincolnshire, a hundred years ago.

P.S.—A list of the birds breeding on Texel, made out by Mr. J. P. Thijsse, is given in Messrs. C. and H. Candler's "Notes from the Netherlands," published in the Transactions of this Society, Vol. V., p. 172; and there is another list which can be procured at the principal inns at Den Burg, the chief town on the island. Neither list is entirely free from mistakes, and the following notes are an attempt to bring the list of birds that breed or are to be seen on the island more up to date. I have to thank my friends Dr. Long and Mr. F. W. Headley for kindly putting the results of their observations at my disposal.

CORRIGENDA.

White Stork (*Ciconia ciconia*).—Does not breed on the island now. Seldom, if ever, seen.

Spoonbill (*Platalea leucorodia*).—Has not bred since the draining of the Marshes near Den Horn, though stray birds may not infrequently be seen, especially in May and June.

Marsh-Harrier (*Circus æruginosus*).—Probably disappeared with the draining of the Den Horn marshes.

Goshawk (*Astur palumbarius*).—Very doubtful.

Greater Reed-Warbler (*Acrocephalus arundinaceus*).—Said to occur, but no evidence to be obtained.

Little Owl (*Carine noctua*).—Doubtful.

Stone-Curlew (*Œdicnemus œdicnemus*).—Probably a mistake—no suitable ground.

GOLDEN ORIOLE (*Oriolus oriolus*).—No first-hand evidence that this bird has recently bred; but in "Wild Life," Vol. II., p. 113, R. Fortune records finding a nest in a small wood near the Haven, in the year 1910.

SCHINX SANDPIPER.—Should be struck out.

CRESTED LARK (*Galerida cristata*).—Doubtful; as a breeding species.

ADDENDA.

SHORT-TOED LARK (*Calandrella brachydactala*).—One pair seen April, 1914.

NIGHTINGALE (*Luscinia megarhyncha*).—Occurs; probably bred 1913.

MARSH WARBLER (*Acrocephalus palustris*).—Bred in 1914.

GRASSHOPPER WARBLER (*Locustella nævia*).—Bred in 1913.

ICTERINE WARBLER (*Hypolais icterina*).—Generally distributed; many in disused decoy to left of road to Oosterend.

PIED FLYCATCHER (*Muscicapa atricapilla*).—One male seen May, 1914.

FIELD-FARE (*Turdus pilaris*).—Seen on migration.

STONE CHAT (*Saxicola rubicola*).—Probably breeds.

SHORT-EARED OWL (*Asio accipitrinus*).—Breeds on the sand dunes.

MONTAGU'S HARRIER (*Circus pygargus*).—Breeds on the sand dunes; would increase if not persecuted.

BLUE HERON (*Ardea purpurea*).—Rare; does not breed.

GREY LAG-GOOSE (*Anser anser*).—April, 1914.

BRENT GOOSE (*Branta bernicula*).—Assembles in big flocks on coast before migration.

Teal (*Querquedula crecca*).—Rather scarce.

Stock-Dove (*Columba œnas*).—Probably breeds.

Little Grebe (*Podiceps fluviatilis*).—Occurs in the Spring, breeding in 1913.

Grey Plover (*Squatarola squatarola*).—Not common; a few odd birds in nuptual plumage during breeding season.

Turnstone (*Arenaria interpres*).—On migration.

Knot (*Tringa canutus*).—A few in breeding plumage, no big flocks.

Dunlin (*Tringa alpina*).—Common; not known to breed on the island.

Common Sandpiper (*Totanus hypoleucus*).—Seen in May; possibly breeds.

Bar-tailed Godwit (*Limosa lapponica*).—Very common, especially on migration.

Dusky Redshank (*Totanus fuscus*).—Small flock seen April, 1914.

Greenshank (*Totanus nebularius*).—A few birds seen.

Curlew (*Numenius arquata*).—Common; a few breed on the sand dunes.

Whimbrel (*Numenius phæopus*).—Very common on migration.

Common Snipe (*Gallinago gallinago*).—A few seen, but apparently not breeding.

Jack Snipe (*Limnocryptes gallinula*).—One or two stragglers seen.

III.

NOTES ON MR. NICHOLSON'S FLORA OF NORFOLK.

By Arthur Bennett, A.L.S.

Now that we have brought together in the above work the scattered notices of Norfolk plants from many sources, we can see what is wanted to be done in the future. Happily condensed, yet clear, Mr. Nicholson's work can be made a starting point for future workers. Many may have wished that notices of former workers had been included, and Bibliography, but of course this would have made the book more expensive, and others do not need these matters. In the following notes I have taken the sequence of the Flora, and added some things that Mr. Nicholson wisely left out. Yet there may be some truth in many of these doubtfuls, and if it should lead to future search it will have done no harm. Starred plants are new records for the county.

Thalictrum Dunense Dum.

Burnham Westgate. K. Trimmer.

Anemone ranunculoides L.

Scoulton, in a wood on the right side of the road, next the turnpike, and close by the public-house; also on the Thetford Road for Scoulton. Winter, Phyt, 1861, p. 257.

Trollius europeus L.

Norton rare. Winter, l.c., p. 290. What possible British plant could have been mistaken for this? Occurs in Salop, Hereford, and Stafford.

Ranunculus trichophyllus Chaix.

Plentiful in Norfolk. Babington in Ann. Nat. Hist., Sec. 2, XVI., p. 290 (1855).

R. CONFUSUS.

N. Wootton. Dr. Lowe.

CALTHA RADICANS FORSTER.

This is a southern plant, and if anything was found with a creeping and rooting stem I would suggest it was the var. procumbens Gunt. Beck of C. palustris L. I very much doubt whether Mr. Moxon knew C. radicans at that date (1842).

HELLEBORUS FOETIDUS L.

Bath Hills, June, 1840. C. C. Babington.

FUMARIA.

Mr. Pugsley's recent recasting of this genus in a Supplement to the Journal of Botany, 1912, gives "F. Borei Jordan, Ormsby. G. C. Druce."

PAPAVER DUBIUM L.

It is, of course, impossible now to refer the records under this to the two sub-species, *i.e.*, *P. Lamotti* and *P. Lecoqii*. Hence it is a pity that Mr. H. C. Watson's ideas were not carried out; *i.e.*, to give records under each segregate, and continue the two under dubium.

ROEMERIA HYBRIDA D.C.

The Norfolk Swaffham is intended! "Swaffham. Dr. Jermyn from the herbarium of Rev. Newbould in British Mus. herbarium"! "Fritton. near Long Stratton. Fields near Castle Acre Priory. Cressingham near Watton. Swaffham in fields belonging to Col. Mason." Winter, l.c., 291.

COCHLEARIA ANGLICA L.

Two forms of this are named: *var. genuina* Hort. m.s. Babington's Manuel, ed. 3.27.1851, and *var. Hortii* Syme in Bot. Ex. Club Report, 1873-4, p. 9 (1875). But I believe Syme's name is preoccupied by *var. stenocarpa* Meyer in Chlor's Hannor, p. 46 (1836). A specimen

from the "Bure near Caistor, 1838. J. Priest" is the var. Hortii Syme.

CAMELINA SATIVA L.

Without specimens it is impossible to say to which sub-sp. the localities belong; in C. en-sativa Syme, or C. fœtida Fries, the latter being the more frequent plant.

ARABIS PERFOLIATA.

Crostwick to Beeston, 1888. E. F. Linton. Horstead to Frettenham. C. E. Salmon. Near Harling Station, Herb. R. Harrington.

* LEPIDIUM NEGLECTUM THELLUNG. In E. and W. Norfolk. Druce in Bot. Exch. Club Report, Part I., 194 (1912). Differs from ruderale in the "seed more obicular, and surrounded by a winged margin."

L. RUDERALE L.

First record for Britain. "Lynne in Norfolk." Nay. Cat., 296, 1670.

FRANKENIA LÆVIS, L.

Yarmouth, Sir J. Gage, 1800! Caistor Salt Marsh, Paget. Trans. VI., 74, 1895. Yarmouth. G. Fitt, 1847, Herb. Brit. Museum, showing it occurred after 1834.

HOLOSTEUM UMBELLATUM, L.

"Wall between St. Austens and Magdalen Gates. Between Magdalen and Pockthorpe Gates, Garden Wall at Thorpe." Crowe in Hudson's Flora at Linnean Society.

SAGINIA CILIATA.

Near Brancaster, W. W. Newbould

SAGINIA APETALA UCRIA.

Gathered in plenty at Hunstanton by C. C. Babington, and recorded in an early number of the Journal of Botany. Hunstanton, H. T. Mennell, sp.

STELLARIA NEMORUM, L.

Moist woods near Ranworth. Winter, l.c., 293. Probably S. aquatica mistaken for it (?) Still there is no doubt that in former years drainage and cultivation had exterminated many species. It has occurred in N. Lincolnshire, found by Rev. W. Fowler in Broughton Woods. Record Club Report, p. 119, 1875.

GERANIUM SYLVATICIA L.

Lynn, in a wood. Crone, l.c.

MEDICAGO MINIMA, L.

Notwithstanding the greater number of stations now recorded for Norfolk, I still hold that the species is far more abundant in Suffolk, where I have walked for seven miles without losing sight of the plant.

MEDICAGO SYLVESTRIS Fr.

Bawburgh, 1914. F. Robinson.

TRIFOLIUM SUFFUCATUM L.

The reference to 1st record is to Trans. Linn. Soc., ii., p. 357 (1794). South Denes, Yarmouth, fifty yards from the west of the Barracks, in plenty, 1840. C. C. Babington.

TRIFOLIUM MARITIMUM.

Yarmouth, 1830. Rev. J. Dalton in Herb, York.

ULEX MINOR.

Yarmouth! Planchon in Ann. Sc. Nat., Apl., 1849. The note in the Flora respecting this by Prof. Babington makes the above reference conclusive as to its being a Norfolk species, as Planchon monographed the genus.

LATHYRUS PALUSTRIS L.

Lynn. Herb. Brit. Museum! Woodbastwick. F. Robinson, 1914.

POTENTILLA.

I have seen no Norfolk specimens of the hybrids between, P. erecta, procumbens, and reptans; they should be looked for. Dr. Wolff, the Monographer of the genus, named several from Surrey for me.

CALLITRICHE. "C. PALUSTRIS L.—C. VERNALIS KOCH., Common." Is this really so? In almost all Floras it is accepted as "common." I have never seen or gathered a Norfolk specimen of it, and in most counties it is rare! Yet Hegelier's figures in his Monograph clearly show the difference from the other species.

CALLITRICHE OBTUSANGULA Le Gall. Wroxham. E. P. Linton, sp.

C. STAGNALIS.

Caister by Yarmouth, 1840. Priest.

MYRIOPHYLLUM.

A curious absentee is M. alterifiorum. Why it does not occur is a puzzle, as it is generally distributed, and far from rare.

EPILOBIUM TETRAGONUM AND OBSCURUM.

In most counties *obscurum* is far the commoner species; certainly it is in the Flegg Burgh Hundred—elsewhere in the county I cannot speak of it from personal knowledge, except at Thurne.

*DROSERA LONGIFOLIA X ROTUNDIFOLIA (D. ROTUNDIFOLIA X INTERMEDIA CALLER).

Noticed at Dersingham. G. C. Druce in Report Bot. Ex. Club, 1911. 20 (1912).

TILLÆA MUSCOSA, L.

Standford Heath. J. D. Salmon, 1850. Herb. Brit. Museum.

*Pimpinella major Huds. (Magna, L.).

Norfolk W. Miss Bell sp. Watson Topl. Botany, ed. 2, 192, 1883. Conclusive as to its occurrence.

Œnanthe pimpinelloides, L.

Up to the year 1844 all the records under this name may be taken as meaning *Lackenalii*. In that year Mr. Ball, in the Annals Nat. History, showed that the name *pimpinelloides* mus be applied as of Smith, not Linneus, and Smith's plant was *Lackenalii*. Afterwards papers by Mr. Watson and Prof. Babington cleared up the nomenclature, except that *peucedanifolia* Poll. was used for one of them. So satisfied was Mr. Watson that this name could not be applied that he suggested the name *Smithii* for it in the Phytologist 14, 1844, as a temporary name until its proper name could be settled. By growing the plant I showed that the real radical leaves (which was the stumbling-block in naming it *silaifolia*) were quite in keeping with Bierberstein's description, and by sending complete specimens to Berlin and St. Petersburg to be compared with Bieberstein's types, I showed it must bear the name of *silaifolia*.

