TRANSACTIONS

OF THE

Norfolk and Norwich

NATURALISTS' SOCIETY.

VOL. X.—PART III.

1916—17.

EDITED BY THE HONORARY SECRETARY.

NORWICH:

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JANUARY, 1918.

(Issued to the Members for the year 1916-17).

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4. The record of facts and traditions connected with the habits, distribution and former abundance or otherwise of animals and plants which have become extinct in the County; and the use of all legitimate means to prevent the extermination of existing species, more especially those known to be diminishing in numbers.

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1 ,, 1913-14	0 6 0			,, Fire Insurance, 13/6, 9/-	1 2 6		
6 ,, 1914-15	1 16 0			,, Aircraft Insurance	0 6 0		
2 ,, 1914 15	0 15 0			,, Postage Stamps	4 1 6		
44 ,, 1915-16	16 10 0			,, Norfolk and Norwich Library—Use of Room	3 3 0		
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List of Publications added to the Society's Library from May, 1916, to April, 1917.

Ashmolean. Natural History Society of Oxfordshire. Proceedings and Report, 1915.

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Bennett A., F.L.S. Notes on the flora of the Orkney Islands. Juncus Tenuis Willd. Its distribution in the British Isles. Hybrid Potamogeton, new to British Isles.

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Buxton D. A. J. Lepidoptera at the Dardanelles. Presented by Mr. G. F. Buxton, F.Z.S.

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ADDRESS

Read by the President, MR. CLAUD B. TICEHURST, M.A., M.B.O.U., *to the Members of the Norfolk and Norwich Naturalists' Society, at their Forty-eighth Annual Meeting, held at the Norwich Castle Museum, April 26th, 1917.*

LADIES AND GENTLEMEN,

THIS is the first and only time that I shall come before you during my year of office which now comes to a close, and I take this opportunity of heartily thanking you for the honour which you bestowed upon me in electing me as your President —an honour I feel all the more deeply in that I am a comparatively new member of this Society and do not dwell within the County of Norfolk. The Society consists of 11 honorary members, 38 life members, 192 subscribing members, total membership 241. It has lost by death during the year Colonel F. B. Longe, Mr. W. Shipley, and Mr. Francis Sutton.

Mr. Sutton took much practical interest in the formation of the Society, and was one of our few remaining original members. He occupied the Presidential Chair in 1884-5, and gave one of the best addresses that the Society has ever published.

Five members have resigned, namely, Messrs. E. H. Barclay, R. Beverley, J. L. Bonhote, B. Lowerison, and Commander Shopland. Deaths and resignations have taken rather a heavy toll of the Society since the beginning of the war, so that if our pre-war numbers are to be maintained it is essential that new members be obtained.

Owing to the continuance of the rigid lighting regulations in Norwich and the district, it has been impossible to arrange for

the usual evening monthly meetings of the Society during the past year, and to have held these during the day-time was impracticable. We can only hope it will be possible to resume these meetings during the next Session.

I would remind the Society that we are within two years of celebrating our Jubilee—we were founded in 1869—and I have no doubt that the Committee will devise some fitting method of marking this most auspicious event when the time comes.

I will now proceed to the subject proper of my address.

THE PROGRESS OF ORNITHOLOGY.*

On looking back and reading some of the addresses of my predecessors I have been greatly interested in, if somewhat frightened at, the learned discourses there set out. War has many far-reaching effects, and one of the minor ones has been the restriction on time and opportunities for research in Natural History, and more especially perhaps in Ornithology than in some other branches. You must, therefore, not expect me to tell you anything to-day very new or very learned, and if I have taken the Progress of Ornithology as the subject of my address it is more to give you a little idea of what has been, is being, and ought to be done in the many and varied side branches of the subject, interspersed with some views and ideas of my own, rather than a serious contribution to the subject. And I may here remark that although most of what I am going to say refers to the British Isles, yet I shall have frequently to go outside this area.

Well, then, it is necessary in the first place to review as briefly as I can the knowledge of the subject from the earliest times, and in the second place to enlarge upon more recent work in special branches. In Biblical times and in the writings of the ancient Greeks there are scattered references to birds, but the first contribution, meagre as it is, yet a great step onwards, we find in the works of Aristotle (B.C. 385–322), after which there was nothing of importance till 400 years later, when

* In preparing the historical part of this Address I have made much use of the Introduction to Newton and Gadow's *Dictionary of Birds*, from which, in many instances, I have quoted freely.—C.B.T.

Pliny the Elder wrote his discursive "Historia Naturalis," drawing, however, largely on his predecessor and attempting a rough grouping. From his time down to the sixteenth century natural science appears to have slept, to be awakened in 1544 by William Turner, our first British ornithologist, who wrote an important commentary on the birds of Aristotle and Pliny, previous authors having been content to copy for the most part these works without adding any information. Eleven years later ornithology, as a science, received a great impulse by the works of Gesner at Zurich and Bellonius in Paris; the latter especially, from his observations made in several countries, was enabled to add a considerable amount of original matter, avoid the absurdities of his predecessors, and form a rude but definite system of classification, instead of using the alphabetical arrangement which was followed up to this time. At the end of the sixteenth century there appeared a work by Aldrovandus of Bologna, whom I mention since he has been often quoted as an authority, but most of his work was a compilation from Bellonius and Gesner. In 1603 there appeared the first faunal work in the shape of "Aviarium Silesiæ," by Schwenckfeld. The geographical explorations of the sixteenth century began during the next century to bear fruit and the knowledge of ornithology was widened beyond the boundaries of the world known to the ancients, by several writers, of whom the most important were our fellow-countrymen, Francis Willoughby and John Ray, who, towards the end of the seventeenth century, by diligent collecting and intelligent research in their many travels, laid the foundation of scientific ornithology as we now know it. Mention must here be made of Merrett who, in 1666, published the first work and catalogue of British birds, and of Sibbald, who, in 1684, wrote the first Scottish fauna, while about the same time there appeared our first county faunas, those of Oxfordshire (1676) and Staffordshire (1686) by Robert Plot, the keeper of our first Museum, the Ashmolean at Oxford.

Though little appeared during the early part of the eighteenth century a considerable if somewhat chaotic store of knowledge

had accumulated, and it was given to Linnæus in his work, the "Systema Naturæ," between 1735 and 1766, to reduce chaos to order; and it is for this reformation of Natural History that his name will go down to posterity for all time. Linnæus recognised that no progress could be made until each bird had a descriptive diagnosis, and he conceived the idea of bestowing on each species two Latin names, one to denote the genus and one the species, and thus in his tenth edition (1758) founded the system of binomial nomenclature. Realising that verbosity was the bane of science (a maxim too often forgotten nowadays!), he carried matters to the furthest extreme, and his diagnoses are in most cases the essence of terseness, so much so that some, at all events, are unrecognisable. He further reorganised classification, basing his system on that of Ray.

Somewhere about 1735 the first book with coloured plates made its appearance in Catesby's "Natural History of Carolina," shortly followed by a book of little value by Albin, and by a much better one, entitled "Gleanings of Natural History," by Edwards. In 1760 there appeared in France a work of great merit by Brisson, giving accurate and minute descriptions of birds known to him; he introduced the use of subgenera and was the first zoologist to designate a "type" for each genus, two advances in our science which have stood the test of time; but he was too early in the field to avail himself of binomial nomenclature to any extent. At the same time another Frenchman was occupied with a great work, namely, Buffon, who, in 1770, brought out the first part of his great "Histoire Naturelle," opposed the system and nomenclature of Linnæus, and upheld, and rightly so, the variability of species in opposition to the great Swede; he did much to enlarge the view of ornithologists. A contemporary of Buffon was our fellow-countryman Latham; many collections of birds had come to England from the continents, and to these Latham had access, as well as to the British Museum, which had lately been formed, and to the Leverian Museum; of a totally different kind of work to Buffon, Latham rendered not a little service to ornithology. The last quarter of the eighteenth century

produced many other authors on general ornithology, no doubt partly stimulated by the authors above-mentioned, but their works were of less importance, and I can only refer here to Pennant, who produced his well-known "British Zoology," founded much on his own observations, and to another author of a totally different calibre, namely, J. F. Gmelin, who copied largely from Latham, but by adding binomial names to the species where none previously existed, became the author quoted for many species to this present day. The last part of this century saw an increased amount of travel and exploration, the result of which was to increase greatly the knowledge of faunal areas and of distribution, and several works dealing with these subjects were produced, among which may be named Linnæus' "Fauna Suecica (1746), Brünnick's "Ornithologia Borealis" (1764), Fabricius' "Fauna Grœnlandica," and Pennant's "Arctic Zoology" (1785); while parts of America were dealt with by Barton, Bartram, Forster, and others, and Central Europe found many workers in the field; but even by the end of the eighteenth century South America and South Africa were barely touched.

I cannot close the account of the eighteenth century without a reference to Gilbert White, who, from his correspondence with Barrington and Pennant, published, in 1789, the result of their interchange of observations as his famous "Natural History of Selborne." White fostered the love of Natural History more than any man has ever done; many in the past have, through his influence, been drawn to the study of Zoology and will be in the future; his writings have stood the test of time owing to the simplicity of style adopted and to the accuracy of the observations recorded. Another who, about the same time, influenced the study of ornithology in the right direction was Bewick, whose "History of Birds" has always been very popular, more perhaps for the wonderfully-executed engravings than for the text, which attains but mediocrity. On reviewing this century's work we find that it produced a number of general works; the information in them for the most part was meagre though a great advance on earlier works; there

were no books on special subjects, while faunas were only in their infancy. The introduction of binomial nomenclature, diagnosis of species, and a reasonable attempt at classification put ornithology on a more scientific basis.

With the advent of the nineteenth century the works of Gilbert White and Bewick had spread widely the taste for ornithology in Great Britain, more so than was to be found on the Continent. As the knowledge of any subject extends it outgrows the capabilities and opportunities of man to follow it as a whole, and since the true naturalist must always be working he is compelled to narrow his field of observation ; and so dawned the day of specialisation.

I cannot enter into detail, nor indeed more than lightly touch on the vast number of works of this period. At home Montagu and Selby in the earlier part of the century wrote excellent works on British Ornithology, while on the continent Temminck, Naumann, Vieillot, and Illiger were engaged in no less important undertakings. Mention, too, must be made of Gray's conscientious and important compilations in his "Genera and Subgenera of Birds," but during this period no one had indulged in speculations and theories, all works being just honest attempts at descriptions of birds with good, if rudimentary, notes on their life-histories. But there came a cloud on the Zoological horizon in the form of the Quinary, or Circular System of Nieremberg, which was adapted by Fischer de Waldheim in 1806 to mammals. This system, a nebulous jargon, hailed by its advocates as the key to the wonders of the universe, was applied to ornithology by able men like Vigors and Swainson, and for 20 years it aroused so much discussion as to blind the eyes of many ornithologists to the new work being done on the Continent by Geoffroy St. Hilaire, Nitzsch, Müller, etc., and at home by Macgillivray; and it did much to retard progress in Britain till its death blows were administered by Rennie and Strickland in 1838.

We must now take a glance at progress in another direction. All the authors up to the beginning of the nineteenth century

were treading the well-known path of descriptive and distributional ornithology. Very important advances, however, were being made by certain scientific men working on new and special lines, which may be called comparative internal and external structural anatomy. Of these earlier workers I may mention, as being of most importance, Cuvier and L'Herminier on osteology, J. Müller and Macgillivray on internal anatomy, and Nitzsch on pterylography. It was on the works of these men that the classifications of birds into orders, families, and genera were made, many such classifications being instituted according to what anatomical structure was taken as a basis. Though much of their work still stands, classification has been much altered. The theories of Darwin and Wallace on what is now called "Evolution" were given to the world in 1858, and produced, perhaps, the greatest revolution of scientific thought of any age, and those who accepted the theory of "Natural Selection" and the fact of variability of species felt as if the mist had at last lifted, to reveal a new light shining on the field of Zoology. This new outlook, the discovery of fossil reptile-birds and studies of them by Marsh and Owen, the great researches of Parker and Huxley in Morphology and its adaptation to classification, carried on later by Forbes, Garrod, Gadow, and others, have brought this branch of our study immeasurably forward and produced the classification used at the present day. Of late years, workers in this field have been few in number and mostly Continental, and though good work has been done in the study of specialised and aberrant forms, nothing very revolutionary has been published.

We have seen that during the eighteenth century most works were of a general nature, but specialisation and the increase in travel and of collections, inaugurated the great advances which were now to be made in faunal works. Among the earliest of these I may mention Wilson's "American Ornithology" (1808–14), Naumann's great works on German Ornithology, and the researches of Pallas and his colleagues in the Russian Empire. After the appearance of these hardly a year passed without the publication of a faunal work on

some country or district great or small. Many of these books were excellent, and by the end of the century most civilised and many uncivilised countries possessed at least one faunal work. Curiously enough, however, Spain and Portugal have no complete work of this kind, and even in France no general work on the fauna of the country as a whole has appeared since Vieillot's "Faune Francaise," completed in 1829, while its reliable works on local fauna nearly all date back prior to 1870. It will thus be seen that there has been a scarcity of working ornithologists in these countries of late years, while Great Britain can show that it has responded to the maxim of Gilbert White—that "every kingdom, every province should have its own monographer." Indeed, nearly every county in Great Britain, with the notable and lamentable exception of Lincolnshire, now has its own avifaunal work, and perhaps in no country in the world is the exact distribution of birds better known than it is in our islands. The great increase in faunal works touching nearly every country in the world carried our knowledge of geographical distribution at the end of the nineteenth century immeasurably forward. A few words must be said on the books relating to Britain as a whole. Between 1837 and 1872 William Macgillivray, probably the greatest ornithological genius we have ever produced, brought out his "History of British Birds," a work, which for accuracy of detail, originality, and the results of personal observation, ranks far above any British work of his or any previous time, and is a classic far too seldom consulted even at the present day. About the same time Yarrell produced the first edition of his "History of British Birds," which was of rather a different scope to the last mentioned work, but excellent for the time. In thirty years the literature on the subject having greatly increased, a fourth edition of Yarrell's work was begun by Newton in 1871, and finished by Howard Saunders later, and is the classic and standard work of to-day; to it, and to Saunders' "Manual," condensed from the same work, must be attributed the education of a great number of ornithological devotees at the present time. And here tribute must be paid to my old

friend, the late Prof. Newton who, by his zeal in instructing and encouraging many of the present and past generations in lines of research, did so much for our science ; while his great "Dictionary of Birds," a regular *vade mecum* of condensed knowledge, will be a monument to his name for all time.

To the numerous other works on British Birds I need not refer ; many of them are but compilations from other authors, notably Yarrell, and not a few of them are mere publishers' ventures to sell to the public mediocre plates.

The specialisation of the nineteenth century showed itself in the production of many monographs, among the first of which may be mentioned Gould's works, though the prices of these are not commensurate with their scientific value. Others followed later, on various subjects, by Elliot, Sharpe, Sclater, Dresser, and others ; but it has to be remembered that the rapid advances which nowadays are being made soon put treatises on one genus or family out of date, and that monographs, the texts of which are so often subservient to the plates, are not adapted to the extension of science, but from their costliness must reduce the number of their readers, and so "enrich ornithology only to its ultimate injury."

In the eighteenth century there were hardly any journals in which ornithological observations were recorded, but the eldest ones were the Philosophical Transactions (circ. 1666), and the Linnæan Society's Transactions, 1791, followed by the Edinburgh "Philosophical Journal" (circ. 1816), though none of these dealt very largely or continuously with ornithology. In 1825 the "Zoological Journal" was started, followed by "London and Charlesworth's Magazine of Natural History," both of which survived about ten years, and were the media, together with the "Annals of Natural History" and the "Annals and Magazine of Natural History," for ornithological papers and records up to the early forties ; but after the birth of the "Zoologist," in 1843, this magazine absorbed nearly all the local observations of British ornithologists and its premature decease at the end of last year will be regretted by every true lover of natural history. Our chief journals at

the present day are the "Scottish Naturalist," 1871, "Irish Naturalist," 1892, and the "British Bird Magazine," 1907.

The oldest society devoted to Natural History appears to be the "Natural History Society of Northumberland, Durham and Newcastle-on-Tyne," 1828, followed by the "Berwickshire Naturalists' Club," 1831, while our own society ranks as the sixth in point of age.

The British Ornithologists' Union, the oldest ornithological society in the world, was founded in 1859, and its journal, "The Ibis," and the Bulletin of the branch society, the "British Ornithologists' Club" (1892), have been, and still are, the mediæ for publishing most of our larger and newest researches in ornithology.

During the last thirty or forty years the growth of natural history societies and their journals has been rapid, not only in Great Britain but all over the world, and nearly every country and many districts and towns have their own societies, showing the great spread of the love of natural history.

I must now pass on to the second part of my Address, and try and tell you a little about advances made in special branches, and I will begin with MIGRATION.

MIGRATION.

The earliest references are to be found in well-known passages in the Bible. The ancient Greeks knew of migration, and mentioned one or two migratory species, but the first list of migratory birds was that compiled by Aristotle, who, however, believed in the emersion, hibernation, and transmutation of species. Pliny, too, mentioned a few species, but there is no more information on this subject till 1555—a period of fifteen hundred years of apparent indifference to natural history—then Olaus Magnus started again the emersion theory, which was 200 years later believed in even by his fellow-countryman, Linnaeus. Perhaps the quaintest theory put forward was one, in 1703, that birds migrated to the moon, but owing to the "temper of the Aether where it passeth,"

they lived without food, and even may have slept throughout the whole journey. Willughby, in 1678, was evidently sceptical about hibernation, which, however, was again revived in 1772 by Barrington with great energy, even to influence, against his better judgment, the accurate Gilbert White. During the nineteenth century this subject received an increasing amount of attention, but the hibernation theory died a very slow death, and was believed in by some down to well past the forties. During this period, through the observations of many, the migratory species were gradually recognised, and the dates of arrival and departure carefully recorded. Of causative theories there were not a few, but the most worthy of attention are those of Wallace, 1874, and of Weisemann, 1879. The former conceived migration to be an application of the theory of the survival of the fittest; he assumed that breeding could only take place in one area, but during the greater part of the year there was not sufficient food for the maintenance of the species, and so those individuals which did not migrate at all or not soon enough would become extinct. The latter suggested that as the temperature gradually rose over the northern Glacial Zone, birds gradually drew up from the more southern regions, their original home, and so established a migratory habit. A step onward was made in 1846, when Naumann propounded the theory of migration routes, and these were later worked out by Palmen; Weisemann thought these routes ancestral ones, and that they represented in some cases old land bridges across seas. The researches of Gätke (published in 1890), on Heligoland, an ideal station for migratory observations, though in it, perhaps, he was prone to exaggeration and sometimes erroneous in his deductions, together with the British Association's reports on migration in the eighties, did much to stimulate research; while the indefatiguable work of my friend, Dr. Eagle Clarke, on various Light Stations in Great Britain during the migratory season (whither on two occasions it has been my privilege to accompany him) bore fruit in 1912 in his "Studies in Bird Migration," the finest piece of work of its kind ever written,

which added a great deal to our knowledge. The British Ornithologists' Club, also, in 1904, formed a committee to study migration and, by the help of observers throughout the country and the aid of the Light Stations for a period of ten years, added valuable facts on this subject. We may say, therefore, that during the last twenty or thirty years our knowledge has vastly increased, especially in migration-routes, weather influences, migratory species, passage migrants, etc., and one now realises that few species are really sedentary, whereas not so many years ago only strictly winter and summer visitors were considered to be migrants ; moreover, we have come to regard some species hitherto counted as extreme rarities, as really of annual occurrence, in small numbers. Such are the Yellow-browed Warbler, Little Bunting, Siberian Chiff-chaff, etc. Why is this ? The reason is that of late years isolated islands have been "worked." Here from day to day one has under observation, without confusion with local birds, a sample, often a small one it is true, of the hordes which are passing, but owing to the smallness of the area every single individual comes under observation. If one can see a Barred Warbler or a couple of Blue-throats in a morning on a place like the Lowestoft Denes, how many of these birds are lost to observation on the whole coast line ?

It is well known that some individuals of a species migrate while others do not, and with the object of gaining information on the point, I started, in 1908 a plan (copied from my friend, Herr C. Mortensen of Viborg) of putting small aluminium rings on birds' legs to see if it was possible, and if so to what extent, to trace individual birds, a subject on which there was no information ; and also to see whether birds returned to the same nesting place and winter quarters each year. I soon realised that for success a huge number must be ringed, and so I enlisted the help of the publishers of the "British Birds Magazine," who heartily took up the scheme, and already some interesting and valuable results have accrued ; and if efforts are persisted in, I think we shall obtain some hitherto unobtainable knowledge. With migration work abroad I need

not deal; each country of course must deal with its own peculiarities, and this has been done in America fairly thoroughly and to a less extent in Hungary, Germany and Denmark, while in many it is untouched.

If we have been able to see a great advance in this subject I do not think the same can be said for the next, namely, *Oology*, in the literal sense, i.e. the study of birds' eggs, and I do not include in this the varied field notes of the nesting period. I suppose the majority of us begin and develop our taste in ornithology by bird-nesting and egg collecting, but there comes a period, with years of discretion, when the mere amassing of egg-shells becomes insufficient to the scientific mind, and one is forced to believe that in egg-shells themselves there is very little to be made out, at least that has been my experience, and was that of the late Prof. Newton, who had made a life-long study of the subject. In spite of the unfortunate boom in egg collecting of recent years no scientific paper of any value has accrued; on the other hand, a great deal of damage has been done. It seems that the rarer a bird becomes in our area the keener are the egg collectors to make it more so by taking its eggs, and the sooner it becomes very rare or extinct, correspondingly great in their own minds becomes the money value of their ill-gotten treasures. To me, of far more interest is "*what the egg is in and what is in the egg.*" Until the last few years there has been no work done upon, nor even descriptions recorded of the downy stage of our commonest birds, except in the praecocial groups, yet here I feel sure we have a work of far more importance than the collecting of well-known eggs.[1] Yet when an egg collector finds the nest of a rare bird with young instead of the coveted eggs, he takes no further interest in it, not realising, I suppose, that these young when first hatched have probably never been described. That eggs vary, often infinitely, has been known for a great number of years, yet many are still content to go on amassing varieties of eggs, while deductions from their material are conspicuous by their meagreness. On the whole, the number of devotees in this branch is in the reverse proportion to the usefulness of their collections.

* The affinities of most, if not all, animals are to be sought in the earlier stages of development rather than in the adult.

The next subject I shall touch on is that of

FOOD.

The question of a bird's food is one of the most important and most difficult subjects, and one which has received but scant attention. From an economic standpoint it is of very great importance and one which should, as is the case in America, be investigated by the State; and yet in England it is left to the zeal of private individuals with results which, from the immensity of the subject, cannot be otherwise than unsatisfactory. In order to arrive at any conclusions of any value concerning a given species it is necessary to obtain many birds at all seasons of the year, including the young in the nest, and from many different localities; the food-contents must be examined by specialists trained in this work, and the whole must be supplemented by reliable field observations. With one or two exceptions no one in Great Britain is doing any work of this kind, and very little reliable work has been done in the past. When one considers the amount of agriculture carried on in this country, and that our annual catch of fish is valued at £10,000,000, the neglect of the study of the economic status of wild birds and the allowing of great increase in mice and rats by destruction of their natural enemies must cost the country millions a year. So much for the economical point of view. But there is another aspect of the question to be looked at by ornithologists, and that is the food of those species which are not numerous enough to affect us economically. One reads in text books that this or that bird feeds on snails, worms, grubs or seeds. What an enormous field of zoology and botany those four words cover! One cannot but think that the remarkably local distribution of some of our birds, for instance the Cirl Bunting, Dartford Warbler, Wood Wren, etc., must in some way directly or indirectly be connected with food supply. It will be remembered that the curiously local distribution of some butterflies was not understood until it was discovered that it depended on the distribution of the food plant of the caterpillar. Again,

every field naturalist can call to mind certain spots which are sure "finds" at the proper season for certain birds, but not for others closely allied. Why are some spots favoured by the Green Sandpiper or the Greenshank to the exclusion of all other places? Why does the Grey Plover keep to the estuaries and shore and the Golden Plover more to marsh, agricultural and heath lands? It has always been a mystery why the Swift should leave us so early when insect life apparently still abounds. But is it so certain that we know what are the food requirements of this species? May it not be that the Swift's particular prey ceases to be on the wing after mid-August? Why does the Yellow Wagtail breed in the water meadows, etc., and the Pied Wagtail prefer the neighbourhood of houses? Surely the key to all these questions lies in the food supply? And yet how little do we know *in what details* the food supply differs between each, and yet these details are so essential to the birds as to make them seek quite different habitats. If further arguments were needed, take two cases where we know more or less the food requirements. We see flocks of Common Scoters haunting the same bit of sea year after year, often to the exclusion of other species, and we know that there, within diving reach, is a bed of molluscs, such as *Nucula nuculus* or *Tellina balthica*, two of their favourite foods. Or, again, we know that the Shorteared Owl with us is commoner in the marshes, because there its chief prey, the Short-tailed Field Mouse abounds, whereas the Barn Owl haunts the hedgerows and stackyards for house mice, young rats, sparrows, etc. There are many other kindred questions of great interest to the ornithologist and essential to the proper understanding of the life-history of birds, and much work remains to be done on this subject.

PLUMAGES AND MOULT.

On the subject of Plumages and Moult I must confine my remarks to a few generalities. Perhaps in no branch of ornithology has the copyist been so busy, each author for years being content to copy from his predecessors their inaccuracies as well

as their accuracies, few indeed taking the trouble to investigate for themselves until of recent years, when much good work both here and in America has been done, and our knowledge advanced on sound bases, though much is yet to be learnt. Even in the best text books the descriptions of plumages are often inadequate or erroneous, and reference to moult is generally conspicuous by its absence. As this subject has been my special study for fifteen years I will briefly indicate why most of the older writers went wrong, and point out in what way correct results may be attained. Firstly, then, the older writers (and even some of the present-day) neglected to realise the effect of abrasion, and believed that a feather could change colour by reinfusion of pigment ; this was a frequent source of error. Such a colour change has never been proved to take place, and the evidence of physiology is all against it. Secondly, the failure very often to trace the stages of plumage in moulting birds ; thirdly, the overlooking and misinterpretation of individual variation, owing to an inadequate series of specimens being examined ; and, lastly, by a faulty nomenclature there has arisen a confusion in terms. For example, by " young," one author had meant what we now call " juvenile " plumage, another what we term first winter plumage. The best nomenclature is, I think, that adapted from Dwight in his " Passerine Birds of New York," namely (1) young in down or down plumage ; (2) juvenile (nestling) ; (3) first winter ; (4) first summer ; (5) second winter, and so on, till adult, according to the species. The only way of surely arriving at the correct elucidation of moults and plumages is by tracing each stage in birds in moult, and recognising, as a guide, the remains of a previous plumage, thus getting reliable information of the different stages ; much help may also be obtained by the application of a little elementary anatomy. For instance, we know that a bird's skull takes some time completely to ossify—in small birds it is about four months (roughly June to October), and if during that period we find a bird's skull incompletely ossified we know for absolute certainty that that bird is a bird of the year. Again, the passage of the egg down the oviduct

produces well marked and persistent changes, so that if we find the oviduct rather broad, thick, tortuous and sagged, it is quite certain that the bird has bred ; or if the oviduct is thin and straight, it is equally certain the bird has never bred ; by these observations we get reliable information and very useful help in this study. Additional help is also available by "ringing" birds, as here again we get certain information as to age. I can only add that in this work it is fatal to assume anything you cannot *prove*, that observations on birds in captivity are next to useless, and may be misleading, and that of course all work of detail must be done on specimens and not in the field.

Under this heading, also, I must briefly refer to varieties of plumage, since in this subject there seems to have been little or no advance. White Blackbirds, etc., are still recorded annually, and have been for many years, and such records *per se* are of no interest, but what is of interest is the causative-factors governing these variations ; every one knows that albinism is due to lack of pigment, and the cause of this is usually put down to "lack of condition," an unconvincing explanation to my mind. We know that normally-coloured parents may have one or more albinistic offspring, and that normally-coloured offspring may be produced by an albinistic parent. That in itself is suggestive of some far deeper seated explanation than lack of condition. Again, some species frequently show albinism in some feather tracks more than in others, *e.g.* chin and first primary or two in the Rook. Is this due to a poor blood supply through vascular degeneration ? Again, the frequency of albinism varies very much in different species, both absolutely and relatively ; is this due to inbreeding of a strictly sedentary species ? In birds of some species in captivity an excess of pigment can be produced by special feeding ; can this account for its occasional occurrence in nature ? All these and other kindred questions we are ignorant of, and they require investigation. Nor have we progressed much on the question of *Dimorphism* beyond working out rough geographical areas where one form predominates over the other, as, for example, in the Fulmar, Richardson's Skua, Tawny Owl, etc., yet here

again some important problems present themselves. Is one form ancestral to the other, and still crops up as a "throw-back," or is a new type, ultimately to be fixed by segregation as a species, being gradually evolved ?

The greatest advance in ornithology of modern times is, I consider, the recognition of *Subspecies* or racial forms. This subject is looked at with askance, if not with scepticism, by many professed ornithologists and by all pure field naturalists, who are often influenced by prejudice, though it is significant that the unbelievers are those who have never studied the question and, therefore, are not accustomed to examine in minute detail, work that can only be done in the cabinet. A. E. Brehm in the early part of the last century was one of the first to have any inkling on this question, but much of his work is nullified by his evident lack of appreciation as to what was a sup-specific difference and what an individual variation. Allen, in 1877, in a paper on the "Effect of physical conditions on the genesis of species" did much to clear the way for the scientific recognition of this subject. What then is a sub-species ? It is the representative in a more or less defined area of a widely distributed species, whose differentiation from the typical form has been brought about by segregation and climatic differences, such as humidity, over a long period. What causes define any given area is a large subject and not always ornithological, and how long a period the external influences must act is a question for the future ; but in one case, that of the Goldfinch introduced into Bermuda, it appears to have taken a comparatively few years to have fixed its sub-specific characters.

Some sub-species are, of course, more distinct than others, and this fact no doubt depends upon the degree of difference in climate and the period of segregation from that experienced by other or neighbouring forms. Extreme examples are found in isolated islands, such as the Wren of St. Kilda, and amongst many of the birds of the Canary Isles, Madeira, etc. ; while as examples of where climate plays a more important part may be mentioned the Song Sparrows of America (*Melospiza melodia*) and the Desert Larks of Africa (*Ammomanes*). In the latter,

Tristram recognised the truth of Darwin's theory—the variability of species. Those who deny the validity or existence of sub-species must either deny the truth of Darwin's hypothesis or else must believe that species vary infinitely, irregularly, and without geographical limit, whereas the study of geographical distribution clearly shows that this is not so. Darwin recognised that species varied, but what he did not and could not know, owing to lack of sufficient collected material, was that many variations in species were limited by geographical areas. His view was that these variations would in time become fixed, and thus new species be formed ; whereas now-a-days we say that many of these variations have *already* become fixed enough for recognition as sub-species, or are, if you like, species in making. So, too, we believe that in many cases individual variation towards a given character exists, but has not yet become fixed for a defined area, or possibly is being lost by hybridisation, and so we have here sub-species in the making or possibly in the reverse.

The most distinct sub-species were but a few years ago looked upon as a species. Thus many of Dresser's species in his " Birds of Europe " are now considered to be sub-species (and rightly so as they are but geographical representatives of the typical forms), and were designated by binomial nomenclature. Now-a-days for simplicity's sake we use trinomials, much to the disgust of those who have never studied the question. Thus Sharpe and Dresser described over forty years ago a certain Tit as *Parus britannicus ;* now there are in the Palæarctic area some ninety forms of the genus *Parus,* and one may well puzzle one's head to know whether this Tit is a Great Tit, Blue Tit, Cole Tit or Marsh Tit ; but when, as we now do, we call it by its trinomial name, *Parus ater britannicus,* we at once know that the bird in question belongs to the Cole Tit group. I need not say which is the simpler. I cannot close this subject without referring to Lord Rothschild's zeal in sending collectors to remote corners of the earth to enrich his wonderful collection at Tring ; and his work on this subject, and on geographical distribution with Dr. Hartert,

has added an immense amount to our knowledge, while the latter's book on Palæarctic birds is a necessity to almost every working ornithologist.