Œ. silaifolia Bieb.

All the records in the Flora under this near the sea may be referred to *Lackenalii*, some of the others may be correct. Mr. Watson up to the latest of his works queries "E. and W. Norfolk," yet it certainly occurs, or did so in Suffolk, as there are specimens gathered by Sir J. Cullum near Bury St. Edmund's in 1774 in the Brit. Museum Herbarium.

Peucedanum palustre, Mœnch.

Drainage and cultivation have so diminished the localities for it outside Norfolk that that county now represents

its headquarters, as it probably contains more specimens than all the other counties combined.

Martham Broad. J. & A. Bennett.

Dubeck in Thurne. J. & J. Bennett. 4 feet high.

ARTEMESIA CAMPESTRIS, L.

Northwold, west of the Cranwick Devil's Dyke station. Mr. W. G. Clarke, 1914.

SONCHUS PALUSTRIS, L.

This was gathered by Mr. Butler in the marshes of the Waveney in 1857, and seen by Prof. Babington. Phytologist 279, 1857, and 357, 1858.

CREPIS PALUDOSA, Mœnch.

It is rather curious that the Rev. G. Munford should have reported this for his "W" division, while Winter in the Phytologist, 1861, reported it from "moist woods near Knapton and Cromer." It is just one of those species that might have occurred, or perhaps a weak state of some Hieracium may have been so named.

VACCINIUM MYRTILLUS, L.

The non-occurrence of this in Cambs, Suffolk, and Norfolk is rather remarkable. Serratula is another remarkable absentee.

V. ULIGINOSUM, "Mousehold."

This is impossible unless planted. It is not known south of Durham.

VERBASCUM PULVERULENTUM, Vill.

It may now safely be said this is confined to Norfolk and Suffolk; the Surrey plant was V. Lynchites! and the Hampshire one also an error.

CENTUNCULUS MINIMUS, L.

Near Lynn. E. Forster's Herbarium

MYOSOTIS REPENS, Don.

"E. Norfolk" is queried for this in Top. Botany, ed. 2, 1883. It occurs in Cambridgeshire! Recorded from St. Margaret's, Suffolk, but doubtful.

LIMOSELLA AQUATICA, L.

Foulden, 1914. F. Newton, sp.

VERONICA SPICATA, L.

"16 miles further west than the previous station (*i.e.*, the one in the Flora), but not so abundant." W. G. Clarke, 30th July, 1914.

OROBANCHE ELATIOR, Sutton.

"On Centaurea Scabiosa and Clover." I have never seen this on clover, and Gunther Beck in his Monograph of the genus gives "Scabiosa and nigra, Knautia arvensis and Onobrychis sativa." I have gathered it on Carduus crispus, L.

O. RAMOSA.

Lakenham. S. P. Woodward.

Starston. Trans. 1, 244, 1880.

*UTRICULARIA MAJOR, Schmid.

Dyke connecting the Thurne or Hundred Stream with Martham Broad, July, 1899. J. & A. Bennett. How it was I did not send this to Mr. Nicholson I cannot now suggest.

U. INTERMEDIA, Hayne.

Horning. Burrill and Clarke. Trans., p. 625, 1913.

Derby Fen. Grimston. Burrill and Clarke.

U. MINOR, L., f. PLATYLOBA, Meister.

Swannington, Oct., 1913. Burrill and Clarke.

THYMUS.

I have no specimens from the county to show what forms occur of those identified by Messrs. Domin and Jackson. Our idea of the genus was wrong according to them.

PRUNELLA LACINIATA, L.

Should be looked for; occurs in Cambridgeshire in several localities. W. Norfolk, about Ringland is likely.

SCUTELLARIA MINOR, L.

Ashill, 1913. F. Newton.

SCELERANTHUS PERENNIS, L.

Honeybeach. Crowe lc.

CHENOPODIUM RUBROM, L., VAR GLOMERATA, Wallr.

Holme-next-the-Sea. Holmes, sp.

RUMEX OBTUSIFOLIUS, L.

The common Norfolk plant is the *R. Friesii*, Gren. et Godr. I have seen no specimens of *R. sylvestris*, Wallr.; this latter has the fruiting perianth scarcely toothed at all.

ELEODIA CANADENSIS, Michx.

According to the Rev. K. Trimmer the first record of this was "In a pond at Swansthorpe, Sept. 20th, 1853." Neither canal nor navigable river near. Has this been seen to decrease of late years? An article on this subject will be found in the Proceedings of the Linnean Society, 71, 1912.

LIPARIS LŒSELII, Rich.

Stow Bedon Fen, 1912. The Smeeth or South Fen at E. Ruston. Rev. Bird, Trans. VIII., 666, 1909.

Still at Thurne, 1915. Messrs. Salmon and White.

IRIS PSEUDOACORUS, L.

The var. genuina Syme occurs between Acle and Halvergate, and at Thurne. I have not seen either the var. Bastardii or acoriformis in the county.

LUZULA FORSTERI, D.C.

This occurs at Polstead in Suffolk (May, 1882, Dr. Hind), and should be looked for.

SPARGANIUM AFFINE, Sch.

This must be held doubtful for the county (the true *S. natans*, L., is a rare Scandinavian species). Most or all of the stations probably belong to the floating form of *S. minimum*, Fries. Dr. Rothert when here (he was engaged on a monograph of the genus) admitted the Surrey and Anglesea specimens to be *affine*.

TRIGLOCHIN MARITIMUM, L.

The first definite record for the British Isles was "Near Yarmouth. Mr. Woodward, 1787," in Withering. Bot. Arr., ed. 2, p. 378, 1787.

JUNCUS COMPRESSUS, Jacq.

I have never seen this in marshes near the sea. The only locality where I have gathered it is between Heigham Sounds and Eastfield.

POTAMOGETON AUGUSTIFOLIUS, Bertch and Presl.

Sutton Broad, 5th August, 1915. Miss Pallis! A second station for the county.

P. GRAMINEUS, Smith.

Up to the year 1840 it may safely be assumed this name meant *P. obtusifolius*, Mert and Koch. Smith knew *gramineus*, Sm., and *compressus*, Sm. (*Friesii*), but muddled *Friesii* and *zosterfolius*, calling the latter *complanatum* Willd.

P. FILIFORMIS, Nolte.

The true plant is not on record south of Berwick, except in Anglesea!

CLADIUM MARISCUS, Br.

Up to about 1852-3 this was still so abundant in Marshland as to be used extensively for thatching. Prof. Newton, Trans. V., p. 562, 1894.

ELEOCHARIS ACICULARIS, Ret. S.

Acle. A. Bennett.

CAREX PARADOXA, Willd.

Hockham. F. Robinson, 1914! Good characteristic specimens.

C. ELATA, All. (C. STRICTA, Sm.)

St. Faith's. Mr. Pitchford, 1781. Herb. Mus. Brit. Mr. Nicholson uses the above name, but no specimens are extant of Allioni's, and it is not certain it is not *C. acuta*. Herr Kükenthal in his Monograph of the *Cyperaceæ* in Engler's Das Pflanzenreich accepts my name for the C. stricta of Smith, *i.e.*, C. Hudsonii.

C. DIANDRA, Schrank.

Shallum Dyke, Thurne. C. E. Salmon, sp.

C. LÆVIGATA, Sm.

Has occurred in Nayland, Suffolk, 1884. E. F. Linton. This should occur at Norfolk at the edges of marshy woods.

*CALAMGROSTIS STRICTA, Nutt. DEYEÀNXIA NEGLECTA, Kunth.

Hockham. July, 1914. F. Robinson, sp. This was gathered by Mr. Robinson, 1st August, 1911, but not named as above until sent to me in 1915. There was formerly a mere of 280 acres, and a "Cranberry Fen" here, both drained in 1795.

*C. STRICTA VAR. HOOKERI, Syme.

This interesting variety, accepted as an endemic var. by Prof. Hackel, has hitherto only been recorded from the

shores of Lough Neagh and Beg in Ireland. The Norfolk plant of Stow Bedon (Mr. F. Robinson, sp.) is even more apart from the type than the Irish, but Dr. Stapf, of the Kew Herbarium, writes me that "he doubts whether our Cheshire plant is the same as the Scandinavian or Central European plant, but that the species wants careful examination."

DESCHAMPSIA SETACEA, Richter.

It is strange this has not been re-discovered on some of the wet heaths.

BRIZA MEDIA, L.

The name "Wiggle-Waggle" was given me by a teacher and her pupils at Thurne.

*AGROSTIS NIGRA, Withering.

Fen close to Limekiln Dyke, Neatishead. Frequent. 2nd August, 1915. Miss Pallis, sp.

AMMOPHILA BALTICA, Link.

Along the coast from Caister to Winterton. Plentiful. Messrs. Salmon and White, sp. July, 1915.

POA PRATENSIS, L.

C. angustifolia (L). Watton. Mr. F. Robinson, sp., 1915. A specific locality.

BROMUS ERECTUS, Huds.

B. villosus, Bab. Watton. Mr. F. Robinson!

OPHIOGLOSSUM VULGATUM, L.

E. Ruston Common. Rev. M. C. H. Bird. Trans. VIII., 666, 1909.

EQUISETUM SYLVATICUM, L.

Upton. S. P. Woodward.

*E. ARVENSE, L., var. PSEUDO-SYLVATICUM, Milde.

Moor Lane, Stalham. Salmon and Bennett, 1900.

These notes add 10 species and varieties to the Flora.

IV.

THE BRECKLAND SAND-PALL AND ITS VEGETATION.

By W. G. Clarke.

A considerable area of south-west Norfolk and north-west Suffolk, which I first described as "Breckland" in 1895, is covered by a remarkable pall of sand, on which grow a number of plants almost confined to this district in the British Isles. Roughly it extends from Narborough on the north to Bury St. Edmund's and Mildenhall on the south, from Eccles and Knettishall on the east to Newmarket and Hockwold on the west, and covers an area of about 400 square miles.

Whence came the sand, and what was the origin of the sand-pall? Apart from the 18 at Grime's Graves* I have records of 48 sections showing sand over some other recorded bed. In 27 cases it was over chalky boulder clay, in 4 over sandy loam, in 5 over chalk, in 6 over "dead-lime," which is glacially-disturbed chalk, in 4 over gravel, and in 1 (Thetford pot-kiln) over "red clay." The average of 37 sections where the depth of sand is given, in sections certainly forming part of the "breck" area, is 5 ft., but on the whole it is very much less than this, particularly in localities where steppe plants are most abundant. In the fen-bordering parishes there are frequently only a few inches of sand over the chalk, and there seems a tendency for the sand-pall to thicken eastward, though at Elveden, which is fairly central, there is a recorded section of 15 ft. of sand over chalk. On the eastern border of Breckland the sand is usually much thicker—14 ft. at Wortham, 15 ft. at Ixworth and Eccles Street, 16 ft. at New Buckenham, 18 ft. at Walsham-le-Willows, and 20 ft. at Rougham, but in these cases I think that factors other than those generally prevalent in Breckland have to be taken into account.

* *Vide* "Report on the Excavations at Grime's Graves, Weeting, Norfolk, 1914," pp. 112–126.

This sand has aroused some amount of attention among geologists, but few explanations of its origin have been given. In the "Geological Survey Memoir" (Sheet 51, p. 89), Mr. F. J. Bennett, F.G.S., stated that "the tract within which this sandy covering occurs is also that wherein the Boulder Clay is thin, patchy, and containing much sand; so that a good deal of the surface sand may have resulted from the weathering of the boulder clay in a dry treeless area, where sun and air would have a powerful disintegrating effect on the thin, sandy clay; whilst over these bare plains the winds would soon distribute a more or less general mantle of sand." Similar views have been expressed by other members of the Geological Survey.