It was not until the end of the seventh decade of last century that any attempt at Bird Protection was made in the British Isles, and then it came seventy years too late to save those indigenous species which had already died out. In East Anglia the Ruff, Bittern, and probably the Godwit had succumbed to the thoughtlessness of killing birds for food in the breeding season, while the Black Tern, Avocet, and Savi's Warbler were exterminated by drainage and cultivation, though the last was almost extinct when first discovered, and probably was a rare bird at any time: I mention these facts as the "collector" is generally held responsible. The greedy hoarders of British-taken rareties, either eggs or birds, together with those who liked a pretty bird in a glass case, were no doubt responsible in helping the final extermination, but collectors in the true sense were so few in those days that they could have had no influence in the matter. As soon as a species whose breeding area is limited gets persecuted and upset by cultivation, that species is doomed, unless it is given stringent protection. Such protection *after* the native stock has vanished is useless. If we had waited until the Kite was extinct in Wales, it is certain that no amount of protection would have re-established it. In the same way, I am very sceptical as to whether protection given to passing migrants can bring back again any of our once indigenous species. Our small area of fens, cut into wherever possible by cultivation, has to compete for these migrants with the attractions of the much vaster, less inhabited and less disturbed fens and meres of Central Europe. The re-establishment of the Ruff, and perhaps of the Godwit, is I think feasible, and but a matter of small expense; it would be far more likely to repay in results than money wasted on some other branches of protection. A few pinioned pairs turned down in a suitably large enclosed and rat-proof area would be certain to breed, some of the young reared would almost certainly return the next year to breed, and so a native

stock would be re-established and would spread if protected. Protection since its introduction has, speaking generally, made no progress. It is true that reserved areas have of late been established, and this attempt at preservation, if not carried too far, is a very good thing, but is there anything so chaotic or idiotic as our protection laws? The principal Act of 1880 was so badly drafted that no less than seven other Acts or Amendments have from time to time been added, thus making "confusion worse confounded." Take, for example, the "Schedule to the Act"; it still stands in its unrevised state, but County Councils may add, though not remove, such species as they think proper, and generally such bodies are regardless of necessity or expediency. On the order when issued one reads that "The Wild Birds Protection Act of 1880 shall apply within the county of —— to the following species of Wild Birds in the same manner as if those species were included in the Schedule to the Act," which may be perfect legal phraseology, but how the ordinary person is to understand what it means passes my comprehension. For the benefit of the uninitiated I may say that the principal Act of 1880, giving a close time to birds during the breeding season, did not apply to owners of land, except in the case of those birds named in the Schedule; in this Schedule we find, uselessly included, such species as the American Quail (an introduced bird now extinct), Sanderling, Smew, and Little Auk (all winter visitors and maritime in habitat). The additions made by County Councils are very variable; thus in 1909 the Norfolk C.C. added four species, while at the same time the E. Suffolk C.C. thought it necessary to add no less than thirty-nine! Of these, quite half stood in no need whatever of the extra protection, while almost as many might advantageously have been added. This is only equalled in imbecility by the list of birds to which the close time is extended, by which certain species are protected during the whole year. Norfolk included twenty-seven species, E. Suffolk more than twice as many, the majority, being summer migrants, could only be affected for a few days by this extension; the others were species which do not need extra

protection, while many which do were omitted. So, too, we find Sunday protection afforded in some parishes or estuaries but not in others, while the eggs of some birds are protected which do not need protection, and even one or two species were included which have never bred in England, let alone in Suffolk. This peculiarity on the part of County Councils is not confined to my county, as two Scottish County Councils applied for the protection of the eggs of the *Knot* and *Bewick's Swan* and refused to have any order at all unless these were included! What is true of one or two counties is roughly true of the remainder, and I think all must agree that the state of things is chaotic. And what are the effects of the Acts? As far as I can see they prevent the legitimate acquisition of scientific material during seven months of the year and, judging by results, seldom restrain the indescriminate "hedge popper," and he who would take egg or bird for the pecuniary gain easily obtained from the amasser of British-taken rarities. The whole of the Acts need repealing, powers taken from the County Councils, who are quite incompetent to deal with such questions, and a new Act drafted on more drastic lines by a committee of experts, even to protecting all our indigenous species, but paying due regard to the economic status of species in connection with agriculture and fisheries, to birds useful as food, and issuing licences to serious students of ornithology, enabling them, with certain limitations, to get specimens for definite purposes.* America is far ahead of us in these matters, while, in a few countries no protection exists at all; in most European ones protection has made a start.

A branch in which considerable progress of late years has been made is what we may call "Field-work" in its various aspects. This is no doubt due to the greatly increased number

* It seems to me, and I know others fully competent to judge, both now and in the past held the same opinion, that the protection after March 1st of migratory species such as many Waders, Ducks, and Geese is a piece of useless and uncalled-for legislation. It must be remembered that the numbers of these species which visit our shores, sometimes only for a few days, are but a very small fraction of the numbers of them in the world, and out of this tiny fraction only an infinitesimal number would be shot and the status as a species of any of them here or elsewhere could not in any way thus be altered.

of lovers of bird life and the increased media for recording and discussing observations. The majority of this work belongs to the breeding season, as that is, perhaps, the time of greatest activity and easiest study. The site and construction of the nest, the habits of both old and young, nest economies and sanitation, courtship, etc., are all being gradually recorded for many species; in fact, there are even monographs written on the subject for some species. Photography, too, has of late years been brought to a fine art and very pleasing pictures are often produced; it has many devotees, but I do not think the time necessarily spent on the subject is in any way commensurate with the scientific value of the results, though doubtless a pleasant and instructive hobby for the lover of nature. Seasonal distribution of birds in various localities, too, has been much more carefully recorded of late; if only the naturalists of a hundred or more years ago could have written on birds known to them with a quarter of the detail entered into now-a-days what a lot of useful information they could have told us! For instance, how much could Sir Thomas Browne in the seventeenth century have told us about our extinct East Anglian birds, or Pennant in his "Tour of the East Fen," yet how meagre is their information. The spirit of precision and detail in ornithology was as yet unborn, yet what was commonplace to them would be of great interest to us now; however, I do not think that 200 years hence the present generation can be accused of not recording observations, commonplace or otherwise. And in this connection I would remark that care must be taken not to record as the habit of a species what is a trait of an individual, nor to consider some observation as new without looking up what has been recorded before, and to discriminate between what is trivial and otherwise, and I would call attention to a rather neglected part of field work—the incubation and fledgling periods.

I cannot close this address without a short reference to *Collections and Collectors*. Among the earliest collections were the Ashmolean Museum, at Oxford; the Leverian Museum, a few specimens from which are still at Liverpool; the British

Museum, and collections of some of the earlier writers on ornithology, such as Selby, Montagu, etc., many of whose specimens are still in existence. During the middle part of the last century the number of those who collected birds increased; such specimens were always mounted and those kept as skins were confined to a few individuals and fewer still to museums. Even now-a-days skin collections, whether public or private, are very few, considering the number of ornithologists; while the number of people who have a few or many cases of stuffed birds is great, though they may know little or care less about them. I have had reason during the last few years to hunt up old records and examine old stuffed birds, and I have come to the conclusion that the latter are absolutely valueless, except for educational purposes to the general public or as a trophy to the private owner. In most cases there are no details of data kept concerning them, and in course of time such information is forgotten or quoted erroneously, and so they become misleading. Very few, too, are such collections which sooner or later do not become ravaged by moth or beetle or at the best fade, while at all times they never admit of detailed examination. It disgusts me to think not only of the waste of birds for no good purpose which are "cased up" every year, but of the very frequent waste as such of valuable scientific material. It is this class of collecting and the amassing of British killed rarities which has given collectors a bad name. In reality there is hardly such a thing as a rare bird, nearly all being common if looked for in the right place; simply because they are British or Norfolk killed stragglers makes them *per se* of no more sclentific value than if they were obtained in their natural haunt. Collecting must of course continue, otherwise our knowledge in very many ways in ornithology would come to a standstill, but collecting in a scientfic way and for scientific purposes is the only form I consider justifiable or advisable.

In conclusion, I would say that in all branches much work remains to be done, and I can only appeal to those who take an interest in Ornithology to study it in a scientific manner, to take up some special branch or detail, however small, and work it out. The field is wide, and the workers are few.

II.

THE CHALK FLORA OF NORFOLK.

By W. G. Clarke.

Chalk is by far the most important geological formation in Norfolk, and gives rise to an interesting flora. Except in the west of the county it is usually covered by more recent beds and loses its interest for the botanist, but there are outcrops in various places, and the quantity of chalk in the boulder clays is also sufficient in many cases to attract calcicole plants. The Lower Chalk exposed in the west of the county is without flint; the Middle Chalk of west and mid-Norfolk contains flint, usually in tabular sheets; and the Upper Chalk around Norwich—the purest of the three, frequently containing 98 per cent. of calcium carbonate—has flint in the shape of nodules in horizontal layers, and occasionally as paramoudras. Dr. A. G. Tansley, speaking of England generally, says that the Lower and Middle Chalk are usually under cultivation, and it is mainly the Upper Chalk which bears the characteristic woodland, scrub and grassland. In Norfolk, however, owing to the drift deposits, it is the Lower and Middle, and not the Upper, which has the characteristic vegetation.

In the map illustrating Mr. L. F. Newman's paper on "Soils and Agriculture of Norfolk" (Vol. IX. p. 384), the chalk is shown as the surface rock in an irregular area from Hunstanton to Thetford, narrow in the northern portion, and widening west of Swaffham and Thetford to the fens, with tongues of varying shapes in the area between Wells, Hunstanton and Swaffham, and along the Little Ouse east of Thetford. There is another chalk area near Norwich. The analyses of chalk soils from Drayton, Morston, Stiffkey and Sedgeford show that the percentage of calcium and magnesium carbonates varies from 2·58 at Morston to 39·60 at Stiffkey, but of course the most

typical chalk areas are uncultivated. The chemical analyses of North Norfolk boulder clay soils show that in the six selected localities the percentage of calcium and magnesium carbonate is highest at Field Dalling, where it is 2·57, and of six localities in South Norfolk it is highest at Raveningham, where it is 4.34. At Bressingham it is 4·0 per cent., and at Attleborough 3.24, figures that are higher than in one of the soils described as chalky.

Of the eighteen known stations of "Cissbury type" flint implements in Norfolk, always associated with easily accessible chalk, twelve are on the Middle Chalk and six on the Upper, as exposed in the sides of the river-valleys of the Yare at Great Melton, Easton and Markshall, and of the Wensum at Ringland, Taverham and Drayton.

The beechwood association of the chalk of the North and South Downs and the Weald is quite absent from Norfolk, nor is there any typical ashwood or scrub association. Professor A. Henry, F.L.S., says ("Woods and Trees of Ireland," 1914, p. 4) that "the effect of glaciation in sterilising the soil has left a great mark on the present distribution of trees in the British Isles. The non-glaciated portion of England coincides with the area now occupied by three trees," the Cornish elm, the English elm and the beech. "It is curious," he adds, "that the beech has not spread naturally into the chalk of Lincolnshire, Yorkshire and Norfolk, which were covered by the ice-sheet." The excavations at Grime's Graves, Weeting, in 1914, revealed the former presence of beech in the south-western part of the county in some abundance, associated with oak and Scotch pine. Dr. E. P. Farrow tells me (*in litt.*) that he considers it probable that the whole of Breckland was wooded in Palæolithic and Neolithic times, before the domesticated herds of Neolithic and post-Neolithic man and the rabbits were sufficiently numerous to kill off all the seedlings and prevent the natural regeneration of the primitive woodland. Possibly during severe steppe-periods in the Palæolithic epoch, the district may have been treeless, but he thinks that trees could have lived on the Breckland sandpall when the climate was

much drier than at present, provided that the amount of biotic attack on the seedlings was small.

Ringstead Downs and Massingham Heath probably furnish the best examples of chalk downland in the county. The distribution of the chalk flora has been influenced by quarrying in various parts and more particularly by ancient earthworks which are often, in the western part of the county, made of chalk piled upon shallow superficial deposits. This is noticeable at Thetford Castle Hill, the Devil's Dykes between Weeting and Cranwich, and Caldecote and Narborough, the dyke on Ashill Common, among the débris of the prehistoric flint-workings at Grime's Graves, Weeting, and to a lesser degree in connection with many ancient boundary-banks in West Norfolk. On almost all chalk areas the upper layer of soil is deficient in lime, so that side by side with the more deeply-rooted calcicole plants are shallow-rooted plants such as *Festuca ovina*, which is usually dominant on chalk pastures. In some cases mole hills and ant hills provide a refuge for calcifuge plants. This may be seen on areas at Hanworth, Bawburgh and Massingham, where *Calluna* seems to be confined to these more elevated situations. The calcicole plants are by no means confined to the chalk, though they flourish best where it is the subsoil, but they are also found on soils deficient in lime. Nevertheless on the big heathland areas of West Norfolk it is usually possible to map the distribution of drift deposits by the absence of calcicole plants, and the dominance of calcifuges like *Pteris*, *Calluna*, *Erica*, *Aira flexuosa*, *Nardus stricta*, and Gorse and Broom.

In Norfolk the plants which seem most characteristic of the chalk areas are *Reseda lutea*, *R. luteola*, *Orchis pyramidalis*, *Ophrys apifera*, *Helianthemum chamaecistus*, *Hippocrepis comosa*, *Astragalus danicus*, *Spiraea filipendula*, *Poterium Sanguisorba*, *Asperula cynanchica*, *Scabiosa Columbaria*, *Campanula glomerata* and *Origanum vulgare*.

Rather than make an arbitrary selection of plants confined to calcareous soils, I have selected those found in Norfolk from

the lists given by Dr. A. G. Tansley [1] and Messrs. J. F. Bevis and H. J. Jeffery.[2] These number fifty-five, and the following eighteen are too common for localities to be indicated in Mr. W. A. Nicholson's "Flora of Norfolk," and in this county it is probable that most of them are not confined to the chalk itself, but are associated with chalky boulder clay or areas where the subsoil water is calcareous :—*Reseda lutea, R. luteola, Polygala vulgaris, Silene latifolia, Linum catharticum, Evonymus europaeus Anthyllis Vulneraria, Centaurium umbellatum, Verbascum Thapsus, V. nigrum, Salvia Verbenaca, Plantago media, Daphne Laureola, Orchis pyramidalis, Ophrys apifera, Habenaria conopsea, Carex flacca, Trisetum flavescens.*

The remaining thirty-seven plants of which records are given in the "Flora of Norfolk," and to which I have confined my investigations are :—

Clematis Vitalba.
Anemone Pulsatilla.
Helianthemum Chamaecistus.
Viola hirta.
Silene nutans.
Linum perenne.
L. usitatissimum.
Rhamnus catharticus.
Hippocrepis comosa.
Astragalus danicus.
Spiraea filipendula.
Poterium Sanguisorba.
Pyrus Aria.
Viburnum Lantana.
Asperula cynanchica.
Scabiosa Columbaria.
Inula squarrosa.
Blackstonia perfoliata.
Cnicus acaulis.
Centaurea Scabiosa.
C. Calcitripa.
Picris hieracioides.
Crepis biennis.
Campanula glomerata.
Atropa Belladonna.
Origanum vulgare.
Thesium humifusum.
Spiranthes spiralis.
Helleborine atrorubens.
Orchis ustulata.
Aceras anthropophora.
Herminium Monorchis.
Iris fœtidissima.
Avena pubescens.
Koeleria gracilis c britannica.
Bromus erectus.

[1] "Types of British Vegetation," pp. 171-2, 176-8.
[2] "British Plants : Their Biology and Ecology," pp. 260-1.

Working out the distribution of these plants in Norfolk I find that there are 121 parishes in which only one has been recorded, forty-one with only two, twenty with only three, and twelve with only four. These parishes are scattered all over the county, with the exception of the Fenland (where the only records are two for Walsoken), and the alluvial areas of the Broadland. Other districts devoid of records are the immediate neighbourhood of Loddon, between Dereham, Attleborough and Wymondham, and between Reepham, Melton Constable and Fakenham—apparently the most calcifuge areas in the county. The more definite chalk flora is to be found in the following parishes :—

Five Records :—Burnham Deepdale, Ditchingham, East Walton, Eaton, Roudham and Thompson.

Six :—Cromer, East Harling, Hillington, Narborough, Stanhoe and Weeting.