The geological evidence shows that originally there was a ridge between Swaffham and Newmarket, consisting of Kimeridge clay, lower greensand, gault, and chalk. The Great Eastern Glacier (F. W. Harmer) coming from N.W. to S.E. across the present fen basin, from which it removed most of the Kimeridge clay, would cut away much of this chalk ridge and carry the detritus of the two formations to the south-eastern extension of its *moraine profonde*, as evidenced by the chalky boulder clay which overspreads so much of Suffolk. After chalk and gault had been in great part removed, the glacier would cut into the greensand, but would not push the detritus so far, and this I take to be the very sandy chalky boulder clay of south-west Norfolk and north-west Suffolk, which contains a great deal of sand, with plenty of chalk, though usually in small pieces, and even to many good judges (as I found during the Grime's Graves excavations) is so different in appearance from an ordinary clay as hardly to be recognised as such. Much of the chalk is the comparatively soft chalk of the district, but there are also nodules of hard Lincolnshire chalk, tabular grey flint from Lincolnshire, and Neocomian erratics from the same area. While the glacial conditions continued, the chalk in this clay would not be affected by water, but when the warmer period recurred and the southern edge of the glacier began to melt, in its gradual retreat it would dissolve much of the chalk in such a porous matrix (the Kimeridgian

detritus to the south-east would be more impermeable), and leave a surface covering of sand containing the flints and erratics of the boulder clay. The streams from the edge of the glacier would probably be sufficiently strong to carry this sand some distance and re-deposit it over chalky boulder clay which had not been decalcified. This may, perhaps, account for its greater thickness to the south-east. It contains a quantity of Triassic pebbles and changed flints. With a loose soil in a comparatively treeless country, there would tend to be further decalcification of the chalky boulder clay, and its distribution would also be affected by the wind, much of the present depth of sand in some areas being undoubtedly blown there. Fig. 21 (Geological Memoir, Sheet 65) shows that at Hockwold the sand is older than the fen peat.

In his report on the sand above the chalky boulder clay at Grime's Graves, Mr. Henry Dewey, F.G.S., said the clay "left a residue strictly comparable with the sand which overlies the clay. There is therefore no reason why the sand was not derived from the chalky boulder clay by atmospheric leaching and solution of the lime." How remarkably this sand has been leached is indicated by various soil analyses (eight of which were kindly furnished to me by Mr. H. Dixon Hewitt, F.I.C.). On Thetford Warren the percentage of sand and insoluble (an average of 18 places) was 95·4; in three Croxton samples 92·1, 88·4, and 93·8; and in three Brandon samples 63·5, 64·4, and 88·9. Hardly any free carbonate of lime was present. In the Thetford Warren sample the percentage of lime was ·02, of phosphoric acid ·09, of potash ·06. The organic matter was 2·1, and the moisture in an air-dried sample ·8.

Within the British Isles a number of plants are confined, or nearly confined, to Breckland, while a few now rare in, or absent from, this particular area are confined to East Anglia, and their habitat leads to the probability that they were originally associated with this district, in which they have been exterminated, but still persist in favourable environment. Dr. J. E. Marr, F.R.S., has pointed out * that steppe conditions

* Tansley's "Types of British Vegetation," p. 97.

existed subsequent to the glacial period, that fossil steppe mammalia occur in England, and that steppe plants must also have occurred here. There are survivors of the glacial flora, and it is more probable that there are survivors of the subsequent steppe flora. In Breckland there is the nearest approach to steppe conditions to be found in the British Isles, and it is therefore reasonable to conclude that a steppe flora would persist longer in this area than in others. It is probable that after the last glacial period steppe conditions were prevalent over a large part of south-eastern England, but where the soil was more fertile and the rainfall greater, scrub or forest would succeed and tend to the gradual elimination of the characteristic steppe plants. Though the excavations at Grime's Graves proved that at the time they were sunk there was woodland consisting of poorly-grown oak, beech, and Scotch pine, with some yew, spruce, and sallow, yet the evidence shows that since the historic period the district was practically treeless until the middle of the 18th century. Wherever scrub was prevented from establishing itself by the poverty of the soil, which was composed of sand and associated with a low rainfall, the steppe flora would tend to persist. This probably accounts for the existing outliers of the steppe flora, the conditions in most of the localities closely resembling those to be found in Breckland.

Dr. Marr gave a list of 11 plants which he considered to be survivors of the steppe flora, but I have ventured to increase the number to 19, though well aware that in some instances good reasons for holding a contrary view could be brought forward.

1. *Silene conica*, Linn. Recorded for 12 vice-counties. Of the 35 Norfolk and Suffolk parishes for which it is recorded 29 are in Breckland.

2. *Silene Otites*, Wibel. Recorded for 3 vice-counties. Of the 36 British records* 34 are in Breckland and the remaining two in Cambridgeshire.

3. *Holosteum umbellatum*, Linn. Recorded for 4 vice-counties. Of the 6 British records (all in Norfolk or Suffolk)

* In all cases records refer to parishes and not to separate stations.

one is in Breckland. Writing to me with reference to this species, Dr. A. G. Tansley says "it used to occur on thatch in the Breckland district, and as it is a well-marked plant of the North German heaths, which apparently show the nearest affinity with the Breckland heaths, it seems probable that it was essentially a Breckland plant so far as this country is concerned, and that it got from the heaths into the rye-fields, perhaps, and so on to the roofs with the straw."

4. *Medicago sylvestris*, Fr. Recorded for 4 vice-counties. Of the 27 British localities 19 are in Breckland.

5. *Medicago falcata*, Linn. Recorded for 5 vice-counties. Of the 72 British localities 38 are in Breckland.

6. *Medicago minima*, Desr. Recorded for 10 vice-counties. Of the 37 Norfolk and Suffolk localities, 28 are in Breckland.

7. *Tillæa muscosa*, Linn. Recorded for 8 vice-counties. Of the 79 Norfolk and Suffolk localities, 25 are in Breckland.

8. *Galium anglicum*, Huds. Recorded for 10 vice-counties. Of the 20 Norfolk and Suffolk localities, 12 are in Breckland.

9. *Gnaphalium luteo-album*, Linn. Recorded for 3 vice-counties. Of the 7 British localities, 4 are in Breckland.

10. *Artemisia campestris*, Linn. Recorded for 3 vice-counties. Of the 17 British localities, 16 are in Breckland.

11. *Veronica triphyllos*, Linn. Recorded for 7 vice-counties. Of the 40 British localities, 20 are in Breckland.

12. *Veronica verna*, Linn. Recorded for 4 vice-counties. Of the 21 British localities, 17 are in Breckland.

13. *Veronica spicata*, Linn. Recorded for 4 vice-counties. Of the 19 British localities, 15 are in Breckland.

14. *Herniaria glabra*, Linn. Recorded for 4 vice-counties. Of the 25 British localities, 10 are in Breckland.

15. *Scleranthus perennis*, Linn. Recorded for 4 vice-counties. Of the 25 British localities, 10 are in Breckland.

16. *Muscari racemosum*, Lam. and DC. Recorded for 3 vice-counties. Of the 19 British localities, 14 are in Breckland.

17. *Ornithogalum umbellatum*, Linn. Of the 51 Norfolk and Suffolk localities, 10 are in Breckland. With reference to

this species, Dr. A. G. Tansley tells me that "it is a North German heath plant, found in abundance in certain parts of the Breck region, and possibly spread from there to other localities where it finds a suitable habitat. Being very ornamental it may well have been widely transplanted to gardens and shrubberies. This is at least as possible a view as that which supposes that the plants of apparently wild habitats are all escapes."

18. *Carex ericetorum*, Poll. Recorded for 3 vice-counties. Of the 6 British localities, 4 are in Breckland.*

19. *Phleum phleoides*, Simonkai. Recorded for 7 vice-counties. Of the 33 British localities, 17 are in Breckland.

In most of these cases the comparisons greatly minimise the much greater predominance of the plants in Breckland, where parishes are much larger, stations more numerous, and individual plants in many cases numbered by the thousand. I know of areas where *Medicago sylvestris* and *M. falcata* have almost excluded other vegetation; many miles of heathland track where one is never more than a few yards from *Tillæa muscosa*; several localities where *Silene Otites* is so abundant as to appear a hay crop; a station for *Gnaphalium luteo-album* with an average of 24 plants to the square yard over a considerable area; a station for *Veronica spicata* where there are over 1400 plants in a very limited space; and several localities where *Phleum phleoides* is the dominant plant. It is probable that *Galium anglicum* and *Holosteum umbellatum* had their original habitat on sandy steppes where they have been almost eliminated by competition or changed conditions, and both plants have persisted on walls where the xerophytic conditions are very similar, but competition is not so keen.

I have worked out the distribution of these plants according to parishes, and this admirably indicates the limits of the steppe flora, the inner area in which they are commonly found, and the outliers where only one or two species occur. The chief

*In April, 1916, I found *Carex ericetorum* at two stations in Eriswell, three miles apart,—W.G.C.

centres, with the number of steppe species recorded for the parish, are:—

Norfolk.—Beechamwell (3), Brettenham (3), Cranwich (5), Croxton (9), East Harling (4), Eccles (3), Kilverstone (5), Mundford (3), Narborough (7), Rushford (7), Santon (6), Swaffham (4), Thetford (11), Weeting (6), West Harling (3).

Other Breckland parishes, or parishes on the border, where two steppe species have been noted are Barton Bendish, East Wretham, Ickburgh, Methwold, Northwold, North Pickenham, and Thompson; and where one species has been recorded, Blo' Norton, Bodney, Caldecote, Castleacre, Cockley Cley, Feltwell, Fincham, Foulden, Garboldisham, Great Cressingham, Gasthorpe, Hilborough, Hockwold, Larling, Marham, Merton, Narford, Old Buckenham, Quidenham, Riddlesworth, Roudham, Shropham, Stoke Ferry, Tottington, Westacre, West Tofts, and Wilton.

Suffolk.—Barnham (11), Barton Mills (9), Brandon (10), Bury St. Edmund's (12), Cavenham (11), Culford (11), Elveden (9), Eriswell (11), Euston (3), Fakenham (4), Great Barton (4), Higham (4), Honington (3), Icklingham (13), Kentford (3), Knettishall (3), Lackford (6), Lakenheath (13), Mildenhall (16), Pakenham (3), Risby (6), Saxham (4), Tuddenham (11), Wangford (5), West Stow (7).

Other Suffolk parishes in Breckland or on its borders, in which two steppe plants have been recorded are Barrow, Fornham St. Martin, Freckenham, Herringswell Santon Downham, Stowlangtoft, Troston and Wordwell; and for which one species has been recorded, Bardwell, Coney Weston, Fornham All Saints, Hardwick, Hengrave, Ixworth, Kennet, Livermere, Rushbrooke, Thurston, Tostock, Walsham-le-Willows, and Worlingham.

These rare plants also extend into Cambridgeshire. Five have been recorded for Newmarket, and others for Chippenham, Fordham, Badlington, and Six-Mile-Bottom, and there are outliers nearer Cambridge.

That steppe conditions were at one time widespread is proved by the group of animals which invaded Europe soon

after the Glacial period, from the dry steppes of Central Asia. These included* the Saiga Antelope (*A. Saiga*), *Lagopus fusillus*, Common Hamster (*Cricetus vulgaris*), Small Hamster (*C. phæus*), Steppe Marmot (*Arctomys bobac*), *Spermophilus rufescens*, *Alactaga jaculus* and *Arvicola gregaris*. Of 14 special "tundra" species, 12 have been found in Western Europe. Where the nearest approach to steppe conditions has persisted the flora more nearly approaches the steppe character. This may be seen at London Bottom, Icklingham, where the sparse vegetation partakes of a downlike character. It consists largely of *Silene Otites*, *S. conica*, *Medicago falcata*, *M. minima*, *Trifolium scabrum*, *Melilotus arvensis*, *Anthyllis vulneraria*, *Phleum phleoides*, *P. arenarium*, *Festuca ovina*, *Festuca pseudo-Myuros*, *Aira caryophyllea*, and *Carex præcox*. There are similar conditions at Cranwich where *Silene Otites* forms almost a hay crop. *Artemisia campestris*, which is naturally a plant of the steppes, persists in places where the soil is unbroken, such as the unploughed balks and heathland banks.†

Certain plants and insects and one species of bird usually associated with the sea-coast are found on the sands of Breckland, and I am one of the many who in the past have considered that these were survivals of the period when the fen-basin was occupied by sea, and the valleys of the Lark, Little Ouse, Wissey, and Nar formed maritime creeks. But additional facts have come to light, and on a reconsideration of the evidence I think that the sand itself is the chief factor, and that it is unnecessary to postulate any ancient association with maritime conditions.

The plants which have been noted as occurring in Breckland and were supposed to be survivals of a coast-flora are *Vicia*

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* Avebury's "Prehistoric Times," 7th ed., p. 293.

† Dr. F. Gidon has described ("Stations résiduelles d'une ancienne végétation xérophile dans la Campagne de Caen," 1912) a xerophilous pseudo-steppe flora found south-east of Caen, which he considers a survival from a period of continental climate, replaced by an oceanic at the time when the coastal forests were submerged in Neolithic or post-Neolithic times. Of the species he mentions, *Phleum phleoides* is the only one included in my list.

lutea, Linn.; *Centaurium vulgare*, Rafn.; *Rumex maritimus*, Linn.; *Carex arenaria*, Linn.; *Phleum arenarium*, Linn.; *Corynephorous canescens*, Beauv.; and *Festuca ambigua*, Le Gall. *Vicia lutea* occurred once as a casual in lucerne at Brandon, and Mr. C. E. Salmon, F.L.S., has shown * that *Centaurium vulgare* was incorrectly identified. *Rumex maritimus* is not confined to the vicinity of the sea-coast or to Breckland, but outside both areas is found at Bungay in Suffolk, and Stratton Strawless, Wroxham, St. Faith's, Thwaite, Hanworth, Scoulton, Great Bircham, Wormegay, Shouldham Thorpe, and other localities in Norfolk. *Carex arenaria*, apart from many localities in Breckland, is also found inland on Lower Greensand at Congham, Leziate, and Roydon. *Phleum arenarium* is found inland at Appleton, and *Corynephorous canescens* at Homersfield. The sedge and the three grasses are all plants of the sand-dunes and not of the salt-marsh, and it is obvious that the loose sandy covering of Breckland provides a more suitable habitat than can elsewhere be found inland, and the occurrence of these species on similar sandy areas where maritime conditions can never have been an originating factor, seems to preclude this explanation. Sand and not sea is evidently the cause of their perpetuation in these inland regions. The parishes for which these plants are recorded are included among those in which steppe plants occur, with the exception of Merton, where *Carex arenaria* is recorded, Didlington, where *Phleum arenarium* grows, and Colveston, where both species occur.

There are certain moths characteristic of the "breck" district, and from the records of their distribution with which Mr. H. J. Thouless has kindly furnished me, it appears probable that in some cases at least they may originally have been associated with steppe conditions and plants.

Dianthecia irregularis only occurs where its food-plant, *Silene Otites*, grows. It is also found in Central Europe and Asia Minor.

Agrophila sulphuralis, although its food plant is *Convolvulus*

* "Journal of Botany," Nov., 1907, p. 391.

arvensis, is only found on the "breck" in Britain. It is recorded from Central and Southern Europe, and from West Central Asia to Turkestan.

Lithostege griseata, which feeds on *Sisymbrium* and *Erysimum*, is also only found on the "breck" in Britain. It occurs in Central and South-Western Europe and Asia Minor.

Spilodes sticticalis, which feeds on *Artemisia vulgaris* and *campestris*, also occurs in South-East England and East Ireland, in West Central Europe, North Asia, and North America.

Tinea imella is also found on wool, etc., in Kent and Lancashire, and in Central and Southern Europe and Asia Minor.

Oxyptilus laetus, which feeds on *Hieracium*, is also found on sandhills on the south coast, in Central and Southern Europe, and West Central Asia to Turkestan.

Acidula rubricata is a general feeder, also found in Sussex, and the North of England, throughout Europe, and West Central and Northern Asia.

Gelechia vilella feeds on *Malva sylvestris*, and also occurs on the south coast, North Germany, Southern Europe, West Central Asia to North Persia and North Africa.

There are also other insects usually found on the coast sandhills and also found on the "breck" area, but as with the coast plants, I would suggest that the sand-pall and the xerophytic flora explain the prevalence of these species in Breckland. The absence of loose sand and the changing conditions which have tended to eliminate steppe plants in other areas would also tend to restrict these species to the coast and such an area as Breckland. Mr. Claude Morley, F.E.S., mentions that 80 beetles attached to arenaceous soils and common on the sandhills of the coast are found in Breckland.

In view of the foregoing facts I would further suggest that the inland breeding of the Ringed Plover (*Ægialitis hiaticula*) is not necessarily a survival from a period when these sands were coastal, but is also dependent on the arenaceous covering of the district. Loose, blowing sand containing many stones forms the desired nesting habitat of the Ringed Plover, and

where this is found outside the breck area, as on the Greensand which forms the higher part of Grimston Warren and Roydon Common, the Ringed Plover also breeds. Its food, which consists of "small crustacea, insects, and worms," would be as abundant inland as on the coast.

V.

BIRDS ON THE WESTERN FRONT (FLANDERS).

By Major Anthony Buxton.

A summer and winter spent at the Front and at the back of the Front have cured me of the idea that the North of France is a birdless region. The noise and bustle of war have had no effect whatever in driving the birds even from the trenches themselves, and I cannot remember any nesting season which has been more productive in introducing birds previously unknown to me than the summer of 1915. The commonest of all military manœuvres is—at any rate in modern warfare—that of sitting still, and while engaged in that occupation there have come chances which have not been neglected of watching birds common in England as well as in France, and others which, for some mysterious reason, seldom cross the Channel.

In March and April I was stationed at a small Château (it would have been called a villa in England) in very open country with a minute copse behind it. This copse was a harbour of refuge for the birds which were beginning to move North, and about the end of March it was crowded for a fortnight with Redwings and Fieldfares, as well as scattered individuals of other species. A sprinkling of Golden Crested Wrens kept arriving, resting a short while, and passing on, and on one morning a single very tired-looking hen Fire Crest took solitary possession of the one fir-tree in the place; she too was gone the following morning.

I expected a very early spring, but this was not the case. The first summer migrants to arrive—and then only in small numbers—were the Chiffchaffs on March 22nd. By the first week in April every suitable place was literally crawling with Chiffchaffs, and they remained throughout the summer the commonest of all the many warblers which, I am happy to say, infest Flanders in summer.

The only English Warblers I did not see were the Dartford and the Wood-Warbler. I was never in really good Dartford Warbler country, but the absence of the Wood-Warbler surprised me, and he is too noisy a bird to miss. Does he pass further west on his way to us, or does he prefer Germany to France, or did the presence of troops there or the superabundance of his cousins the Chiffchaffs and Willow-Wrens hurry him on his way? Nightingales, Blackcaps, Garden-Warblers, Sedge-, Reed-, Grasshopper-, Warblers, all came in their appointed times and places, and in enormous numbers. With them came three Warblers new to me: the Marsh-, the Icterine-, and the Great Reed-Warbler.

I first identified the Icterine (though I had to await my leave and a reference to Dresser's "Birds of Europe" to recall his name) on the ramparts of Ypres. He used to sing every morning from dawn till 10 a.m., and again at intervals in the afternoon; while singing he was so tame that he had no objection to the audience being within a few feet of his head. On a small tongue of land, jutting into the moat from the ramparts and just below where the Icterine sang, were one pair of Blue Tits and family, two pairs of Reed-Warblers, one pair of Blackcaps, one pair of Garden-Warblers, numbers of Greenfinches and, as I shrewdly suspected, the Icterine's wife. In the reeds of the moat was a colony of Great Reed-Warblers. I became intimately acquainted with the domestic affairs of all the birds on that little tongue of land, unhealthy though it was from a shelling point of view.

The Blackcaps and Garden-Warblers had had their first nests blown sideways by shells: the latter had had too severe an attack of nerves to allow them to try nesting again—at any rate while

I was there. Not so the Blackcaps; they rebuilt the day after my arrival within ten feet of their old nest; but the bombardment had an interesting effect on the lady, for the three eggs she laid—I might almost say before my very eyes—were as white as a Woodpigeon's. The cock was as proud of them as if they had been the proper colour, and did quite his share of incubation, and neither bird bothered to move when they were being shelled, nor did the Reed-Warblers even raise their heads out of their nest when our Batteries or the Germans were firing. I left before the opportunity came of studying the colour of the young Blackcaps, if ever they came safely into this world, but if anyone sees a white Blackcap at Ypres next summer, I can explain the phenomenon. To return to the Icterine. After much watching, I noticed he, too, dipped down to this tongue of land and disappeared mysteriously in the bushes, followed by me. After beating vigorously, I made him lose his temper and call excitedly to the hen, but I failed to see where she came from, and though the nest was really obvious, I did not know what it looked like or whether it would be on the ground or in a bush. I had almost touched it dozens of times, but it took a brother officer and myself two more days to find it. It was a very beautiful nest, rather bulky and deep, mossy on the outside and tied, I think, to a lilac bush about five feet from the ground, and the hen only left it when the bush was touched. The eggs were covered with cherry-coloured spots. I have always found descriptions of bird-notes unsatisfactory, but a "cross between a Sedge-Warbler and a love-sick Starling" is a shrewd, if uncomplimentary, hit at an Icterine's song. I met many Icterines afterwards, but never such a tame one as my friend of the Ramparts. He changed three days which might have been dull into very pleasant ones, and I am eternally grateful to him and his neighbours in that shell-strewn spot.

At the same date I heard from an officer who returned from the trenches at Hooge, that a brood of Nightingales was hatched on the day of the heaviest Hooge bombardment, on the lip of the first line trench.

To show how utterly indifferent the birds are to shelling, on May 13th, at 8 a.m., in the garden of Potizze Château, I heard a Nightingale begin to sing. Half-an-hour afterwards, German shells were rained upon the garden incessantly throughout the day. The bird sang on without a pause, where the shells fell thickest, until 12 p.m. and survived, for next morning he started again in the same place as cheerily as ever.

I first came across the Marsh-Warbler in a less noisy part of the world, and, after what I had heard, was rather disappointed with his song. A nest was shown me in Meadow Sweet, on the side of a marsh ditch. That was the only nest I saw, though the birds were common enough wherever suitable ground existed, and were almost aggressively tame. Perhaps I am prejudiced about his song; the bird, the nest, and the eggs are all delightful, especially the last, the loveliest Warbler eggs I know, and the nest is a perfect model of neatness.

Late in June, I was roused to envy by hearing that another officer had found an Oriole's nest in an oak wood. There was an oak wood near my billet, so why not a Golden Oriole? For a fortnight I watched that wood in vain. Then one day, approaching it with a friend, we both heard a clear whistle which we agreed came from a French boy or an Oriole. As a matter of fact it was an Oriole, or rather four Orioles chasing each other round the tree-top in a state of great excitement, whistling and screeching. Next day the birds were still there, quieter, and the following day one pair at any rate seemed to have definitely settled down in a certain part of the wood, and, I felt sure, would nest. I sat down to watch with my telescope, and after a wait of about half-an-hour, saw the hen Oriole hopping cautiously from bough to bough to a little thin oak-tree 100 yards from me. She paused a moment and then flew to what looked like a small round ball hanging from one of the branches. I could hardly believe I had found the nest so easily, but ten minutes later she returned to the same place, and that time I saw a blade of grass in her mouth, and there was no further cause for doubt. I watched the building of the nest on other occasions and never saw the bird carry more than

one blade of grass at a time in her bill, and, however carefully I reached my hiding-place, the nest was always approached with extreme caution and from exactly the opposite direction to my watching post. Unfortunately, for some reason which I could not discover, the nest was deserted before its completion, and I never had the opportunity of finding another one.

The whistle of an Oriole has a very human sound, rich and full, but his repertoire is too meagre. He starts with a splendid note which can be heard 400 yards off, and you settle down with the pleasant expectation of listening to a sort of Charles Capper solo, but it is all over after half-a-dozen bars, because no one has ever taught the poor bird any more. The call note is loud and screechy. I can take off both it and the whistle passably, but neither will go into print. They are amusing, active birds, full of life and sound, and the oak woods of Flanders and the Pas de Calais support a fair stock of them.