Seven :—Barton Bendish, Hunstanton, Massingham, Norwich, Shouldham, Sandringham and Yarmouth.

Eight :—Walsingham.

Nine :—Cranwich.

Ten :—Fincham, Foulden and Thetford.

Eleven :—Marham.

Twelve :—Burnham Westgate.

Thirteen :—Swaffham and Westacre.

Sixteen.—Ringstead.

With the exception of Eaton, Norwich, Cromer, Yarmouth and Ditchingham, all these localities are on the Lower and Middle Chalk of West Norfolk, chiefly on the latter. Of the twenty-nine parishes mentioned, nineteen are in the area of the chalky boulder clay, six in the area of the North Sea drift, and four in the area of the chalky-Kimeridgian boulder clay.

The only moss actually confined to the chalk in Norfolk is *Seligeria calcarea* Rom., and this is only found in quarries where the hard Lower Chalk is exposed.* Mr. W. H. Burrell informs me that *Hylocomium rugosum* is frequent on the lime-

* "Flora of Norfolk," p. 182.

stone in West Yorkshire and Lancashire, and in Norfolk is apparently confined to the chalk of West Norfolk, Cranwich, Santon, Thetford and Weeting being the localities recorded. *Ditrichum flexicaule* is only recorded for a chalk pit at Sheringham, and its variety *densum* for heathland at Wretham. *Thuidium abietinum* is confined to calcareous soil, and is recorded from Bawburgh, Garboldisham, Swanington and Santon, and *T. Philiberti* was found on the chalk at Alderford Common. *Camptothecium lutescens* is common in chalk pits, and on the West Norfolk heaths. *Tortula ambigua* is common on mud-capped walls and in marl-pits ; *Dicranella varia* and *Barbula unguiculata* are very common on roadside marl-heaps and in chalk pits, but are also found on the clay. The following lime-loving plants are common on the boulder clay—*Porotrichum alopecurum* and *Anomodon viticulosus*—while *Pottia recta* is a similar but rarer plant. *Barbula tophacea* is abundant in chalk-pits where water stands occasionally.

There are a few lime-loving species which are not found on the chalk of the county, but occur on the mortar joints of walls. The only occasion on which *Phegopteris Robertiana* has been found in Norfolk was on a bridge over highly calcareous water at Santon. Water apparently ascended the bridge by capillary attraction and formed limestone stalactites on the inside of the arch. *Bryum murale, Eurhyncium tenellum, Grimmia pulvinata* and *Tortula intermedia* also occur on the mortar joints of walls, while *Weisia verticillata*, normally a limestone plant and usually found incrusted with limestone, is recorded from a brick-lined well at Costessey. In a chalk subsoil there are special physical conditions, but a calcareous water must chiefly have a chemical influence, and the latter is probably the more important factor in plants which find a suitable habitat on mortar joints. Certain species of mosses are common on lime built walls on the Pennines, but do not occur in Norfolk. This may, however, partly be due to the difference in rainfall, but chiefly to the fact that in the Pennines they find a natural habitat on the limestone, from which the walls are fed annually, while in Norfolk such a natural source is lacking.

As is well known land-shells are very much more abundant in chalky areas than in those where chalk is absent. In Norfolk, however, Mr. A. Mayfield informs me, only one species appears to be confined to the chalk, and this is *Pomatias elegans* (Müll) which has been found among chalk rubble at Drayton and Whitlingham, and was also most abundant among the chalk rubble in the prehistoric flint mines at Grime's Graves, Weeting. *Helicigona lapicida* is also very fond of chalky sites, but has occurred plentifully in other places.

SOME FISH-NOTES FROM GREAT YARMOUTH AND NEIGHBOURHOOD FOR 1916.

By Arthur H. Patterson.

(*Associate of the Marine Biological Association of Great Britain.*)

The Great War must again be made excuse for what lack of interesting matter may be noticeable in my Fish-Notes for 1916; the same curtailments affecting bird observation also applied to my restricted rambles on the seashore, whilst the handicaps on, and the limitations of, certain fishing industries, usually sources of so much entertaining matter, as well of economic import, still further circumscribed my opportunities for seeing rare and interesting fishes, and for collecting material. And one can but foresee the difficulties ahead that will affect our deep-sea fishermen, when the war is over, through the many obstacles of a serious nature bestrewing the sea-floor of the North Sea.

There can be little doubt that the lessened netting of the waters for the past two years must have acted beneficially, as a very welcome (?) close season, affording recuperation to the erstwhile much-depleted edible species. It has been remarked on—the apparent increase of herrings, for instance, that "the sea is thick with them," so much so, that in the shallow waters close inshore they have been unusually abund-

ant. Small off-shore boats, even draw-netters, have been exceedingly fortunate in making comparatively large hauls, and big prices, when landed. Several 'longshore-men have fished in their little cobles, not so large as the average shrimp-boat, some of them being on occasion as nearly "full to the brim" as warranted their safety.

Of our annual Harvest of the Sea—this couple of lines will cover all I have to mention.

The local shrimpers, when unhampered by spells of untoward weather, did remarkably well, good catches (up to twenty pecks on a tide), and a ready sale, at the orthodox price of threepence per pint, giving them an opportunity of making a payable season. I have been told by a shrimper that it had been quite a common thing this year for poorer persons to purchase shrimps (the Æsop's prawn) for dinner, in lieu of flesh meat, and a by no means unwise procedure, for the locally boiled "shrimp" is as "meaty as a nut," and as toothsome and nutritious as many a much more vaunted delicacy.

Two of our more speculative shrimpers had been fishing this year in motor propelled boats, a proceeding that made them independent of the tides (upon which the sailing boats work) for they can go in and out *ad lib.*, and take advantage of the often short spells of settled weather between adverse winds, that stand to affect the others. They went out oftener, making comparatively large catches at a very slight increase of motive power and expense.

The "shrimps" were of invariably good size and quality; but being under Naval restrictions the men had to keep within proper bounds, which may account for the complaints made respecting a paucity of soles among their catches, often a very profitable asset when they can get among them. The fisherfolk in the shallows of the Wash would seem to have been more fortunate in this matter.

The Breydon and other smelters, reduced to a very few individuals through the claims of Army and Navy, did remarkably well, for notwithstanding the complete extinction of mulleting, "butting" (flounder-netting) and practically that

of eel-babbing, the Smelt still ventures upstream for spawning in goodly numbers ; the " growing-up " of the mud-flats, and their frequent bareness, even at high-water, does not affect this species as it does the Grey Mullet and Flounder, this fish keeping entirely to the deeper drains and channels.

Whether Smelts really rise to floating insects I am unable to say, but it is not a rare thing for them to dash to the surface, making concentric rings by their impetuosity. I have found their stomachs filled with Herring-fry, as well as crustaceans. I do not think the offensive oils, etc., floating on the surface any great detriment to the species, for although the tides vary in density through silt in suspension, their presence in numbers is a fact. With the exception of an occasional Flounder, small Bass, Grey Mullet and sundry Lesser Weevers, and occasionally less common interlopers, drawn to a common destruction by the encircling draw-net, few fish seem to seek the company of this aromatic-smelling species. It was a common saying among Breydoners, " plenty of Smolts—few Smelts "—the former being the Atherine (*Atherina presbyter*), a species occasionally abundant, in other seasons rarer, and I have myself observed the coincidences of this disparity of their proportionate numbers.

Riverside idlers (a scanty class nowadays) have made interesting catches on hook and line of moderate-sized eels, reserving them for their own tables, but eel-babbing has not been up to the normal ; we can, however, count professional babbers in this vicinity to-day upon the fingers of one's hand, with one or two to spare. Fish-shops have been badly supplied with fishes, Skates being small and scarce, Cods and Haddocks scanty, as well as other species usually common enough. Skinned Dog-fish are now exposed without exciting comment. One source has remained untapped, except by piscatorials. I refer to the fresh waters, abounding with Roach, Bream, Pike, etc. I have *heard* of catches being sent inland, but no self-respecting local fishmonger has dared to introduce what might undoubtedly become a source of profit. Surely in these days of close preservation, fresh-water fishes ought to

teem in our rivers and broads, seeing that up to the seventies river poachers netted them by the ton for Birmingham and other inland markets. And why our water-owners have not emulated foreigners in utilising their opportunities for rearing Perch, Tench and Carps, is hard to say, seeing that their flesh is not only wholesome and nutritious, but of excellent flavour. My first fish-entry for the year is as follows :—

"Several local trawlers have lately done exceedingly well ; on the 8th (January) a sailing trawler's catch made just over £200. Two others made £170 apiece. Fish scarce ; keen demand. Prices as follows :—

Soles on the 8th as high as £20 15s. per trunk.
,, ,, 7th ,, ,, £22 15s. ,,
Plaice ... ... £6 to £8 ,,
Whitings ... ... 37s. to 47s. 6d. per trunk.

When watching a local fish-monger selling some Flounders I observed that three, which any Breydoner a few years since would have gladly sold for twopence, cost the purchaser one shilling and sixpence !

The high tide that on January 13th overflowed Breydon Walls, eventually breaking through in two or three directions, flooded the surrounding marshes to a depth of two or three feet, joining up ditch to ditch, until some miles of them were lost to sight. After the waters fell quite a sprinkling of Roach and small Pike, the former up to half a pound in weight, the latter to eighteen inches in length, was left on the levels, some being found in back gardens. The Gulls and Hooded Crows had a feast provided by these stranded fishes quite as unexpectedly as welcome. On the 14th soldiers were observed coming from the Lowestoft Denes (sand-dunes), carrying strings of Whitings which they had picked up. It would appear that these fish in the course of the strong rough tide had been dashed against the sea-wall and killed.

Large Pike.—In a local paper published on January 15th, I observed a photo block of a rather ugly Pike that had been captured on Barton Broad by Mr. G. W. Barnard, of Norwich, on the 9th ; weight, 20½ lb. Mr. Edward Rose, of Acle, when

fishing on Upton Broad, landed an example scaling 23 lb. This Broad is a fast growing-up lagoon abutting on the River Bure. This second-named jolly angler, of 75 years, possesses a small collection of his own catches, which include a Salmon-trout of 7½ lb., captured at Acle; a 5½ lb. Bream; a 3½ lb. Perch; and a Roach of 2 lb.

A Common Carp (*Cyprinus carpio*) of some 3½ lb. reached me from Norwich in a very odoriferous condition, on Jan. 20th. With a view to its identification, my correspondent informed me later that it had been found dead at Buckenham (some 20 miles inland), on a salt tide, that had also "turned up bushels of (freshwater) fish."

Commenting on my references to the utilisation of Dog-fish as food, Mr. R. J. Howard, of Blackburn, wrote me on March 10th:—

"In the January *Zoologist* you say that various species of Dog-fish (Tope and Piked Dog) which before the threatened scarcity of food caused by the war were used as manure, are now readily sold as food at remunerative prices. This reminds me when (as a boy) fifty years ago, the Piked Dog-fish was commonly seen on the fish-stalls, and was known as 'Darwen Salmon.'

"The River Darwen (pronounced 'Darven' by the working-class) is a heavily polluted stream which passes through the borough, and I imagine that the fish received its local name in this connection. As a *name* it is still well-known, but I question whether many persons in the town are aware that, as stated by Day ('British Fishes,' Vol. II., p. 318) 'it is largely employed by the poor as food in the Hebrides, and sold as Darwin salmon.' It is possible that some Blackburnian, knowing the name given to the fish in the Hebrides, may have humorously and somewhat sarcastically gives it the local name, which has survived at least forty years the sale of the Dog-fish in our own market. The local name was known to me more than twenty years before the publication of Day's work in 1884. I have a small piked dog in front of me as I write. It came in a lot of fish sent to a local fish-monger, who

tells me that he has had Dog-fish twenty pounds in weight; but does not know the species. These (probably Tope) he has exhibited as curiosities."

On a certain date in March (which I had failed to notify), I understand that as an aftermath of very rough weather, "a novel harvest is being gathered . . . on Hunstanton beach, and along the adjacent shores, in the form of large Starfish, measuring some 12 in. across, which have been washed up off the mussel scalps and oyster beds in shoals, and sea-urchins, which have come ashore in numbers, such as have never been seen before by the oldest 'longshore men in the district." (Extract from local paper.)

Mr. C. G. Doughty, of Gorleston, sent me on March 24th a very beautiful specimen of the Müller's Scopelus (*Scopelus Pennantii*) that he had found washed up on the beach. He writes: "The enclosed little fish found by me, lying alone on the sand on Gorleston beach on the 22nd inst., will interest you. It appears to be a Scopelus, *vide* Yarrell's 'British Fishes,' 2nd Edit., Vol. II., p. 162, and to differ from the ordinary 'Pennanti.' You will notice the spots run right under the head; in one light they are dull pearl, in another pale green, which I should call a turquoise green, if turquoises were green instead of blue."

This fish, referred to as Pearlsides (a very appropriate name) probably inshores in spring, and as it belongs to the *Salmonidæ*, peradventure it may do so with a view to ascending a river (?). Most of the examples known to me locally came ashore through stress of weather, the first county fish dating April 1st, 1889; on that occasion the weather was exceptionally fine, when I found it among the refuse and weeds from a draw-net. Other dates:—February 24th, 1890 (3 examples); March, 1893, (one example); and another found after a high tide, on the Bure banks, a few years after.

Comber Wrass.—A $6\frac{1}{4}$ in. example of the Comber (*Labrus comber*) was picked up on the beach on April 13. It, like the two taken in March, 1915 (*vide Zoologist*, January, 1916), was exactly akin in colours to Couch's figure (Plate CXXII.). The

ancient beach-man, a real old "'longshore shark," who brought it to me, set great store on its intrinsic value. I gave him more than its worth, but he has never since ceased to lament the figure he accepted for the same; otherwise he had mistaken me for a millionaire! No class of men are more awkward to deal with.

From the *Angler's News* of May 6th somewhat elaborate list of the "Season's Big Fishes," I have culled the following items as given for my own district. They are as follows:—

Pike, Dr. Hobson, December, 25 lb., Barton Broad.
,, Mr. E. Rose, February, 23 lb., Upton Broad.
,, Mr. Barnard, January, 20 lb. 8 oz., Barton Broad.
,, Mr. W. Woods, February, 18 lb, Heigham Sounds.
Perch, Mr. G. Floyd, October, 3 lb. 8 oz., Bure, Wroxham.
Bream, Mr. W. Hewitt, December, 7 lb. 14½ oz., Wensum, Norwich.

May 12th.—Dabs (*Pleuronectes limanda*) very plentiful off shore just now, and they are freely taking a bait. At this period the shrimpers would seem to have been rather fortunate in dropping across fairly good catches of Soles.

Eel-Notes.—My essays after eels this year date from May 19th, at which time they were fairly plentiful, the greatest difficulty thenceforth for some time being to get a sufficiency of worms for bait. On this date from 9 p.m. to midnight I captured 108 of moderate size, the largest being as thick round as my thumb. They increased in size with the lateness of the hour; the largest eels seem invariably to bite about midnight. I had moored my punt against the quay side, near Breydon, over a rough brick and stone bestrewn bottom at near low water, the fish beginning to bite as the flood began to make. Sixty was the result of the next night's babbing; but on the night after, when fishing at St. Olaves, on the Waveney, I obtained but one! From henceforth I had extremely poor fishing, more especially in the Waveney. In July Eels would not touch worms in the Yare at Yarmouth, preferring shrimps and mussels. I observed minute eels feeding among the river weed attached to a houseboat's

bottom. In August there floats at various depths so much reed and coarse grasses (that fall from laden wherries, or drop in as they are being loaded) that night lines invariably come up in the morning smothered with rubbish obscuring the baits. I caught a $1\frac{3}{4}$ lb. example on one hook, on August 6th, from whose stomach I took several pieces of hardish carrot, like filbert nuts, that had evidently been pitched overboard from a yacht. A half-pound Eel that had torn its "throat" in its struggles to free itself from the hook, came up with the tail inserted through the aperture, and protruding from the mouth—dead. These river Eels were sweet and well flavoured; but those I captured later on Fritton Lake were of a more than decidedly muddy flavour, and by no means palatable.

It is somewhat surprising that Eels should be so extremely sensitive to certain odours and flavours, *e.g.*, tarry, oily exhalations, etc., and yet small ones will haunt sewer-outlets; and although Eels soon succumb in floating eel-boxes from overcrowding and confinement, yet will bore into even putrid mud. In September I saw a farmer spearing Eels in some numbers, in inky-black ooze, in a ditch which the sewage and drainage from the farm and cattle yard were emptied.