One of the commonest birds to be seen from and behind the trenches is the Crested Lark, a tame, cheeky little creature who seems to enjoy human company, military or otherwise, and sings his pleasant, trilly song even in January. He is the one thing worth seeing in all that horrible country round Vermelles and Loos, and he seems to be commoner there than anywhere else, though what he finds to attract him there, Heaven knows. I like him immensely, but not quite as much as his cousin the Woodlark, whom I have not met in northern France. The habits and appearance of the two birds are distinctly similar in many respects, especially in their flight. Both are given to singing quietly to themselves on the ground when approached by a human being; both sing at a regular and not at an absurd height as the Skylark does, and both are very fast runners and given to the most deceitful habits when nesting. The Woodlark is the more aristocratic looking, and is only half the size of the Crested Lark, has a browner, less dusty appearance, and far smaller crest. A hen Woodlark sits very tight on her nest, whereas a Crested Lark slips quietly away when danger is still at a distance. Both these larks are most trying to the temper of anyone searching for their nests; they are so ridiculously

tame and so difficult to perturb in any way, that I always lose my temper before I can make them lose theirs, whereas success lies in keeping perfectly calm oneself and thoroughly annoying the cock to such an extent that he calls the hen off the nest to ask her advice and keep him company.

The Staff were very troublesome last Spring in arranging battles and other things which called me away on several occasions when I was within an ace of finding a Crested Lark's nest; success only came when I was "standing to" during the second Battle of Ypres. On that occasion I came across a very love-sick cock Crested Lark in a hop-garden. He was panting with excitement, mouth open, wings trailing, his crest and his ridiculous stump of a tail erect—altogether an absurd spectacle. He drove his wife away when I appeared, and she flipped off to a field of growing wheat where it was soon pretty obvious she had her nest. The field was close to a road along which people often passed, and I thought she would disregard my presence if I sat on the road. But not a bit of it! She regarded me with the greatest suspicion at once, and though she ran about in the dust at my feet, and both birds flew over my head to look at me from every point of view, she would not go to the nest while I was in sight, and I had to move to a considerable distance from the field before she went to the eggs. Even then she left and visited the nest many times before I found it. Every time any one passed along the road she got up, and almost invariably from the wrong place, for she ran from the eggs before flying, and on returning she also ran a considerable distance with her head tucked in low between her shoulders. The nest looked to me more like that of a Skylark than a Woodlark, and was not so neat or so deep as that little bird makes hers.

In the winter in the Pas de Calais there have been quite a number of Hen-Harriers and Buzzards, and I once saw a Peregrine. Twice in August and once in February I have seen a Great Grey Shrike, in each case at the top of an open down, which is not the sort of place in which I expected to see him.

I do not know whether it is still the fashion to talk of "Continental Titmice" of various kinds as though they differed from our British ones; the Great, Blue, Marsh and Long-tailed Tits (all extremely common) look to me exactly the same in France as they do in England; moreover they speak exactly the same language, including bad language. And what birds use worse for their size than Tits? I refuse to believe that the Marsh-Tit I meet and listen to every morning in France differs at all from the Marsh-Tit who eats my cocoanut while I eat my poached egg on the other side of a pane of glass in England.

Besides the birds mentioned in this article, a naturalist who keeps his eyes, and still more his ears, open will see on the Western Front practically all the birds he would expect in a southern English county, together with those additions which I have mentioned. Another small Warbler, who remains a mystery, I mean to solve this summer; and there were, doubtless, other species which I was too blind or too deaf to notice. If he prefers larger game, again he need not be disappointed; I have seen Roe, Wild Boar, Foxes, and the tracks of Pine Martens and Otters; and I have—but that is another story, better left for a time when I cease to be under the stern eye of military authority.

VI.

METEOROLOGICAL NOTES, 1915.

(From Observations taken at Norwich.)

By Arthur W. Preston, F.R.Met.Soc.

January.

This was a wet and stormy month, rain falling on 29 days to the depth of 3·24 ins. Sunshine was greatly deficient, and there were only four days on which the sun shone for over two hours. Mean temperature was slightly over the average. There was but little snow. Some rather sharp storms of snow and hail on the evening of the 17th were accompanied by thunder and lightning.

February.

Even more rain fell in February than in January, the total gauged here amounting to 3·44 in., which was the largest amount recorded in any February since 1881. There was a remarkable absence of severe frost, but the nights were relatively warmer than the days, which did not yield any unusual warmth. A rather severe thunderstorm occurred on the afternoon of the 19th.

March.

The month opened with a snowstorm, but milder weather ensued for a few days. It was, however, subsequently very changeable, and considerable winterly weather prevailed at times. Snow fell on eight days, heavily on the 18th. The night of the 18th-19th, when the thermometer fell to 22·8 deg. in the screen and to 14·4 deg. on the grass, was the coldest of the entire winter.

April.

This was a dry month, the total rainfall being less than an inch. Sunshine was about 10 hours in excess of the average, and on the 30th the thermometer reached 70 deg. Morning ground frosts were frequent, particularly in the second half of the month.

May.

There were many and great fluctuations of temperature during the month, and two or three fairly warm days were invariably followed by as many cold ones. On the 13th, which was the coldest day in May for 20 years past, the maximum temperature was only 43 deg. Ground frosts occurred on four nights. Sunshine was about 20 hours in excess of the average for the month, and the Whitsuntide holidays were accompanied by exceptionally brilliant weather. A severe thunderstorm occurred on the afternoon of the 6th, after which there was no more thunder until June 27th, a period of $7\frac{1}{2}$ weeks.

June.

A severe drought, which set in on May 22nd, continued till June 25th, during which time only ·13 in. of rain fell on 5 days. This drought, which was accompanied by parching winds, was much felt both in town and country, but daily thunderstorms during the last four days of the month brought some welcome rain. An extraordinary, but brief, outburst of heat occurred on the 8th, when the thermometer reached 89·5 deg. in the shade. On the morning of the 20th the exposed thermometer fell below the freezing point. The thunderstorm of the 28th was particularly severe, and had fatal results at Mundesley and Claxton.

July.

The month opened with fine, hot weather, the shade temperature exceeding 80 deg. on the 3rd and 4th. The

thermometer did not, however, again reach this point during the remainder of the summer. On the early morning of the 7th a sharp thunderstorm was the prelude of a period of cool, unsettled weather, with heavy rain on many days. During the week ending July 29th thunderstorms occurred almost daily. The month's sunshine was 20 hours below the average.

August.

The unsettled weather which set in on July 7th continued until August 17th. Heavy rains fell at frequent intervals, and in the middle of the month thunderstorms, some of great severity, occurred daily; in fact, it is but rarely that such a long succession of these storms has been recorded. After bright mornings the early afternoons would become densely overcast, the thunder commencing about 2 p.m. and continuing to four or five o'clock, after which beautiful evenings would ensue. After the 17th very fine weather occurred, broken by showers at the close of the month.

September.

The opening days of the month were showery and cool, but from the 5th to the 24th the weather was fine, dry, and warm, the temperature exceeding 70 deg. on several days. No rain whatever fell during this period, but heavy downpours occurred on the last four days of the month.

October.

Frosts were registered on the 2nd, 3rd, and 4th, and again in the last week of the month. There were some warm days in the second week. The month's rainfall was only two-thirds of the average. There were several fine, bright days during the month, but the total sunshine fell considerably short of the average.

November.

The mean temperature of the month was four degrees below the average, and it was the coldest November, with three exceptions, during the last fifty years, such exceptions having been in 1871, 1879, and 1910. On the morning of the 27th the temperature fell to 23 deg. in the screen and to 16·6 deg. on the grass. Snow fell on five days, but the falls were slight.

December.

This month was mild, wet, and stormy throughout, the rainfall having been nearly 2 inches in excess of the average. Mean temperature was 3 deg. above the normal, and there was hardly any winterly weather.

The Seasons.

The iollowing tables show the mean temperature and rainfall of the four seasons, together with those of the five previous years, compared with the usual averages. Winter comprises the three months December to February inclusive; Spring, March to May; Summer, June to August; and Autumn, September to November:—

Temperature.

Seasons.	1910.	1911.	1912.	1913.	1914.	1915.	Average.	Departure of 1915 from average.
	degrees.	degrees.	degrees	degrees.	degrees.	degrees.	degrees.	degrees.
Winter -	39·2	40·2	40·8	41·2	40·3	39·7	38·4	+ 1·3
Spring -	47·4	47·8	49·4	48·6	48·5	46·4	46·3	+ 0·1
Summer -	59·5	63.6	60·0	58·4	61·8	60·2	60·2	0·0
Autumn -	49·0	50·9	47·6	52·3	51·0	48·6	50·1	− 1·5
Year - - (Jan. to Dec.)	49·1	50·5	49·6	49·8	50·5	48·8	48·8	0·0

RAINFALL.

Seasons.	1910.	1911.	1912.	1913.	1914.	1915.	Average.	Departure of 1915 from average.
	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.
Winter -	9·96	8·55	8·00	6·34	4·66	13·35	5·37	+ 7·98
Spring -	7·10	6·11	3·60	5·84	5·45	5·18	5·13	+ 0·05
Summer -	7·62	4·50	17·25	4·88	5·25	7·47	6·87	+ 0·60
Autumn -	7·58	8·02	7·58	9·15	6·38	6·58	8·38	— 1·80
Year - - (Jan. to Dec.)	31·84	26·67	35·03	24·42	27·62	29·97	25·75	+ 4·22

The Winter, for the sixth year in succession, was above the average temperature, although the excess was less marked than in the four previous Winters. The Spring and Summer gave mean temperatures in close agreement with the average, but the Autumn, through the cold November, was a degree and a half colder than usual. The Winter was excessively wet, the Spring was normal, the Summer yielded more rain than for three years past, and the Autumn rainfall was nearly two inches deficient.

THE YEAR.

One of the most notable meteorological features of the year was the abnormal wetness of the Winter. The combined rainfall of the three months December to February inclusive was 13·35 inches, exceeding the average by about 8 inches. This seems to have been the largest amount on record registered here during the three Winter months. The total rainfall of the year, notwithstanding the June drought above alluded to, was 29·97 inches, which was about 4¼ inches above the average. Another remarkable feature was the close proximity of the mean temperature of each of the first ten months to their respective averages. November and December, however,

showed considerable variations, the former month having been 4 degrees below and the latter 3 degrees above their normal temperatures. The mean temperature of the year was in almost exact agreement with the average. Sunshine was nearly 30 hours deficient, the chief falling off having been in January, July, and October. May and June were the sunniest months. Mr. J. H. Willis has again kindly furnished me with his records of sunshine. Harvest commenced in Norfolk about August 12th, concluding about the middle of September, and, with the exception of the first week, was attended with fine, dry weather.

MR. PRESTON'S METEOROLOGICAL RECORDS FOR 1915.