Melanistic Dab.—On June 6th a fishmonger gave me the most remarkably-coloured Dab I have ever seen; the upper surface was of a peculiar creamy-drab, much like the old-fashioned mottled soap of our fathers' day to look at, with here and there a suggestion of whitish-fawn spots. The fins were quite transparent save where blotched by a few splashings of white, as of milk dropped upon them. The fish measured 10 in. in length and was one of several of a like kind turned out of a fish-trunk. Where they came from I am unable to say; but it seems from their remarkable correspondence they must have been the offspring of the same parents; and as if to confirm my opinion I saw another lot of Dabs on the following day, all of one size, coloured on the anterior half of the under side. I have before noticed that freaks occasionally occur in batches.

Curious Sole.—On July 13th I had shown me an 8 in. Sole,

the upper surface of which was of a striking salmon colour, the most beautiful variety of this species I have so far seen.

In the early part of August I spent some half days fishing with a friend on Fritton Lake, a half-hour's walk from my houseboat on the Waveney. We had moderate sport, our greatest combined catch being some 3 stone of Bream, a few Roach only sprinkled among them. I had been asked by one or two of the villagers for any of "some size" for their tables. It was refreshing to see their appreciation of those I left on my way back, and to understand that they served them up as a very savoury dish, considering the general prejudice existing against fresh-water fishes in eastern Norfolk. A few Rudd were taken on the surface, but of small size, and these were of an exceeding rich golden hue. This species does not appear to reach the size here as at Heigham Sounds and the adjacent broads.

My companion captured a Carp of some 2½ lb. which gave some pretty play; it, however, on being landed received a knock on the head that made it forget the terror of its capture. This fish I had cooked for my own delectation; Buckland's advice to surmount its "muddy flavour," by placing it in a box alive and transferring it for a while into running water, was ignored, and I found that both hot from the kettle for dinner and cold for supper, with an appropriate touching up with a little sauce, the flesh was of exceeding good flavour.

Mr. Thomas C. Rising, writing me from Lowestoft on August 5th, refers to an inshoring of the Scad (*Trachurus trachurus*). He says:

"Large numbers of small fish appearing off the Claremont Pier, I got a friend with a cast net to try for a few. We met with considerable luck. On examination I found the "whitebait" to consist exclusively of Sprats, mostly 1 in. in length, though now and then we got one up to 3 in.

"Seeing some Scad, or Horse-mackerel, under the pier, I put some of the whitebait on fine tackle and obtained excellent sport, the Scad being bold biters and gallant fighters. They averaged 1 lb. in weight. Children paddling on the

beach are getting great numbers of Sand-eels, very small ones, about 1½ in. long.

"Moving among the shoals of whitebait were numerous very small Garfish; one we netted measuring 5½ in. in length. After using what we wanted as bait, we fried the rest, and very toothsome we found them.

"I was much surprised, on examining the Scad, to see that the mouth was quite unlike the usual type of mouth in a predatory fish."

(I examined a head sent me by Mr. Rising, but confess I saw nothing unusual to fire my imagination.)

August 10th.—I have a note referring to quite a number of Scads thrown up, dead or stunned, to the surface of the sea in the immediate vicinity of a sunken wreck in the neighbourhood, that the Trinity men had been breaking up by means of explosives.

After a spell of dull indifferent weather during the first part of August, a few days of sunny warmth brightened up the Broadlands, and anglers began to find the fish eagerly on the feed. I noticed in a communication to the *Anglers' News*" a professional fisherman referred to some interesting catches. At Runham Swim, on the Bure five miles from Yarmouth, two anglers captured 3 stone of Bream; and bags scaling up to 12 stone, on the authority of Mr. Alma Nicholls, were made in the neighbourhood of Stalham. At Hickling Rudd were being taken up to 2 lb. in weight. On August 10th, at Heigham Sounds, 47 Rudd and Roach were taken that next morning, turned the scale at 45 lb. On August 20th a Rudd is recorded as weighing 2 lb. 5 oz. The following excerpt is somewhat a startling one: "Hickling Broad has yielded large bags of Bream up to 8 stone and 10 stone almost every day." In the Ant a 3 lb. Rudd was hooked. I fear that the majority of these fishes are thrown to the pigs or on to the manure heap, a waste of good food. That is pitiful, to say the least, because the local palate remains so obstinately prejudiced.

Dabs were much in evidence in shallow waters at the latter part of August, considerable catches being made by one or two

sea-anglers fishing off Hemsby, seven miles north of Yarmouth. The fish ran up to 1½ lb. each in weight.

Starry Ray.—When passing a fishmonger's on the evening of August 30th, I quite by accident turned my eye upon the very dimly-discernable occupants of the slab. I noted a solitary small Ray, and putting my hand on its disc, was at once assured by the numerous and formidable spines that it was a Starry Ray (*Raia radiata*), which, on bringing it to the light inside, was at once apparent. It was the size of a breakfast plate, and I was assured it had been taken in local waters.

As the result of exceptional immunity from fishing operations, certain species of sea-fish appear to be wandering in somewhat unexpected directions. A Turbot, weighing well over a stone, was netted from the shore in September ; a Plaice, of 4 lb. 5 oz., was taken by an angler from a pier, a Brill of 1¾ lb. succumbing to the same rod ; whilst on October 16th a Sole of 1 lb. 6¾ oz. was also captured on a line.

September.—Some gossip went the rounds of the local angling fraternity over a Perch taken in the vicinity of the Broads—said to be a Black Perch and without stripes. It was hinted that probably it was a Black Bass ; I did not see the fish, and doubt the possibility of its being such, although some years ago (I believe at Frank Buckland's suggestion) a small number of this species was turned into local waters, but they did not thrive, and now are probably extinct.

A much more likely thing may be that the fish had come into contact with the salts by accident, or from that indifference of the Perch to an occasional saline bath for the sake of the shrimps it finds there. It is noticeable that Perch caught in tidal waters affected by the salts are prone to lose their dark stripes soon after death.

Whitings inshored during October, fluctuating somewhat in abundance with the weather,—and consequently tidal conditions. October was mostly a very rough month, with much rain, and the wind almost continuously from the south-west and thereabouts, often extremely violent. Sea-anglers flocked to the piers and met with mixed success. Young finger-length

Bibs (*Gadus luscus*) were fairly numerous, and helped to vary the bags, although of no use for the table. An experienced sea-angler remarked to me on the "badly-fed" appearance of the Whitings; I could not detect anything out of the normal.

With regard to the Bibs, I happened to remark on the fat, deep-bodied little fish, to an ancient sea-angler.

"Oh! they're only bastard fish," he volunteered, and when I ventured to assure him that they were a true and distinct species, he gave me a look of the deepest scorn, and wanted to know "how long they had been Bibs?" He was so dogmatic and unpleasant in his manner, quite typical of the shore-lounger who knows fish only by their local names, that I rather testily assured him that they had been named Bibs long years before he had been born, an assurance which effectively persuaded him to discuss the matter no further. It is rather unfortunate that most fisher-folk, ignorant of the true character of any fish that at all puzzles them, almost invariably settle the matter in their own minds as to its being a "bastard," and trouble no further, and hence many a rare and interesting specimen remains unrecorded.

The Eastern Sea-Fisheries Reports of Inspector Donnison continue to be of an interesting nature. He refers to the "outstanding features," in the March-end Report for the half-year as "tempestuous weather, the high prices received for nearly all kinds of fish, and the fact that young Herrings and Sprats have entered the Wash after an absence of a number of years." The latter statement suggests to me that the abundance of small fishes in that neighbourhood may account for the noticeably small numbers of Terns frequenting Breydon. He mentions the capture of "Pink Shrimps" in November (1915) from the 17th to the 20th, by one smack, of 100 pecks," which brought home £20, or £5 per share." "Brown" Shrimps (*Crangon vulgaris*) made high prices, and were plentiful; "one crew of two men caught 60 pecks on one ebb tide." Referring to this particular catch made in "three short hauls," he informs us that they were taken over small mussels; other heavy catches were made where these small molluscs were abundant.

Probably these crustaceans find easily accessible food thereat, as in the neighbourhood immediately south of Yarmouth, the Æsop's Prawns haunt the widespread *Sabella* beds ; our shrimpers insist that these worms are the favourite food of these " Pinks." The appearance of " deep-water Herrings " in the Wash, like their influx into waters laving the eastern coast, may be due, as he suggests, to the decreased fishing by larger drifters. " In October (1915), the Sheringham boats caught 2,900 score Dog-fish, and three Runton boats 60 score," catches that a few years ago would no doubt have been devoted as bait to the crab-pots.

The capture and destruction of Starfish relieved the mussel scalps of many tons of these insiduous pests, " 75 tons of brood Starfish " being obtained from September to March. " Star-fish," he reports, " appear to be sensitive to cold or to a sudden change of temperature. . . . When the colder water came from the land and foreshores, the Star-fish clung to each other by means of their suckers. They were in balls the size of a man's head, and when the anchors and cables of the ' Protector ' and barge came up the clinging Starfish made them twice their diameter." In the September (1916) Report reference is again made to the prodigious numbers of Starfishes found in the Wash and neighbourhood—" the crew of the ' Protector,' assisted a few days by one of the bailiffs, obtained over 1,600 cwts. of Starfish." The devastation made on the mussel-beds must at times be enormous. In one locality " every Mussel, big and little, had been devoured." Tons of these pests were sold for manure, more were killed in steam, and afterwards thrown overboard in localities where they would not be a nuisance to prawners and shrimpers. The second Report contains a couple of photographic reproductions showing starfish lying on and near live mussels, and several of the Staff collecting them.

November 2nd.—One of the most remarkable invasions on the East Norfolk coast of a species hitherto esteemed exceedingly rare, occurred in the beginning of November, when probably a shoal or shoals of some thousands of Saury Pike

(*Scomberesox saurus*), judging by the numbers brought into the town, must have been wandering in this part of the North Sea. Quite by an accident I happened to be passing through a back street, when I noticed a score Garfish-like fishes lying on a fish-slab, something unusual about them at once rivetting my attention, although from a cursory glance one might have mistaken them for half-grown *Esox belone*. Taking one in my hand I noticed the proportionately shorter and acuter "bill," which, with its slightly upturned rake, reminded me wonderfully of an Avocet's mandibles; the finlets between the dorsal and caudal fins (absent in the Garfish) still further satisfied me.

I purchased three at threepence each, and sent two of them to a taxidermist's for the Norwich Castle Museum and the Tolhouse Museum, Yarmouth, respectively, the third I had boiled for my supper, finding it with a simple spicing of salt and pepper extremely good, in flavour and firmness very like a Mackerel, but superior to it.

Previous Norfolk records are few and somewhat ancient; two on the authority of "J.H.G." (evidently the late Mr. Gurney, senr.), as given in the Norfolk and Norwich Naturalists' Transactions (1874) by Dr. Lowe, "about 16 in. long, caught October 25th, 1844, now in the Norwich Museum." From what I can gather there is a likelihood of their having been taken off Yarmouth. Then he refers to another, on the authority of the Rev. E. W. Dowell, as having been taken in Blakeney harbour, December 7th, 1846. Sir Thomas Browne, that keen observer, thus makes reference to the species: "the saurus wee sometimes meet with yonge. Rondeletius confesseth it a very rare fish somewhat resembling the acus or needle-fish before and a mackerell behind. Wee have kept one dryed many yeares agoe."

On the evening of the 2nd I made a trip round to the few fishmongers' shops in the town, discovering that one merchant had that day purchased a couple of swills-full (with probably 400 or 500 fish in each) and that another had secured a "kit"-full of them. Most of them measured 16 in. in length, and they were

extremely alike in size. Dr. Day and others place the full-grown fish at 18 in., but it is just probable that they are exceptional individuals at that length. I attempted a dissection of the internals, but everything inside seemed to to have become such a mass of very oily fat, that I speedily desisted.

Next morning I visited the fish market, finding some other hauls had been taken, half a swill-full being in one place, two heaps on the floor in others—perhaps 1000 fish all told. They sold readily, and no prejudice seemed to prohibit their speedy consumption. On the previous day I had given one fish-merchant a rough drawing of the species and a hint of its name and habits. My finding had leaked out among the fisherfolk, who were having much idle time on their hands, and an interested group opened out for me as I, in turn, visited each lot. But for my diagnosis they would have attracted but little attention, and been passed by as Garfish, "Guard-fish," and "Gorble-fish," (Gore-bill !) the latter local names for the larger species. On the presence of finlets on the Saurus, and their absence on the Garfish being pointed out, they immediately recognised that they were not "bastards," the usual name given to any species with which they are unfamiliar. About 150 in a kit on the wharf on November 6; several taken November 8th in 'longshore nets.

For a number of days the wind had been from the south and south-west, often rising to half a gale in force, so that the North Sea had been fed by more southern waters than we usually get at this period of the year, and on these tides the Saurus may have put in. Capt. D——, of H.M.S. ——, kindly sent me the temperature of the sea-water, dating from October 31st to November 6th inclusive; these were respectively 50, 50, 51, 48, 49, 50 and 49 deg.

It has long been my practice to record in the *Eastern Daily Press* any rare, or interesting species of fish found in local waters. I duly recorded the advent of this invading shoal of Skippers, extolling its culinary virtues on the table. Others at once were persuaded to sample its flesh; one gentleman assuring me that one he had had fried "was in flavour excellent, reminding

him of both the Mackerel and the Grey Mullet—combining the tastiness of both."

A Porbeagle Shark (*Lamna cornubica*), measuring 6 ft. 6 in. in length, was brought to the fish-wharf on November 6th. About an hour afterwards I saw a fishmonger's assistant scrubbing the beast, as if it were the carcase of a fat hog, on the floor of the fish yard, for exhibition on the shop-slab. Considering the fact that this fish is an extremely clean feeder, confining its attention chiefly to the Herring and Pilchard shoals, not to mention other gregarious species, it should certainly be made use of as food instead of too often spending time enough on exhibition to become "unfresh," (to coin a phrase), and then to be thrown on the manure heap. It is esteemed as food in some parts of France. The "claspers" of this Porbeagle were large and formidable weapons. The stomach was found, on cutting it up, to be empty. The liver was very bulky and dark-coloured.

Mr. Thos. C. Rising, writing me from Lowestoft on November 6th, says: "Whitebait has been scarcer than usual. I examined a quantity and found them exclusively Sprats, and the fry of the Sand-eel. Garfish are very scarce. Shoals of Scad feeding round the Claremont Pier on fry, for about one hour daily; they are very regular in their times, according to tide. In the Inner Harbours in September large quantities of small Coal-fish and Whiting-pout (Bibs). During August an unusually large number of prawns taken with the shrimps. Fewer Soles than usual; Dabs abundant, remaining here much later than usual. Whiting appeared in mid-August, and then went away again until mid-October, and are in good condition. Few Codlings up yet, those which have been caught often in poor condition."

This remark would apply to several Cods so far captured in the neighbourhood of Yarmouth; submarine explosions, or something akin to shell-shock may have seriously injured many fishes, as well as killed others, whose carcases have been seen floating on the surface. Out of condition fish, known locally as "slinks," are occasionally captured, some being

swarmed with parasites, mayhap some may be suffering from the attention of the Myxine (although so far none have been submitted to me), but these attenuated fishes are almost invariably knocked on the head and thrown over again, as unfit for eating. One case recently of a Cod which, from its length should have weighed quite 23 lb., scaled but 14 lb., and might have been described as somewhat resembling a sheep's head to which is attached an oxtail.

November 9th.—About 100 more Saury Pikes brought to wharf to-day. *November 10th.*—Some 200 to-day.

Flounders.—With Blind Ben (my old Breydon chum) went Flounder-stabbing to-day (November 10). I discovered their "lay" in the Ship Drain, the bulk of the fish being found on a weedy bottom some thirty yards in extent (the drain is one mile long, and shaped like the letter S), by about ten yards wide at low-water, depth varying from twenty inches to three feet), a stratum of broken shells (clams, mussels, etc.), underlying it. The largest fish weighed over a pound, our total catch making a little less than 20 lb., which we roughly estimated as worth at least half a sovereign. The stomachs and intestines contained little else than "raw" weed. Only the very smallest were natives of Breydon, the larger ones (in ova and milt) being fish from the sea, and they were at once to be distinguished by their pearly-white underparts, protective, or "irritated" discolouration not yet having had time to show.

War prices for fish at the shops have been high; a few of them jotted down on November 11, as given below, may be interesting in years to come as a reminder of the sacrifices being made in the Great World War in the matter of fish-food :—

Salmon	4/– per lb.
Saury Pike	3d. each.
Sprats	7d. per lb.
Fresh Herrings	1d. to 2d. (generally).
Skate	9d. per lb.
Plaice	1/4 ,,
Soles	3/6 ,,

Flounders	...	...	...	1/– per lb.
Codfish ...	...	...	...	1/4 ,,
Whitings	...	...	...	10d. ,,
Eels ...	...	...	...	1/– ,,
Smelts ...	...	...	...	3/6 ,,
Dabs ...	...	...	...	1/– ,,
Dogfish ...	...	...	...	6d. ,,
Codlings	...	...	...	9d. to 1/2 per lb.
Haddocks	...	...	...	10d. per lb.
Mackerel	...	...	...	5d. and 6d. each.

Only a few years since Skate was held in no great esteem only by the poorer folk, catering for whom, to the quaint cries of " Skate and Skate docks, alive ! this morning ! " there perambulated several humble fish-hawkers, whose " Roker " (Thornbacks) and " Homers " (Spotted Rays) were freely sold in the rows and back-streets ; and although of late years the more important fish-shop keepers have sold their skates by weight, it has only come to pass since war-time that their humbler confreres started to do so. " Sides " (half discs) of skate were, like Haddocks, Whitings, Dabs and other common fish, sold by " sight " and size. Flounders until recent years were hardly saleable from fish slabs ; and never has the sale of Eels locally been made anything more than an accidental or haphazard venture, although in the piping times of Breydon, fifty years ago, frowsy-looking fish-wives, meet spouses of their hardy husbands, who " babbed " and " picked " for them in the tidal waters and on the oozy flats, were an institution in the Saturday market. Clad in outer-gear of genuine sack-cloth, exhibiting their Eels in inverted buckets, the opening being reversed, these sturdy women sold their fish by weight, in scales made of string and inverted saucepan-lids, and " skun " their wares into the buyers' baskets.

" How those poor skinned Eels must suffer ! " said a customer to a lady eel-weigher and skinner.

" Lor', bless yer, no mum ! " replied Mrs. " Eeley " Bowles, " they doant mind bein' skun, they're used tu'it ! "

On December 1st a gentleman casting from the beach hooked

a curious, gaunt-looking fish very like a Hake in shape; it had taken a lug-worm. The fish, which I afterwards saw, whilst not having the appearance of a sick fish, was 30 in. long, 10 in. in girth, and weighed 6½ lb. It curiously compared with Couch's Slender Salmon (*Salmo gracilis nobis*. Plate CCXVI.).

Its captor kindly allowed me to cut off the head, which I forwarded to the Natural History Museum, Kensington. Mr. C. Tate Regan kindly overhauled it, and wrote me: "The head is that of a Salmon (*Salmo salar*), and I take it that the fish has recently spawned and has not been more than a few weeks at most feeding and trying to get into condition."

IV.

ON THE OCCURRENCE OF THE ISOPOD, *PARAGNATHIA HALIDAII*, IN NOROLK, WITH A DESCRIPTION OF THE PRANIZA STAGE.

By Private J. Omer-Cooper, R.A.M.C.

During the summer of 1915, my brother and I were fortunate enough to obtain from Christchurch Harbour, Hants., a considerable number of specimens of *Paragnathia halidaii* (Bate and Westwood) both in the Praniza and adult stages. A study of this material resulted in a paper by my brother establishing the genus *Paragnathia* and giving a description of the specific characters, but only figuring the first Peræopods of the adult male and female. Some short time ago, I was again in a position to attempt a little work in carcinology, and I wrote to Mr. Robert Gurney asking him to allow me to examine the specimens of Gnathiidæ recorded in his valuable paper on the Crustacea of the Norfolk Rivers, published in Volume VIII. of these Transactions, and identified by him as *Gnathia Maxillaris* (Mont). The determination of the Gnathiidæ being a matter of difficulty, it seemed not unlikely that this identification was incorrect, *Gnathia maxillaris* being a purely marine

species. This proved to be so, for Mr. Gurney's specimens, which consisted of three young larvæ and two well-advanced Pranizæ, belong to *Paragnathia halidaii*.

The identification of most crustacea in the larval stages is a matter of no little difficulty, and this is specially so in the case of the Gnathiidæ for two reasons—firstly, that the larvæ differ only in minute particulars from each other, and secondly, that no descriptions of sufficient accuracy for this purpose have been published for the majority of species. The identification of Pranizæ is, however, a matter of some importance, as a large number of the recorded specimens of Gnathiidæ have been in this stage, and these are much more frequently obtained than adults. I am therefore taking this opportunity of describing and figuring in detail the above Praniza in the hope that it may form a basis for future comparisons, and may in some measure help to remove the great confusion which exists with regard to these forms.

Paragnathia Halidaii (Bate and Westwood).

Anceus halidaii, Bate and Westwood, British Sessile-eyed Crustacea, ii., 1868, p. 203; Delage, Arch. Zool. exper. gen., ix., 1881, p. 68.

Gnathia formica, Norman, Ann. Magg Nat. Hist. (7), xvi., 1905, p. 86 (non *Anceus formica*, Hesse).

Gnathia halidaii, Boutan, C.R. Acad. Sci. Paris, cliii., 1911, p. 639.

Paragnathia halidaii, J. and W. Omer-Cooper, Zoologist, 1916, p. 26; W. Omer-Cooper, Ann. Mag. Nat. Hist. (8), xviii., 1916, p. 124.

Description of the Praniza Stage.—Body rounded and fusiform, with the first segment of the mesosome very small and closely united with the head, the fourth, fifth, and sixth very much distended, and the seventh abruptly narrowed, being similar in diameter to the metasomic segments and bearing no appendages. Ths cuticle covering the fourth, fifth, and sixth segments is very thin and quite transparent, and the

sutures are not observable on the dorsal surface in most specimens, though they may be seen with difficulty ventrally close to the median line. The metasome is about one-third of the width of the mesosome, and has the sides almost parallel. The last segment is small, and is fused with the telson as in all Isopods, with the exception of the aberrant Anthuridæ. The telson is rounded at the end and bears two short slender setæ This short rounded telson is one of the most distinctive features, as in all other pranizæ with which I am acquainted, the telson is long and triangular. In the segmented larva which precedes the praniza, the segmentation of the mesosome is complete in respect of the fourth, fifth, and sixth segments, and there is no distended area, otherwise the description of the adult praniza refers equally to all the larval stages. The colour varies considerably in different specimens, and this characteristic is therefore valueless for the purpose of identification. The young larvæ are speckled with reddish-brown, and are very transparent, but in the later stages the swollen central area is filled with a gelatinous substance which is brilliantly coloured. The majority of specimens have this substance of a deep orange colour, but not infrequently I have found specimens in which it is brilliant bluish-green, or with the anterior part green and the posterior orange. Mr. Gurney's specimens are lemon yellow, but they may possibly be somewhat faded.

The Head has a small frontal median lobe with the edge straight; it is without markings, and is smooth and rounded. The upper lip and mouth parts project to form a conical somewhat curved suctorial proboscis. The eyes are laterally placed, dark brown in colour and well developed.

The Anterior Lip (Fig. 3) is well developed, with the lateral margins curved to form a partial sheath for the mouth parts. It has a median and two small lateral expansions. The median line is thickened and fleshly ventrally, and this ridge runs to the end of the middle lobe, reaching almost to the tip of the mandibles, and no doubt assists suction by closing the groove between them.

The Antennules (Figs. 4, 4a, and 4b) are stout and almost equal in length to the antennæ: they have a three-jointed peduncle and a flagellum of four joints. The first joint of the flagellum is short and but slightly narrower than the last joint of the peduncle, and carries no setæ; the second joint is of the same width but six times longer, and carries at its extremity two setæ, one on the lower side which is small and of the normal type, and one (Fig. 4b) on the upper which is large and of peculiar structure, corresponding very closely to the "olfactory filaments" described by Mr. Scourfield in the Cladocera. The base is slightly expanded, and the proximal portion has highly chitinised walls which reach only to about one-fifth of the total length, while the distal portion has a thin membranous cuticle, is slightly distended and is rounded at the end. The third segment is about one-third of the length of the second and is narrower, while the fourth is very small. Both these joints carry sensory filaments of the structure described, and the last in addition carries a stout terminal seta.

The Antennæ (Figs. 5 and 5a) are rather more slender than the antennules and have a four-jointed peduncle and a flagellum of eight joints. This eight-jointed flagellum is a feature of considerable importance, as by it pranizæ of this species may be differentiated from those of the genus Gnathia, in which the flagellum is composed of only seven parts.

The Mandibles (Figs. 6 and 6a) are modified for piercing the skin of the fish upon which the pranizæ live, and also apparently assist in their attachment, for the extremity is styliform and carries a number of sharp, curved teeth on the inner side. The lower portion is considerably flattened and expanded, and less highly chitinised. It has near the base a small curved projection, which is probably a much reduced molar process. There is no lacinia mobilis or palp.

The Maxillulæ (Fig. 7) have no joint, and are small, curved, styliform organs, very feebly chitinised, with the apex slightly widened and very flattened. There is a deep channel on the inner side running from the flattened portion to the base, where

they are joined together by a very thin expansion of the inner margins which has a short median groove.

The Maxillæ (Fig. 8) are stout piercing organs slightly curved, and with a few minute serrations on the inner side near the apex. They are without joint.

The Maxillipeds (Fig. 9) are sub-styliform with a very obscurely three-jointed palp. There is a single pair of coupling-hooks which are situated just below the palp and near the middle of the maxillipeds, so that when in position they hold them at right angles to each other. The first joint of the palp is produced into a sharp serrated piercing organ which reaches to the end of the palp; it is slightly curved, and bears near the base a single long stout seta. The second and third joints are lamellar and extremely thin and transparent, the third having a few curved setæ at its apex. In the male praniza just before the final moult, the maxilliped of the adult may be seen lying with the expanded basal joint below and its palp within the larval maxilliped. In the adult female there is no maxilliped, but just after the final moult a small and degenerate remnant (Fig. 9a) may be observed which appears to be rapidly absorbed.

The First Peræopod (Gnathopod or Second Maxilliped) (Fig. 10) is sub-pediform, and ends in a stout curved claw bearing a small tooth near the base. The first joint is not expanded and is slightly ridged on the upper surface; the second joint is slightly wider and one-third shorter than the first, and bears a curved spine on the upper surface mid-way between its articulations; the third joint is one-fourth longer than the second and about the same width, it bears distally two small setæ on the upper surface and one long slender one on the lower; the fourth joint is narrower than the preceding one and about half its length, it is triangular and the distal articulation is not very easily observable; the fifth joint is rather longer than the third and tapers distally; the sixth is curved and highly chitinised, forming the claw, which is admirably adapted for attachment to the skin of the host.

The Peræopods (Figs. 11 and 12) are sub-similar, the second

being rather stouter than the others. They bear on the third joint one or two (one in the second, two in the sixth) stout setæ of peculiar structure (Fig. 11A). These are slightly expanded at the base, and at the junction of the distal and middle thirds a small number of minute setules are arranged in an oval on the inner side of the setæ. They are possibly sensory.

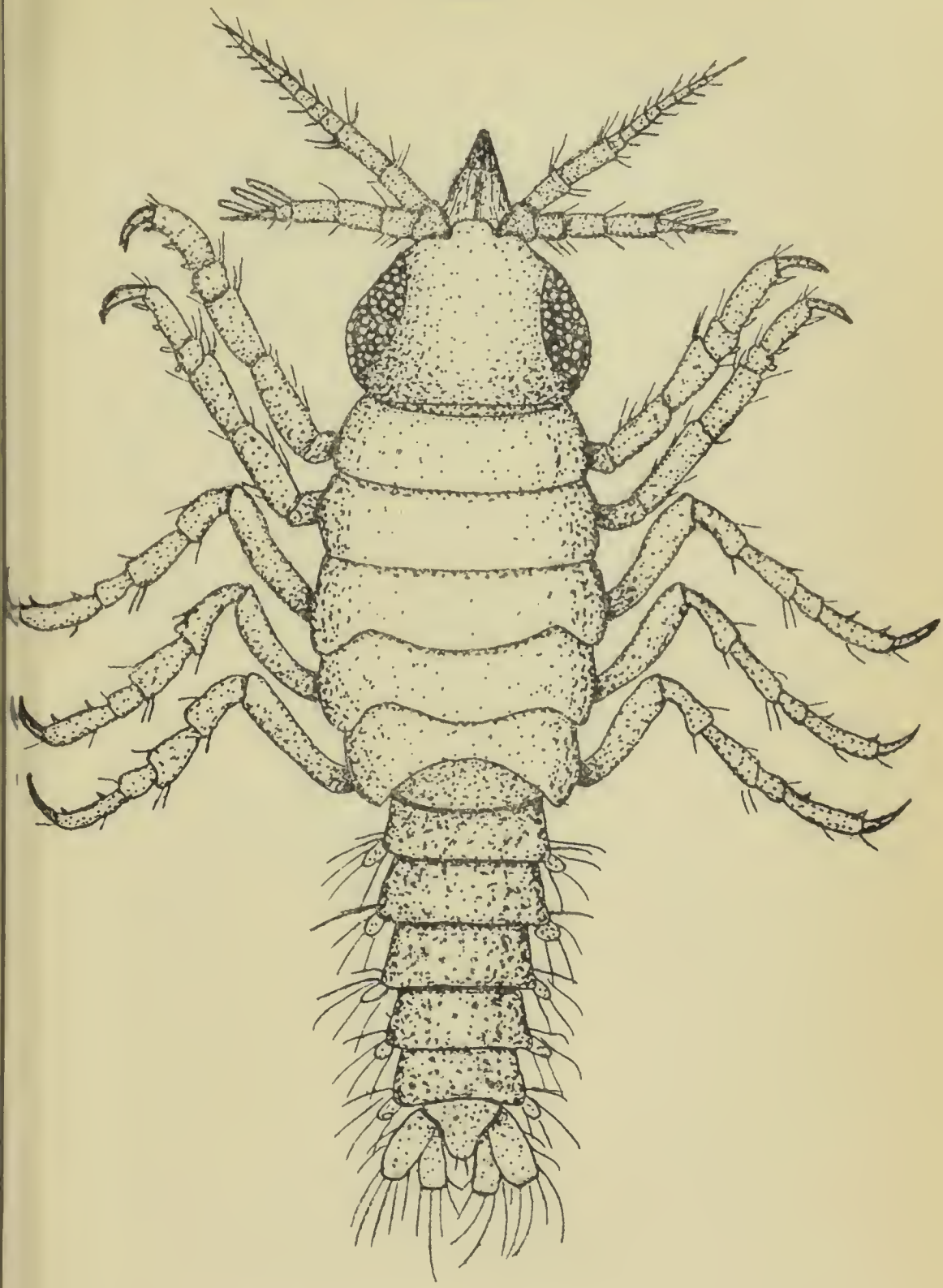
The Pleopods (Fig. 13) are in the young larva and early praniza purely natatory, and carry long plumose setæ on both rami. In all stages the sympod bears two stout setæ (Fig 13A) on the inner margin. The rami are sub-similar and unjointed, but in the more advanced praniza the endopod loses its natatory setæ and becomes fleshy and respiratory in function, and occasionally the exopod also loses its natatory character and sheds some of its setæ.

The Uropods (Fig. 14) form a caudal fan and project about one-third of their length beyond the telson. They are fringed with long plumose setæ in all stages.

Size.—The segmented larvæ when they first leave the mother are 1·5 mm. long, and the adult pranizæ from 4 to 5 mm., though there is considerable variation in this respect.

Remarks.—Like the young of other Gnathiidæ, this praniza is an ectoparasite of fish, clinging to them and sucking their blood, the mouthparts and peræopods being modified considerably for this purpose. When they first leave the mother they swim actively about, and they can live without food for a period of at least eight weeks. Later they become distended with food and they are then sluggish, crawling about slowly and being almost incapable of swimming. When fully fed, or for some reason separated from their hosts, they seek the bank, where just below high-water mark they construct a short burrow ending in a small cavern in which several live together and undergo the final ecdysis. In this stage and apparently during the whole of the remainder of their lives they take no food, the female indeed being quite unable to do so, as she has no digestive system and has lost all her mouthparts with the exception of the degenerate first peræopod, which forms a very imperfect operculum.