Month.	Barometer.					Thermometer.					Hygrometer.	Sunshine.	Rainfall.		Wind.								
	Highest.	Date.	Lowest.	Date.	Mean.	Highest.	Date.	Lowest.	Date.	Mean.	Mean Relative Humidity 9 a.m.	Hours.	Inches.	No. of Days.	Direction and Days.								Mean estimated force
															N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	
	in.		in.		in.	°		°		°	%												
Jan.	30.42	19	28.73	1	29.555	52.0	13	28.0	23	38.9	87	25.0	3.24	29	4	4	2	1	5	5	6	4	2.8
Feb.	30.40	26	28.75	13	29.598	50.2	5	28.8	12	39.5	93	64.2	3.44	21	2	0	0	3	12	3	3	5	3.2
March	30.41	9	29.33	18	29.949	60.0	24	22.8	19	41.4	81	111.9	1.91	17	8	3	0	2	1	3	7	7	2.5
April	30.32	27	29.09	7	30.025	70.0	30	30.3	15, 18	46.1	70	170.1	0.80	10	5	4	4	2	3	3	5	4	3.1
May	30.45	9	29.65	13	30.045	73.8	25	32 0	15	51.7	70	226.6	2.44	14	4	13	5	4	1	1	1	2	3.2
June	30.28	12	29.71	28, 29	30.029	89.5	8	37.2	20	58.6	67	226.1	0.93	10	1	11	6	0	3	6	2	1	4.8
July	30.22	2	29.20	17	29.854	82.3	4	47.5	13	61.1	73	189.8	3.73	20	1	0	0	1	5	5	15	4	2.8
Aug.	30.29	23	29.45	3	29.975	76.0	11	42 8	30	60.8	78	173.2	2.81	19	7	0	2	2	2	3	6	9	2.4
Sept.	30.34	1 0	29.38	26	29.985	74.8	16	37.0	28	57.3	78	174.4	1.53	9	5	0	5	3	3	4	5	5	2.9
Oct.	30.34	18	29.45	31	30.032	64.8	12	31.8	2	49.1	89	86.4	2.01	17	3	4	6	9	3	3	0	3	2.1
Nov.	30.74	20, 21	28.64	12	29.889	52.8	12	23.0	27	39.5	88	67.7	3.04	23	6	3	5	0	2	2	4	8	2.8
Dec.	30.41	19	28.89	24	29.599	55.8	10	29.0	9	41.9	92	37·6	4.06	27	3	0	2	1	12	5	4	4	3.2
Means					29.878					48.8	80	1553.0											3.0
Extreme & Totals	30.74	Nov. 20, 21	28.64	Nov. 12th		89.5	June 8th	22.8	Mar. 19th				29.97	216	19	42	37	28	52	43	58	56	

VII.

THE JANUARY FLOOD OF 1916 AT GREAT YARMOUTH.

By Arthur H. Patterson.

A well-known Norfolk angler-naturalist has, on more than one occasion, reminded me of the increased tendency to flooding in the basin of the Yare and its two main tributaries. In words akin to these, he said:—"The greed of your Commissioners in constantly deepening the water on the bar will ruin the riparian owners on our rivers." In other words, he insisted that an increased in-flow of water would make the whole valley susceptible to flooding. In this I have long agreed with him.

Time was when the sand-bar at the harbour entrance at Gorleston was of considerable detriment to the port; vessels of only moderate depth being compelled to pick their opportunities on the flood-tide to depart, or to come in on the same. As a boy, I well remember my father frequently bewailing the fact; it was nothing rare for a vessel to stick fast there, and I believe, on occasion, it was almost possible for a man to walk across it without getting out of his depth.

One must, at least, touch on this matter in order to grasp the idea of an increased tendency to flooding. The removal of the bar was, in the first half of last century, a continuous and an expensive matter, dredging operations only keeping the entrance of the river passingly negotiable. Experiments were tried in lengthening the Gorleston piers, or breakwaters, until it was discovered that by extending the north pier, on the Yarmouth side, the ebb tide would go out with an increased scour, in this way automatically reducing the height of the bar; whereas a lengthened south pier did not, whilst it allowed the sand on the flood tide to accumulate with greater rapidity. We have no need now for dredging the harbour entrance, as at Lowestoft. I think I am correct in saying that the present

formation of the breakwaters is not so favourable to an incoming of the shoals of Codlings, Whitings, the number of Flounders, with Grey Mullet and the incursions of Soles, Skate even, and many other species, the pursuit of some of which species was at one time profitable to the old race of Breydoners, now, with the exception of three or four very aged men, extinct. Smelts still come in in fair numbers, but I think the quantities now found in the Ham at Gorleston, south of the piers, that have not "hit" the harbour entrance are somewhat greater; and contrary to the opinion of the late Mr. T. Southwell, I still believe that considerable numbers of maturer Eels *come up* with the elvers from the sea in spring.

To assist the natural dredging of the harbour, even if it were not the original intention, the focussing of the Yare and Waveney at Berney Arms point, with the additional spur, known as the "Dickey Works," a little lower down, that "set" the water off the flats, has considerably deepened the channel bisecting Breydon, so much so, that no dredging is required there, except at long intervals, to remove points, *e.g.*, the Knowle, and perhaps in the vicinity of Burgh Castle. Where, I am told, in the '50's, and earlier, Breydoners could stake their nets across Breydon channel, we now have depths varying from 18 feet to 23 feet of water.

On the other hand, the "Dickey Works," near the other breakwater at the Burgh end of Breydon, whilst setting off the tides into a common focussed outrush, also made an eddy, which, as a consequence, threw up the silt on to the flats, and in the course of a man's lifetime they (the mud flats) have grown-up several feet. Areas, such as Rotten Eye, where as a lad I dare not walk, are now hard. Other natural causes assisted in what Breydoners complained rightly, from their standpoint, in "ruining the place." On the soft ooze there grew "gardens" of *zostera*, which attracted thousands of widgeon on their spring migrations (2,000 nowadays at one time is a great event, although hundreds occasionally occur from March to May). This *zostera marina* holds the particles of silt, that with the flotsam coming upstream is held in

suspension and settles there, to be added to tide by tide, year unto year. The *nereids* (*nereis divirsicolor*), so attractive to the probing Whimbrel, Godwits, Knots, Dunlins, etc., gradually die as the silt hardens; then comes the *ulvæ lactuca* and the hairy "Raw" weed of the old Breydoners. The Drains, *e.g.*, Ship Drains, Duffell's Drain, and one or two cross drains deepen in proportion, with faster-running waters. Except on the springs, or fairly good tides, the flats are now not all covered; occasionally they do not cover at all on the neaps with easterly or southerly winds, whilst a northerly gale, even on the neaps, will cover them two feet under. But normally the water covers the whole area but for a very short time, and the muds grow harder yearly. In one or two places, as at the "Lumps," saline grasses, such as characterise the fast-dwindling ronds, have appeared and increased. The ronds have been ever subject to erosion, and also as toll to the wall-menders.

From these little explanatory notes it will be seen that the flood-tide has a much shallower basin to expand itself in, and it must in consequence go up rivers; and so in the last few decades salt water has gone up-stream in increasing volume and violence, to the great detriment of the shoals of fresh-water fishes, and to the accentuated danger of the marshlands on either side the river, demanding an increase of vigilance on the part of the riparian owners.

The North River, or Bure, is not so susceptible to big tides, because the Knowle, at its confluence with Breydon, a nuisance as it is to navigation, acts as a dam. The Waveney and Yare marshes are wetter; and those rivers are more liable to flood waters. The Redshanks are much rarer than formerly on the Bure marshes; the reedy-ronded Waveney is still their favoured resort.

Taking all things into consideration, the simple answer to the problem, more especially as the Commissioners are unlikely to moderate what my angler-naturalist friend called their "greed," is to raise the banks and keep them in good repair, as occasion makes demand. I think I may here add that I am of opinion that we get sharper tides along the coast; a sort of

promontory that used to exist half-way between Yarmouth and Caister, and known as the Patch, has in a few years been obliterated, and other changes take place that may make good my belief. So, altogether, I may venture to say that, with more than usually forceful north-west gales, we shall always be subject to these high tides.

The high tide of January 13th, 1916, being backed by a prolongation of the gale, sent up an enormous tide, a second flood-tide coming in before the previous one had had time to ebb; and so for hour after hour the seething, swirling waters rushed up-stream. Rafts of timber were torn from their moorings, and huge logs were borne along like so many things possessed. Boards from the timber yards were licked from the quays. and floated along like so much matchwood. Boat-shed doors were lifted off their staples and swept into the common procession, whilst boats and yachts, moored in the sheds, ramped like restless horses at the bridle, tossing indoors on the surge that broke into their winter quarters.

In Yarmouth there was much excitement among those who dwelt near the river sides, or in the low-lying parts that had known floods before. In more than one instance water broke over the quay-sides and made big streams inland, where a little foresight in the banking up of marl and the erection of plank barriers might have prevented a lamentable inrush.

Breydon walls were sorely tested on either side; and breaches by continual onslaughts of big waves were quickly made on the southern side; nor did the northward side withstand the weight of water pressing against it. On the south some long stretches with a concreted facing saved the bank behind; but it was where neither flint nor concrete had been used as a defence that the ugliest breaches were made. Water broke continually over the concreted portions, brushing down the grasses and bleaching them, making many gulley-like runs. The tops of the unprotected portions that stood the lashing in the aggregate were toothed and jagged as if smitten with battering rams. Water simply poured over the walls, flooding the ditches, and covering the marshes with from two to three

feet of water. This, under the circumstances, was fortunate, for it eased the pressure upon the town banks, or Southtown had been worse placed than ever.

The description of one flood may answer well for others, and I will confine my description to what I saw of its effects, after the worst had happened.

I found my own boat-shed on the edge of Breydon undamaged, but the punt had had a lively time in her waltz with fish trunks and loose wood, and the silt lay thick everywhere when the tide went down. In the adjoining shed the big doors had been ripped off. Timber baulks had been stranded on landing-stages, and several bestrewed the mud at the base of the walls. Here and there one had acted as a battering-ram, holes being pounded in the concrete slope, whilst in one or two instances I observed that the ends of these timber baulks had been ground by attrition into the shape of pointed cigar-ends. *Zostera* fronds were flung all over the apex of the walls, with much light flotsam. In three days the waters had subsided on the south marshes to a level of the ditches, thanks to prompt measures taken to drain them. Many Roach, up to half-a-pound each, and some Jack were left dead on the marshes, their gleaming sides attracting Gulls and Hooded Crows. Worms had been drowned in myriads, to the huge delight of Lapwings and Black-headed Gulls. The larger Gulls found much to discuss over the moles that had failed to reach the higher slopes of the walls; a few of them did, their tunnels in their hungry endeavours being marked by the mounds thrown up on the hard soil.

On the 15th I walked up the New Road, and found much of the water had gone, although near the Ash Tree Level quite a big lake remained, on the edge of which many Grey Plovers were picking up defunct earth-worms. The marshes were still very sumpy and the ditches full up.

When going to St. Olaves by train, on the 16th, I found several marshes near Belton still under water, the small trees marking the higher places, and the flood water shimmering in the sunlight, and rippling right up to the railway metals on one

side, gave one a curious impression as of discovering a newly-formed Broad. The blues and purples of sky and cloud and the brown of old reeds, reflected in the clear flood, heightened the illusion. This portion was the last to be drained. Wise heads were shaken, and the grass was to be spoiled for, at least, two or three years, but at the moment of writing—three months after—every marsh looks normal, and cattle are already feeding on the recuperating pastures.

The effects of the incursion of salt waters up-stream were noticeable in the destruction of fishes. Tons are said to have been destroyed in the Bure and Thurne, but hundredweights will make a big display. Perch, Tench, Roach, and Bream suffered badly, and Jack up to 6 lbs. and 7 lbs. were found on the surface dead. The villagers put off in boats and garnered them in for the pigs. The Gulls gathered at Potter Heigham and Acle, where they gorged themselves from day to day; a goodly Godsend indeed had been the floods after a prolonged bad herring season at Yarmouth, in which these birds had fared badly enough.

Some indignation was aroused at Yarmouth, the inhabitants at Southtown, whose homes or properties had been sadly damaged by the incursion of the waters, being especially angered. Meetings were held at which the shortcomings of the local authorities were severely discussed, and a better system of protection was demanded. The protests had a good effect, and remedial work was begun at once. Concrete edgings, some eighteen inches high, have been constructed at the quay-edges where deemed essential, and a general raising of the banks has been continued elsewhere: whilst Breydon banks (on the south side) have been repaired and all the vulnerable parts strengthened and raised. This process must be repeated as future high tides make demand, and the excellent pumping facilities at Yarmouth might be yet more largely augmented. Riparian owners must also see to their share of the repairs if the marshes and levels they own are worth the protection they profess them to be.

VIII.

IMMIGRATION OF ROUGH-LEGGED BUZZARDS IN 1915-16.

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

The migration of Rough-legged Buzzards (*Buteo lagopus*) to Eastern England, and especially to Norfolk, during the winter of 1915-16, was the largest and most important influx of this species that there has been for several years.

Rough-legged Buzzards are not generally expected before November, but it is believed that one pair at least were identified by Mr. J. Vincent as early as September at no great distance from the coast. But as a few Common Buzzards appeared also, it was not before October that the presence of the Rough-legged species could be positively certified. It was difficult to prove anything as to numbers, because several people gave orders that the Buzzards were to be protected, and consequently the same birds would be seen first in one parish and then in another. But it is pretty safe to say that Norfolk was not visited by less than forty, and Suffolk and Lincolnshire possibly by half that number.

Up to Christmas twelve had been accounted for in Norfolk, as already announced in the "Zoologist" (1916, p. 204), but later occurrences have not been recorded at present in that journal.

On January 6th, 1916, a dark male, described by Mr. Saunders as of quite a sooty colour, was shot at Freethorpe, and on the same day Dr. S. H. Long saw a pair on the heath at Langmere, which showed that they were getting inland. Here it may be remarked that they generally seemed to keep two together, but whether of opposite sexes cannot be determined. At Hickling a pair remained without being divided all through the winter, being repeatedly seen by Mr. Vincent, who protected them.

On April 1st there were still two at Clippesby, as I learn from Mr. E. C. Saunders.

On April 18th a friend took me to see what to both of us was a sad sight, two fine Buzzards hanging on a keeper's pole with a Grey Crow.

On April 24th one was seen at Stody by Mr. G. Davey, and this would nearly mark the date of their departure. However, another, which may have been quite the last, was seen by Mr. Vincent at about four miles from the coast on May 5th.

As usual, their chief food proved to be rabbits, and on some warrens at Winterton and Somerton, Mr. Saunders was informed, they had been rather troublesome, even being so bold as to take rabbits out of traps. But this propensity has been the cause of their destruction, for, although too shy to be shot, they can be easily trapped, and a dead rabbit is a bait which cannot be resisted.

Although a Rough-legged Buzzard has no objection to wounded game, if it can catch them easily, its natural food seems to be rabbits and rats. In 1880 a bird-stuffer, who had had in five to stuff, told me they all contained remains of rats; so, instead of being the gamekeeper's enemy, the bird is rather to be regarded as his friend.

As a proof of this, the following may be cited:—"In 1874-76, and again in 1891-93, when a formidable plague of field-mice broke out in parts of Scotland, an unwonted number of Rough-legged Buzzards appeared to feed on them" ("Birds of Dumfriesshire," pp. 192, 193). There can, therefore, be no doubt that they do more good than harm to the agriculturist. In 1891-3, besides the Buzzards, great numbers of Short-eared Owls* came to Dumfriesshire and bred.

With regard to the plumage of the Rough-legged Buzzard, it may be noticed that it is rather owl-like, and very soft compared with that of the Falcons. Some of those which met

* On digging out the earth of a fox which had acquired a taste for lamb, Mr. D. Glendinning found five young foxes, 76 Short-eared Owls, nearly all of their young ones unable to fly, and a number of Grouse, Black-game, Partridges, Wild Ducks, Curlew, Plover, Rats and Voles. (Annals Scot. Nat. Hist., 1893, p. 199.)

their fate in the spring were assuming the adult dress, which is quite different from that of a young Buzzard in autumn, being altogether more barred, especially on the thighs.

In a young Rough-legged Buzzard the irides are brown, or brownish, but in one shot on February 11th Mr. E. C. Saunders remarked that they were turning yellow. However, it would appear from my father's observations that yellow irides are not, as has been thought, an invariable mark of age. (See "The Ibis," 1876, p. 374).

The darkest Buzzard received by Mr. Saunders, which was a male, had very dark hazel-brown eyes; in a female, which I saw in the flesh, they were not quite so dark. All the lighter-coloured Rough-legged Buzzards which came under Mr. Saunders' inspection had dull yellow eyes, but these would probably have been a good deal brighter in life.

The last occasions on which Norfolk and Suffolk were visited by Rough-legged Buzzards in any numbers were in 1880, when I repeatedly saw them on the wing, and in 1891 and 1910.

What must have been the largest immigration ever recorded on the East Coast was in 1839, but observers were few and far between then. Forty-seven, my father was told, were taken near Thetford alone!

IX.

THE FLORA OF A NORWICH WASTE PATCH.

By W. G. Clarke.

Towards the end of June, 1915, our President drew my attention to the flowers on a waste piece of land in the heart of the city of Norwich, adjoining the river Wensum on the north, about 70 yards north of St. Miles' bridge. A high wall divides it from the river, to which it has a frontage of about 150 feet, with a depth of 90 feet, and it is surrounded by walls and buildings. The soil is hard, and about half the area, or 750 square yards, is devoid of vegetation, while on the remaining portion it occurs only in patches. Workmen were also in attendance, and plants were frequently broken or destroyed, yet in three months I succeeded in obtaining no less than 111 species from this site. The most abundant plants were *Sisymbrium officinale*, *Brassica arvensis*, *Diplotaxis muralis*, *Capsella Bursa-pastoris*, *Coronopus procumbens*, *Cerastium vulgatum*, *Spergula arvensis*, *Melilotus indica*, *Æthusa Cynapium*, *Matricaria inodora*, *M. suaveolens*, *Artemisia vulgaris*, *Arctium Lappa*, *Plantago major*, *Chenopodium album*, *Atriplex patula*, *Polygonum aviculare*, and *Poa annua*. In addition to some of the rarest corn-field weeds hitherto recorded for the county, I was successful in obtaining 13 species (indicated in the list by an asterisk) new to Norfolk. The reason for the presence of most of these flowers has kindly been furnished to me by Messrs. Bullard & Sons, Ltd., of the Anchor Brewery, who state that at the end of the 1914-15 malting season, dust from English and Californian barley was placed there. In previous years, in addition to the dust from local barleys, dust from Russian, Austrian, and Tunisian barleys was also thrown there, and it is probable that a seed-bed was provided by the inflowing of water and silt during the great floods of August, 1912.

The presence inland of *Glaucium flavum*, *Vicia lutea* (one previous record for the county), and *Hordeum marinum*, is worthy of note. The only previous record for *Glaucium*

phoeniceum was in 1755; there is only one record for *Asperula arvensis*, only two for *Saponaria Vaccaria* and *Melilotus indica*, and no recent record for *Lathyrus Aphaca*.

For assistance in the identification of some of the species I am greatly indebted to Miss M. C. Knowles, of the National Herbarium, Dublin, Mr. W. H. Burrell, F.L.S., and Mr. A. J. Wilmott, of the British Museum (Natural History).

Adonis annua, Linn.
Ranunculus arvensis, Linn.
Delphinium Ajacis, Linn.
Papaver somniferum, Linn.
P. Rhœas, Linn.
P. dubium, Linn.
P. hybridum, Linn.
Glaucium flavum, Crantz.
G. phoeniceum, Crantz.
Radicula palustris, Moench.
Sisymbrium officinale, Scop.
Brassica Napus, Linn.
B. Rapa, Linn.
B. nigra, Koch.
B. arvensis, O. Kuntze.
Diplotaxis muralis, DC.
Capsella Bursa-pastoris, Medic.
**Neslea paniculata*, Desv.
Coronopus procumbens, Gilib.
Raphanus Raphanistrum, Linn.
**Rapistrum rugosum*, All.
Reseda lutea, Linn.
Viola arvensis, Murr.
Saponaria Vaccaria, Linn.
Silene latifolia, Rendle and Britten
Lychnis alba, Mill.
L. Githago, Scop.
Cerastium vulgatum, Linn.
Stellaria aquatica, Scop.
Spergula arvensis, Linn.
Malva sylvestris, Linn.
M. rotundifolia, Linn.
**Trigonella Foenum-græcum*, Linn.
Medicago lupulina, Linn.
M. denticulata, b. *apiculata*, (Willd.)
Melilotus altissima, Thuill.
M. indica, All.
Trifolium pratense, Linn.
**Astragalus lamosus*
Vicia Cracca, Linn.
V. pseudo-Cracca
V. lutea, Linn.
V. sativa, Linn.
V. angustifolia, Linn.
**V. monanthos*, Desv.
**V.* ——— (?) (This plant was carefully compared with all the material in the Kew Herbarium by Dr. Augustine Henry, F.L.S., and Dr. Staff, and could not be matched. It resembled *Vicia peregrina* in some respects

and *V. angustifolia* in others.)

Lathyrus Aphaca, Linn.

Epilobium angustifolium, Linn.

E. hirsutum, Linn.

Œnothera biennis, Linn.

Bupleurum rotundifolium, Linn.

Scandix Pecten-Veneris, Linn.

Æthusa Cynapium, Linn.

**Caucalis latifolia*, Linn.

C. daucoides, Linn.

C. Anthriscus, Huds.

C. nodosa, Scop.

Galium Aparine, Linn.

G. tricorne, Stokes.

Asperula arvensis, Linn.

Erigeron canadense, Linn.

Anthemis arvensis, Linn.

**A. mixta*, Linn.

**Anacyclus valentinus*. DC.

**Chrysanthemum coronarium*, Linn.

Matricaria inodora,, Linn.

M. Chamomilla, Linn.

M. suaveolens, Buchenau.

Artemisia vulgaris, Linn.

Senecio vulgaris, Linn.

Arctium Lappa, Linn.

Cnicus lanceolatus, Willd.

C. arvensis, Hoffm.

Cichorium Intybus, Linn.

Taraxacum officinale, Weber.

Sonchus oleraceus, Linn.

Lithospermum arvense, Linn.

Convolvulus arvensis, Linn.

Solanum nigrum, Linn.

Datura Stramonium, Linn.

Hyoscyamus niger, Linn.

Plantago major, Linn.

Chenopodium album, Linn.

Atriplex patula, Linn.

Polygonum Convolvulus, Linn.

P. aviculare, Linn.

P. Persicaria, Linn.

Rumex obtusifolius, Linn.

R. crispus, Linn.

R. Acetosa, Linn.

Euphorbia Peplus, Linn.

Mercurialis perennis, Linn.

M. annua, Linn.

Urtica urens, Linn.

Phalaris canariensis, Linn.

Alopecurus pratensis, Linn.

Milium effusum, Linn.

Phleum pratense, Linn.

**P. Michelii*, All.

Agrostis alba, Linn.

Apera Spica-venti, Beauv.

Poa annua, Linn.

Festuca Myuros, Linn.

Bromus tectorum, Linn.

B. sterilis, Linn.

Lolium perenne, Linn.

L. temulentum, Linn.

Hordeum marinum, Huds.

**H. hexastichium*, Linn.

**H. leporinium*, Linn.

Pteris aquilina, Linn.

X.

THE YARMOUTH HERRING FISHERY OF 1915.

By Arthur H. Patterson.

The autumnal East Coast Herring Fishery of 1915 will for long be remembered as one characterised by the lowest number of vessels fishing out of Yarmouth for many years past, for the comparative heaviness of the catches, and for the record prices obtained.

It would not be out of place here to give the figures of the boats employed during the past three seasons, that of 1913 constituting a record :—

1913.

999 drifters (English and Scotch) fished out of Great Yarmouth. The catches amounted to 824,213 crans, or 82,413 lasts ; 820,527 barrels were exported, independently of the fish smoked and otherwise cured for home consumption.

1914.

370 drifters (English and Scotch) accounted for 177,459 crans, or just under 17,750 lasts. About 49,000 barrels of pickled herrings were shipped, the chief portion "going coastwise," a rather loose term.

1915.

185 drifters (English and Scotch) fished out of the port ; the number of crans was 120,122, or 12,012 lasts. Seeing that but half the number of boats fished, when compared with 1914, the catches would rightly be deemed exceedingly heavy.

The boats fishing out of Lowestoft may be reckoned at about two-thirds the number using Yarmouth port, and the catches in like ratio. Fishing commenced in October ; fifteen drifters coming in on October 5th with a few fish, five crans

being the heaviest catch—roughly, about 3,000 herrings. The highest price realised was 82/- per cran. The herrings were reported as " not large, but of fine quality," a description that applied to the fish generally all during the season. A Lowestoft drifter, fresh from the sea, put in with two crans, that made £5 14s. per cran, more than a penny per fish. On the 18th, a Yarmouth boat (the " Try ") landed 150 crans, which brought to the fortunate vessel's credit £400. The largest number of boats coming in on one day was over 100, with catches amounting roughly to the value of £20,000.