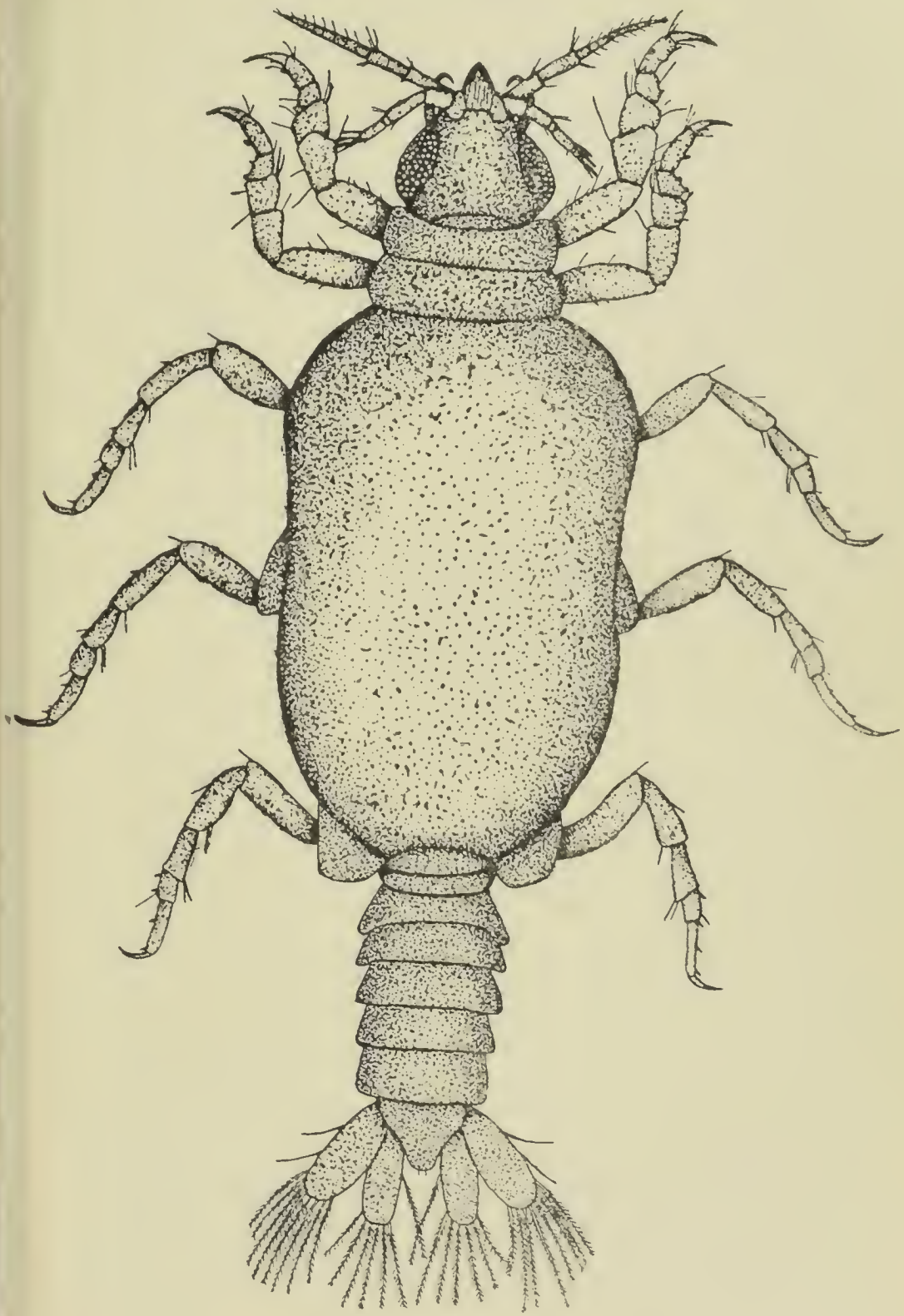
Plate I.



PARAGNATHIA HALIDAII.

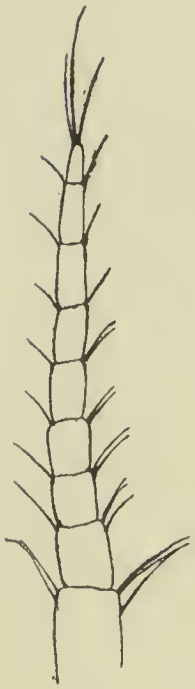
SEGMENTED LARVA.

Plate II.



PARAGNATHIA HALIDAII.

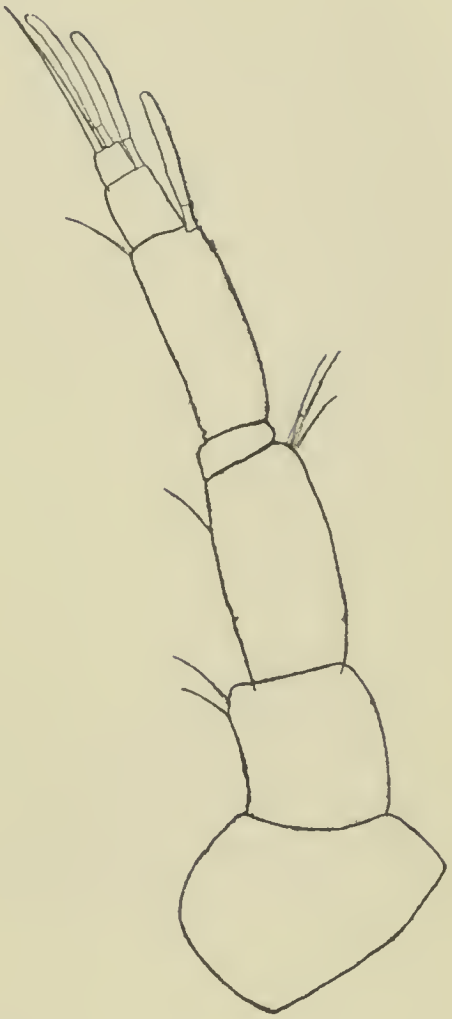
LAST PRANIZA.



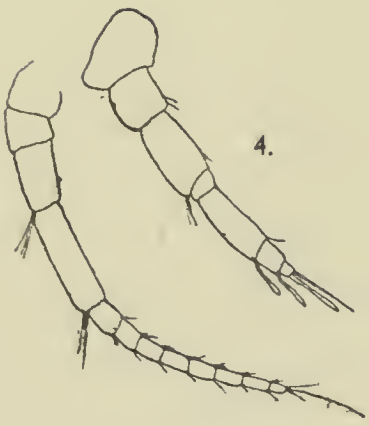
5a.

4b.

3.



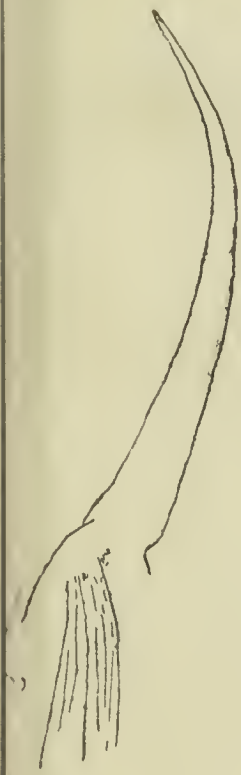
4a.



4.

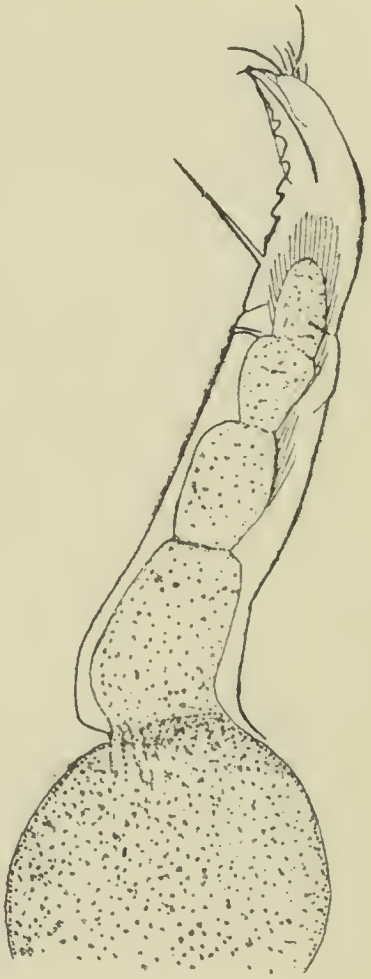
5.

Plate IV.

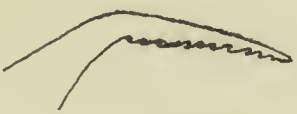


8.

6.



9.

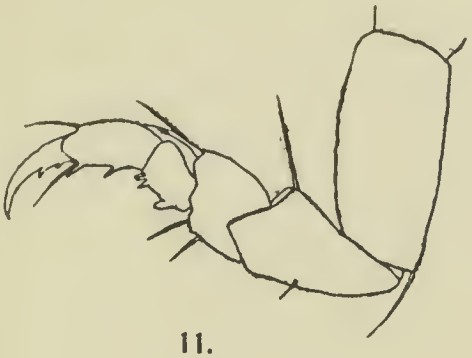


6a.

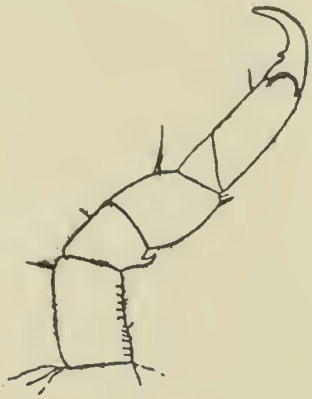
9a.

7.

Plate V.

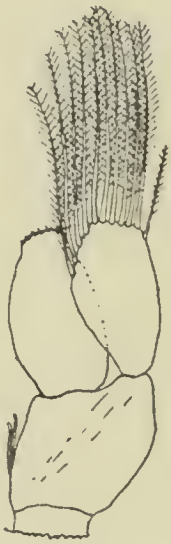


11.



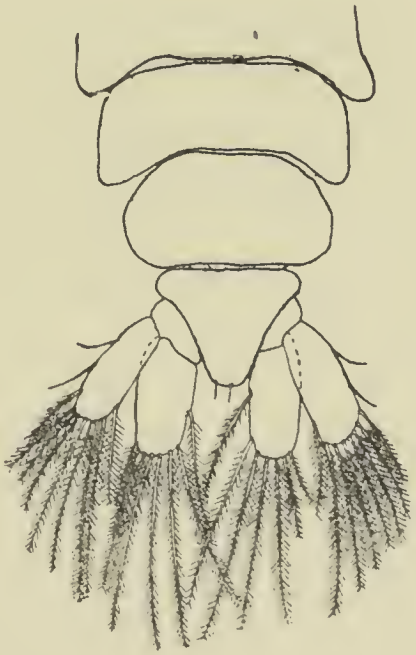
10.

12.



13.

13a.



14.

11a.

EXPLANATION OF PLATES.

Plate I. PARANATHIA HALIDAII, segmented larva.

„ II. PARANATHIA HALIDAII, last praniza.

„ III. fig. 3. Anterior lip.

„ 4. Antennule.

„ 4a. Antennule more highly magnified.

„ 4b. Sensory filament of antennule.

„ 5. Antenna.

„ 5a. Flagellum of antenna more highly magnified.

IV. „ 6. Mandible viewed from below.

„ 6a. End of mandible.

„ 7. Maxillulæ.

„ 8. Maxilla.

„ 9. Maxilliped.

„ 9a. Maxilliped of female.

V. „ 10. First peræopod (Gnathopod).

„ 11. Second peræopod.

„ 11a. Seta of peræopod.

„ 12. Sixth peræopod.

„ 13. Pleopod.

„ 13a. Setæ of pleopod.

„ 14. Telson and uropods.

THE NATIONAL TRUST.

Report of the Blakeney Point Committee of Management for 1915 and 1916.

The present report dealing with the years 1915 and 1916, covers a period during a large part of which the National Trust's Reservation at Blakeney Point has been practically withdrawn from access owing to the measures deemed necessary by the military authorities for ensuring the safety of our shores. On the present occasion it must suffice to say that from August 1915 to July 1916 inclusive, permits for residence on the Point were withheld, and the naturalists and scientific parties who have made a practice of carrying our systematic observations and pursuing their investigations into natural knowledge have had to be content to suspend their work. From August 1916 onwards, however, the rigour of the occupation has been mitigated and, as the accompanying report will shew, touch has been established once more with some of the old lines of work whilst certain new lines have been opened up. That what may be described as a military occupation will have any appreciable permanent effect hurtful on the vegetation on the Point no fears need be entertained. The play of the natural forces, wind, tide and waves, may be relied on with confidence to obliterate alike the traces of constant patrolling and the defensive constructions of the sappers.

We wish we could say as much for the Terns. The breeding reports for 1915 were entirely favourable. The Terns came in good numbers and the young birds reared were quite up to the average.

At the close of the breeding season came the more stringent regime, and in the spring of 1916 in the absence of a watcher no effective control was possible. Accounts agree that the birds were interfered with and that the number of young hatching out was very small. However, 1913 was also a dismal year from this point of view. (See Report, 1913, p. 7), and yet the following season the Terns came back in greatly increased numbers.

Utilisation of Marram Grass for Paper-Making.

In view of the probability that as the war progressed further restrictions would be imposed on the import of paper-making materials, advantage was taken of the re-opening of the Point

to make a series of preliminary experiments into the capacities of Marram Grass from this point of view. Hitherto this plant, so far as we know, has never been exploited commercially for paper, though a few years ago it was reported on very favourably by a paper expert.[1]

Our experiments were made with the following objects :—

(1) To determine the yield of dry grass per acre.

(2) To find out how frequently the grass could be cut without impairing the plants.

(3) To ascertain the best method of cutting so that the wind should not blow away the sand from the stubble.

(4) The use of chemical and natural manures in promoting the growth of the crop.

The experiments were made in August and September 1916, and will be continued. It is hoped to publish a full report on the matter in these pages next year.

Samples of paper have already been prepared from material supplied from The Point.

Other experiments on a considerable scale were also started in September to ascertain the effects of applying various chemical fertilisers to dune soils. The fertilisers were applied both singly and in combination on a number of small areas which are being kept under observation.

Experimental Tree Planting.

In the last Report (1914, p. 8) mention was made of the fact that a modest scheme of tree planting was in contemplation with a view to arresting the further attrition of certain parts of the area from which much sand is being blown away by the wind. In November 1916 and again in January 1917, a small number of young trees of a variety of species (both coniferous and broad leaved) were planted out (1) on The Hood which is the part of the area particularly threatened, and which it is desired to preserve as a topographic feature, (2) in the neighbourhood of the Laboratory where the progress of the trees can be conveniently observed. In a future report complete lists will be given of the trees planted with notes on the result of the experiment.

It is hardly necessary to say that there is no intention to plant trees indiscriminately or in any way to modify the

[1] Kew Bulletin, 1912, p. 396.

natural character of the sand dunes. Plantings will be restricted to small clumps and belts, and these will be placed in suitable positions and for some definite purpose. The Committee are much indebted to Mr. Linn. Chilvers of Hunstanton who has taken great interest in the experiment and has placed his expert knowledge at their service.

High Tides.

High Tides are becoming more frequent than has been the case for a number of years and on September 14th, 1916, was experienced what is probably the highest tide since the famous one of November, 1897. At page 6 in the present reports some account is given of last September's tide. In view of the height which it reached, the fact that the tide-tables for 1917 predict several still higher tides,[1] including one (on September 3rd) 12 inches higher than that of last September, it is evident that on the date given one of the elements for a huge inundation will be provided. Should this tide get material assistance from the wind it is a reasonable probability that it will be accompanied by events comparable to those of November 1897. Anyhow, a tide of this height has not found a place in the tide-tables for many years past.

Hand Lists of the Flora and Fauna of Blakeney Point.