The Banff boat " Benison " was reported in the local paper of November 1st as having come in with a huge catch of 280 crans, equal to 280,000 fishes, and this haul constituted a record. The nets used by that boat numbered 67, of which four nets were slipped, so full were they. The catch was sold to one buyer at nearly £600. The English sailing drifter has entirely disappeared, and the Scotch sailer has become a *rara avis*. A number of the latter sailing boats have been fitted with motor power, thus adding at a comparatively small outlay greatly to the catching and homing powers of these boats.

Very rough weather broke in at the height of the season, and kept the boats lying idle when they would otherwise have been fishing; a gale playing sad havoc with many of the nets of those boats which were caught at sea. A Scotch boat, the " Grateful," ran in with a fortunate haul of 50 crans; these were disposed of at £6 11s. per cran. The highest price per cran for the season was 146/-, about *threepence-ha'penny* a herring, a figure never before known. Forty shillings was the minimum figure recorded this season.

The boats plying this season were of an older type of steam-drifter, the Naval Authorities having taken over the pick of the fleets at Yarmouth and Lowestoft, and laid a heavy hand on the fishermen themselves. Some of the Scotch motor vessels earned up to £2,000 for two months' work; and the larger steamboats " made up " on huge earnings, one boat having to its credit no less than £4,300. One Scotch boat earned £2,400 in eleven days; and a boat purchased for this

fishing brought in for her lucky fishermen no less than £700 in one week.

In ordinary seasons some 200 steamers, some of large tonnage, came hither to load "pickles"; this year saw none of them, a few small steam-coasters taking what little was exported to other ports for transhipment; the majority of the catches being consumed in the Homeland. Some Scotch curers are said to have developed a market in the United States, and local merchants cultivated a trade with France.

The year 1915 may be summed up as the fishermen's year, some of the men taking what may be characterised as huge sums, and it is to their credit that many of them put their hard-earned gains to good uses.

The south portion of the town was badly hit, there being so few Scotch coopers; and fisher-girls, carters, and the several thousands of various hands connected with a great fishery were represented only by a fraction of their normal numbers. Many of the Scotchmen, as well as Englishmen, at the close of the fishing found their way into the Army and Navy; and not a few marriages took place, a feature always connected with what is known as a "fisherman's fishing."

XI.

MISCELLANEOUS NOTES AND OBSERVATIONS.

I THINK the growth of a *magnolia grandiflora* on this house has been so rapid as to be worthy of notice. It was planted on April 20th, 1901, on the south side of a wing of the house at the north end which projects westwards, and, therefore, it is completely sheltered from north and east winds. It was taken from a pot and was about 3 feet high; some good garden soil was put into the hole dug for it, but since then nothing in the shape of manure or top dressing has been applied. It commenced to grow very quickly and has flourished wonderfully ever since, and has bloomed well for some years. At the end of the summer of 1915 it had reached the top of the wall of the house it had been planted against, and was 26 ft. 9 in. high,

15 feet wide, girth of stem 1 ft. 4¾ in. at 6 inches from the ground. It was protected from frost the first two winters after it was planted, but since that time has been left to face all weathers.

EDWARD KNIGHT.

Keswick.

SENECIO PALUDOSUS L. & S. PALUSTRIS DC. IN NORFOLK.—In the "Journal of Botany" for August of this year, the Editor contributes a biographical notice of Richard Middleton Massey, who died in 1743, and was buried at Rostherne in Cheshire.

In the course of this notice he names a letter written (May, 1714) to Petiver by Massey from Wisbech, in which he offers to meet him at Derby or Nottingham; "but if you come on horseback it is not above half-a-day's journey to come by Wisbeach, from which I will show you the way into that country, and bring you cartloads of Stratiotes Aloides; nay, you will meet that and the Conyza foliis laciniatis (Senecio palustris) on your way to me." Petiver (May 27) asks for the localities of the "Conyza and of Lingua avis seu Virga aurea species (S. paludosus)." Massey replies: "Lingua avis grows at Stretham Ferry in the road betwixt Cambridge and Ely; Conyza fol. lac. I have found in great plenty along the old Podike from Stowbridge and betwixt Wisbeach and Peterborough." On June 16th Petiva asks him to "send a Quire or two fil[d] with their specimens, particularity ye Lingua avis and ye Conyza palustris fol. integris and laciniatis."

Here we have an entirely new station for S. palustris, but it must have become extinct before Miss Bell, of Stow Vicarage, corresponded with Mr. Watson, or she would have named it.

It may be noted that then the Senecio occurred with entire and serrated leaves.

The "betwixt Wisbeach and Peterborough," a distance of about 16 miles in a straight line, would be in Cambridgeshire, and is an additional station for that county.

In recent maps the old Podike seems to be merged partly in roads, but in the 1789 map of the Bedford Level it is shown as continuous from Stow Bridge to Outwell, adjoining Hares Severals, Buck Fenn, and Outwell Common.

ARTHUR BENNETT.

THE GREAT BUSTARD IN CAPTIVITY.—Since the publication of my last Note (*vide* Vol. ix., p. 638) on an attempt at the domestication of the Great Bustard, my birds have remained in health and good plumage. The male continues to be very pugnacious, the more so as he gets older. They are all easily frightened, especially by overflying airplanes, which cause them to crouch and seek any available shelter.

Towards the end of May, 1913, the two hen birds seemed unsettled and quarrelsome, so I left them out in their run at night, and on the 31st I found an egg in the run, and another on June 2nd. As neither of the hen birds showed any disposition to sit, I placed the eggs under an Orpington hen, but neither hatched out. Two more eggs were laid on the 12th and 15th respectively, and these eggs were placed under another Orpington hen, but again with no result. During 1914 and 1915 no eggs were laid. On leaving Norfolk in the spring of 1916, I gave the birds to the Zoological Society of London, and they are now in the Society's gardens in Regent's Park.

E. J. H. ELDRED.

BIRD NOTES FOR 1915.—The most important occurrence of the year was that of a Great Skua, near Ixworth, forty miles inland, a very rare visitor to the Suffolk coast at any time; this occurred in January. In April a Common Guillemot was picked up just outside Bury, having struck a telegraph wire; it was kept alive a day or two and then died. In the same month four specimens of the Eared Grebe in breeding plumage were shot on a pond near Woolpit Warren; the same pond was visited by a Cormorant in early June. In the first week in

September a fine specimen of the Manx Shearwater was obtained on Troston Heath. This is the month in which these birds generally migrate. On September 23rd the last Turtle Dove appeared in our garden here. On October 14th a Little Owl was killed at Bradfield St. George; it rose from a meadow and was thought to be a young Wood-pigeon. On October 18th the first Woodcock was shot at Westley, a bird of the year. These birds breed in a wood of 300 acres not far off. On November 13th the first large flock of Fieldfares appeared during the hard frost. On November 22nd many Black-headed and Herring-Gulls were following the plough close to Bury. On December 13th Golden Plovers were seen on the plough at Norton.

During July a young Cuckoo, which was hatched in a Wagtail's nest, remained in the garden for nearly a week and was seen to be fed not only by its foster-parents but also by a Chaffinch and some Sparrows. It was quite tame, and occasionally took a bath in the bird pan.

W. H. Tuck.

Note on the Crested Tit.—On June 19th, 1916, I was staying in Inverness-shire and was fortunate enough to observe Crested Tits feeding their young. The female brought two small green caterpillars in its bill at the same time. Then the male came with a Daddy Long Legs with the wings carefully removed. Then the female came with a Bordered White Moth. While they were doing this they were also feeding their young up in the adjoining fir trees. Apparently three of the young had returned to the nest, for when the bark was removed from the tree the three flew a considerable distance. I secured a young male from these three, which has been mounted by Mr. T. E. Gunn and is now in the Norwich Museum.

Garioch.

Wild Bird Protection on the Norfolk Coast.—Owing to lack of funds, it has not been possible for the Breydon Society to print the watcher's observations for the past two years. This is much to be regretted, and unless the Society receives additional pecuniary support, there is a fear that the services of the watcher may have to be dispensed with altogether. A large amount of valuable information on the spring and autumn migrations have been gradually accumulated by the Breydon Society, and were it not for the pressure of other work an attempt would have been made this year to tabulate the observations that have been recorded for, now, a period of several years. We hope, however, to do this at some future date.

On behalf of the Wolferton Wild Birds' Protection Society, Mr. Cresswell, the Hon. Sec., writes: "The number of Common Tern does not appear to have increased, but this may be accounted for by the nests not having been so carefully noted as in former years. Lesser Tern nested in about the same numbers as last year, and Ringed Plover appear to have increased. On two occasions nests were lost owing to an unusually high tide."

We have no information as to the nesting of the Terns at Blakeney Point and at Wells during the year 1916.

Ed.

OBITUARY NOTICES.

Dr. M. C. Cooke (born 12th July, 1825, died 12th November, 1914) was an honorary member of this Society. He was editor for many years of "Science Gossip," also of "Grevillea" from 1872-1892. He helped to form the Society of Amateur Botanists and the Quekett Club. The list of works published by him is a lengthy one, and includes the following:—Plain and Easy Account of British Fungi, Rust, Smut, Mildew, and Mould," "Handbook of British Fungi," in two vols., "Myxomycetes of Great Britain," "Edible Fungi," "Handbook of British Hepaticæ," "Illustrations of British Fungi,"

with 1200 coloured plates, "Introduction to Freshwater Algæ." His collection of 46,000 specimens and drawings is at Kew. The genus *Cookella* was founded in his honour.

C. H. Martin, of Abergavenny, who was killed in action on 3rd May, 1915, was for a short time in charge of the Gurney Laboratory at Sutton Broad, and afterwards assistant in the Nat. Hist. Department of Glasgow University for three years. He was educated at Eton and at Oxford, where he took honours in Zoology. He worked for some time at the Naples Zoological Station. He was specially interested in the study of Protozoa, and published important papers on Acinetaria, Trypanoplasma and allied forms, and on the cæcal parasites of fowls. Latterly, and in collaboration with Mr. T. G. R. Lewin (since killed in action), of the Rothamsted Experimental Station, he published valuable contributions on the Protozoa of the soil. He was awarded the Rolleston memorial prize for his researches.

Lieut.-Col. E. A. Butler, Winsford Hall, formerly of the Royal Irish Rifles, died 16th April, 1916. He was a sportsman and naturalist, and the shooting-lodge at Winsford Hall was adorned with many heads of wild animals which had been shot by him and by many cases of rare birds. He was also greatly interested in horticulture.

In addition to the above, the Society has lost by death the following members during the year :—

Mr. W. J. Birkbeck, of Stratton Strawless Hall, who had been a member since 1901.

Rev. E. R. Burroughes, late rector of Stoke Holy Cross, who went out to South Africa for the sake of his health and died there a few months after arrival.

Sir T. F. Buxton, Bart., of Warlies, Waltham Cross, who had been a member of the Society for thirty-five years.

Lieut. E. R. Cubitt, of Honing Hall, killed in action.

Mr. H. E. Dresser, author of *The Birds of Europe*, died at the age of seventy-seven on November 2nd, 1915. By his death the whole ornithological world lost one of its most distinguished members. He became a member of the Society in 1877.

Dr. J. H. Harvie-Brown, of Dunipace House, Larbert, N.B., who had been a member of the Society for forty years. His published volumes on *A Vertebrate Fauna of Scotland* are alone a lasting tribute to the memory of a great naturalist.

Mr. T. H. Heslop, of Cringleford, who had been a member of the Society for the past six years.

Mr. J. T. Hotblack, of Norwich, who was one of the most regular attendants at the Society's meetings. He had been a member for thirty years.

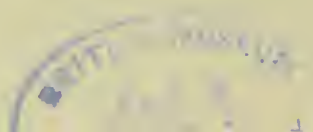
Mr. Henry Lee Warner, of Walsingham Abbey. Although not an active member, Mr. Lee Warner had supported the Society for six-and-thirty years.

Mr. James Mottram, of Norwich, who had been a member since 1891. A well-known personality who will be much missed at our meetings.

Rev. C. W. Peck, late of Diss. An enthusiastic botanist, who joined the Society in 1913.

Mr. R. J W. Purdy, of Foulsham. Mr. Purdy was one of our original members and one of the most genial of companions. He was a good sportsman of the old type and a keen field naturalist. He will be missed by a large circle of friends.

Mr. J. T. Todd, of Norwich, who joined the Society in 1874.



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