In addition to the various papers dealing with the natural knowledge of Blakeney Point (a list of which is given on pp. 3 and 4 of the cover) it is proposed to issue for the convenience of visitors Hand Lists of the various groups of animals and plants which occur on the area. With the current Reports we print the first of these, dealing with the Birds, by Mr. Wm. Rowan. In it 213 species are recorded for the Point, of which 15 are well known to breed there. Other lists will follow from time to time as the various groups are worked through systematically. In this way, as the lists multiply, the richness and variety of the resources of Blakeney Point will be manifest at a glance. The lists will be procurable separately.

Finance.

We give below an abstract of the annual accounts touching Blakeney Point since its transfer to the National Trust. The small revenues that accrue are derived entirely from the rents paid by the owners of huts and houseboats on The Point

[1] August 5, 6 and 7; September 2, 3, 4 and 5; October 1, 2 and 3.

together with sundry dues for smack lays, sites for tents, and occasional use of ground on the Blakeney side of the property. Hitherto, it has been the policy of the Committee to refrain from embarking on any special expenditure until such time as a reasonable reserve should have accumulated. It is hoped eventually should funds permit to obtain the permanent services of a Guardian who would reside for a large part of the year on the Point. Already, when the area passed into the hands of the National Trust in 1912, The Blakeney and Cley Wild Birds Protection Society had from 1901 engaged Mr. R. J. Pinchen as Bird Watcher during the breeding season, and the same arrangement has been continued with the cordial approval of the National Trust.

Receipts and Payments Accounts.

1913.

Receipts.	£	s.	d.	Payments	£	s.	d.
To Quarter Share Rents, etc. to Michaelmas, 1912	0	14	3	By Anchorage Money returned to Aged Pilots	0	8	6
Hire of Quay Corner at Fairs ...	3	5	0	Outdoor Stoves for Point ...	1	8	6
Rents :—				Printing Regulations, Permits and			
Huts, etc. on Point ... 2 9 0				Agreement Forms	2	7	6
Tents, &c. at Blakeney 0 7 0				Legal	2	6	8
Page and Turner, Slip-				Hire of Room (Norwich) ...	1	0	0
way 0 10 0				Stamps	0	4	0
	3	6	0	Miscellaneous	0	11	6
Blakeney Harbour Co.	0	5	0				
Deficit	0	16	5				
	£8	6	8		£8	6	8

1914.

Receipts.	£	s.	d.	Payments.	£	s.	d.
To Rents—				By Brushwood, Hurdles, Reeds and			
Huts, etc. on Point ... £9 0 0				Transport	3	10	0
Tents, etc., Blakeney ... 0 9 6				Fees for issue of Shooting Permits	1	1	0
Page and Turner ... 0 10 0				Printing Notices	0	7	6
	9	19	6	Aged Pilots	0	5	0
Hire Quay Corner	2	7	6	Miscellaneous	0	4	0
Blakeney Harbour Co.	0	5	0	Printing Report	0	12	0
				Commission (Rents)	1	10	0
					7	9	6
				Deficit from 1913	0	16	5
					8	5	11
				Balance in Hand ...	4	6	1
	£12	12	0		£12	12	0

1915.

Receipts.	£	s.	d.	Payments.	£	s.	d.
To Balance in Hand	4	6	1	By Fees for Issue of Shooting Permits	1	1	0
Rents—				Printing Report	1	4	0
Huts, etc. on Point £10 16 0				Commission (Rents)	1	10	0
Tents, etc., Blakeney 0 13 6				Aged Pilots	0	5	0
Page and Turner ... 0 10 0				Miscellaneous	0	4	0
	11	19	6	Balance	12	6	7
Blakeney Harbour Co.	0	5	0				
	£16	10	7		£16	10	7

The personnel of the Committee for 1917 is as follows:— Sir Edward Busk, The Rev. Everitt J. Bishop, Mr. A. W. Cozens-Hardy, Mr. Walter Derham, Mr. G. Claridge Druce, Mr. W. A. Forsyth, Mr. Quintin E. Gurney, Mr. Robert Gurney, Mr. J. H. A. Hart, Dr. Sydney H. Long, Professor F. W. Oliver, Sir Digby Piggot, The Rev. Gordon Roe, The Hon. N. Charles Rothschild, Miss M. A. Sewell, and Mr. C. J. Temple-Lynes.

A. W. Cozens-Hardy, *Chairman.*
F. W. Oliver, *Secretary.*

REPORT ON THE BLAKENEY POINT LABORATORY FOR THE YEARS 1915 AND 1916.

Owing to the restriction of access to The Point during rather more than half of the period covered by this report the various investigations in progress in the Laboratory or field have alike suffered interruptions. But quite apart from this, with so many of the regular workers called away by their military duties or preoccupied by the war in other ways, it had become perfectly evident that many lines of work would have to be suspended whilst others could at best be kept alive by such of our clientele as were still available. Under these circumstances activities have in the main been restricted to (1) Recording the general trend of the vegetation over the area as a whole during the period 1915-1916; (2) Examining a certain number of the accretion datum-planes laid down in 1914, with the object of testing the value of the method devised. The preliminary results of this examination are given at p. 16; (3) The re-surveying and contouring of the so-called "New Bank," *i.e.* the L-shaped terminal of the Yankee Bank, which was originally formed in 1912;[1] (4) The starting of certain experiments to ascertain the value of Psamma as a material for the manufacture of paper, and the best method of cropping the grass for this purpose; (5) Treating a number of unit areas of the dunes with chemical fertilisers, singly and in various combinations, with a view to

[1] This bank is fully described by Hill and Hanley in "The Structure and Water Content of Shingle Beaches" in Journ. of Ecol. Vol. II., 1913, pp. 22.

determining the effects of supplementing in various ways the natural salts of the soil; (6) Planting various species of young trees on the sand hills of the Hood and in the neighbourhood of the Laboratory.

Progress under (4), (5) and (6) will be fully reported in due course.

In the following pages several matters are dealt with arising out of work done before and since the war. The effects of a super-tide which visited the area on September 14th, 1916, are also described, and as an appendix we print an "Annotated list of the Birds of Blakeney Point," drawn up and kindly placed at our disposal by Mr. Wm. Rowan whose numerous observations on the breeding grounds of the Point are well known to readers of our publications. This list, which it is intended to be the first of a series of hand lists of the Fauna and Flora, will also be issued separately.

The High Tide of September 14th, 1916.

From time to time the east coast is visited by tides of exceptional height, tides that is which rise considerably above the height predicted by the tide-tables. These master tides depend especially on the coincidence of winds from the N.W. with a spring-tide, conditions which lead to an undue piling up of the waters.

The last really great tide on the Norfolk coast would appear to have taken place in the latter part of November, 1897, and to have caused enormous damage to the shore, sea walls, reclaimed marshes, and other littoral amenities. It was this tide which inundated the main village street at Cley and entered the ground floor rooms. The marks of it can still be traced, *e.g.*, in the ground floor public rooms at the George Hotel where it rose a foot or more from the floor.

Tides such as this one top the Blakeney shingle beach and flow over it like a weir, transporting vast quantities of shingle from the crest to the lea fringe. They are the principal agency of landward drift of the beach; they get in among the sand hills and erode the slopes that border the various Lows; and they pick out and wear down the level of the more available lines of invasion into the dune systems, often one, two or more feet in a single tide, thus facilitating access on future occasions. Big tides effect considerable changes in the relief

of the dunes and beaches at any time; when they are accompanied by tempestuous weather their power is increased enormously.

Between 1897 and 1908 we have found no record of any very considerable tide—since the latter year they have become more frequent (*e.g.*, one or more in the years 1912, 1913, 1914, 1915), that of November 1912 leaving evidence of having topped the crest of the main beach at many points and carried down fresh shingle into the existing talus fans on the marsh border.

Though as a rule big tides are unforeseen and no one is present to note what happens, this was not the case on September 14, 1916, when a party was in residence on the Point. We give here a short account of what was actually observed on this occasion.

According to the predictions of the tide-tables the spring-tide cycle should have culminated on September 13th, the booked height being 10 feet 6 inches above mean sea level—some 18 inches higher than the average. Actually the 13th passed off without any exceptional occurrence, the tide, though a full one, not transgressing the ordinary limits.

During the night of September 13 14 the wind shifted to the N.W. and by morning was blowing half a gale. Though the height predicted was 10 feet 4 inches, 2 inches lower than the previous day, observers were astir betimes (the tide was due at 8.35 a.m. Summer time), and it was evident from the strength and direction of the wind and the way the tide flowed that the water could rise above the predicted height.

At 7.30 a.m. the tide entered the low S.E. of the Life Boat House and shortly afterwards overflowed the rib of beach facing west and, for the first time in recent years, filled the low in which are situated the four shingle wells. This low actually forms the western extremity of Long Low and the waters finding no obstacle ran up this low, past the laboratory, and right into the heart of the dunes of the Headland till brought up by a bank of sand which blocks the low at a distance of half a mile N.E. of the boat house. Our photograph (Pl. I, Photo 1), taken from the N.W. side of Long Low shews the Life Boat House as it then appeared; our wells and the fences surrounding them are entirely submerged (about 4

ft. of water) in the further portion of low just beyond the point where the blades of Marram grass project over the surface of the water (Photo 1). Photograph 2, on the same plate, is taken from a point south of Mr. Holliday's hut and shews the lows on this side of the life boat house filled by the tide.

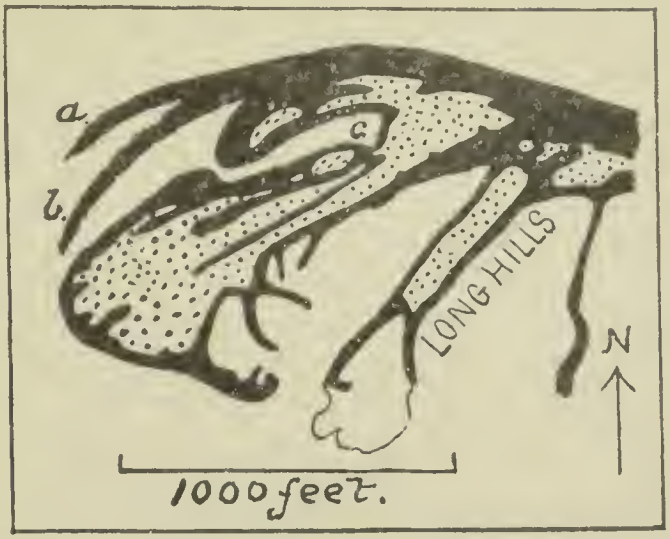
At its full height the water entered the Old Life Boat House (our headquarters) and rose 6—8 inches above floor level. Not since 1897 has the tide found its way in here.

Meanwhile on the N.W. side of the Headland the tide having filled Great Sandy Low proceeded to surmount the divide between this and Glaux Low. Achieving this by 8 a.m. the waters surged over and a hissing turbid torrent made its way into Glaux Low, the head travelling down the incline at 5 or 6 miles an hour, undercutting the dunes and demolishing two timber and brushwood obstacles that had been erected eighteen months earlier with a view to building up a barrage of blown sand. Ultimately the tide stood 4 ft. deep in the Low and extended some distance up a lateral gulley in the direction of the Laboratory. The turbidity of the advancing waters was due to particles of black humus swept up from the sand dunes eroded on the way. Eventually the humus was left as a black fertilizing layer on the floor of the Glaux and other Lows invaded.

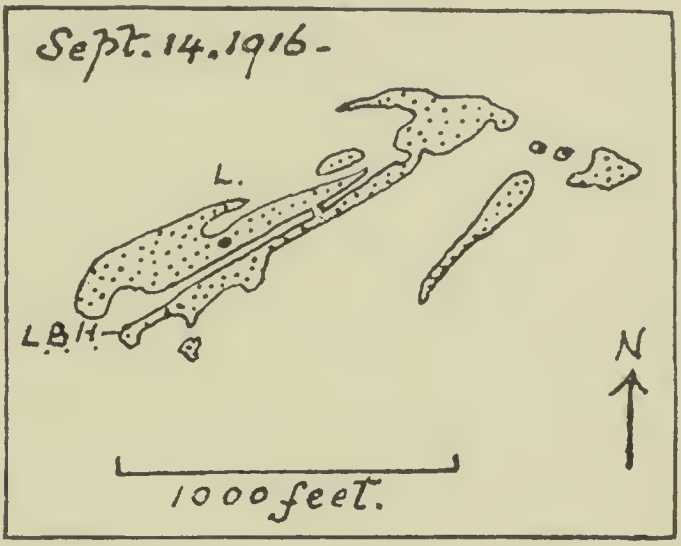
For the rest, practically all the Lows of the Headland filled with water, the N.E. section of Long Low (beyond the block) getting its tide via Great Sandy Low. For the time being the Headland was an archipelago and the plateau on which stands the Laboratory could be reached dry shod from the huts at the Point only by making a detour via the sand block in Long Low.

Further away such familiar topographical features as the beach running from the Life Boat House to the house boat "Britannia," and the Long Hills bank from the "Yankee" to the S.W. extremity disappeared from view.

The general facts of the position at high water are summarized in the chart, text-fig. 2 which should be compared with text fig. 1 which represents the terrain exposed on the occasion of an ordinary high tide. The two charts correspond in all respects and are plotted to the same scale.



TEXT-FIG. 1. Chart of Headland to shew ground exposed at ordinary high tides. Shingle beaches are black; sand dunes dotted. *a* and *b*, outer and inner new beaches; *c*, Great Sandy Low. The open sea is at the top of the chart. Scale 1/8725.



TEXT-FIG. 2. Chart of Headland shewing the ground not covered by the sea on the occasion of the high tide of Sept. 14th, 1916. The Laboratory stands where a large dot is placed below the letter *L*; *L.B.H.*, Life Boat House; the block in Long Low near its N.E. end is indicated. The scale and relative position of ground as in text-fig. 1.

Of the huts on the Point, only the Old Life Boat House was entered by the water. The tide came very close to Mr. Bishop's and actually ran under Mr. Holliday's house. The Laboratory was approached on both the Glaux Low and Long

Low sides but another 2 feet rise would have been required to reach the floor level.

When the tide was at full height it was seen pouring over the main beach at the bend in several cascades, much shingle being carried down to the edge of the great Salicornia marsh between the bend (*i.e.* the point where the telephone poles begin to run straight along the beach after leaving the sand hills of the Headland) and the point of articulation of the Long Hills. From this point to Cley Beach the tide overflowed the crest as evidenced by the fact that the line of drift previously on the seaward face was carried over the crest to form an undulating line on the landward slope. At points where the crest sagged there was in addition considerable movement of shingle in the same direction, though in the aggregate this was not very great as the tide did not remain long at its fullest height. It may be mentioned here that the water does not rise simultaneously on both sides of the beach; it is already ebbing on the seaward side before the highest point on the landward is reached—a consequence of course of the long distance round which the tide has to travel. As usual the transport of shingle across Cley Beach was greater than on any other section on account of this portion having a somewhat lower crest.

As the tide ebbed away a very curious phenomenon presented itself on the stretch of beach between the Hood and the Watch House on the Marrams and also along Cley Beach. This took the form of numerous shallow trenches situated on the lee slope at right angles to the length of the beach. These trenches which were 6 to 8-ft. long and occurred every few yards were in nature percolation ravines and resembled in miniature the well known ravines of the Chesil Beach. They were formed in consequence of the much greater height reached by the water on the seaward face leading to discharge through the beach itself. At the mouth of each ravine was the talus of shingle which it had discharged.

The following tide rose about half way up these ravines and rising with a considerable west to east current filled in the lower halves of the ravines which thus became smoothed out. The surviving heads of the ravines formed a singular row of oval depressions all at one height and having about the dimensions of clothes baskets.

In this condition, without knowledge of what had gone

Plate I.

Photo. 1. High Tide, 14th Sept., 1916.
West end of Long Low inundated.

Photo. 2. High Tide, 14th Sept., 1916.
Inundated lows to S.E. of Life Boat House.

before, the origin of the amputated depressions would have been far from easy to explain.

As a spectacle such a tide as this is not without the sensational element, particularly at the moment when the full height is approached and the visible area of *terra firma* is seen rapidly to shrink. With a gale blowing the sense of insecurity is emphasized by the fury of the waters and the hissing sound emitted as the undercut flanks of the dunes crumble away.

Of damage done, the most permanent is the lowering of parts of the crests of shingle beaches and the beds of lows; this makes access next time easier. The dunes for the most part quickly recover as fresh sand is brought by the wind.

In some places the movement of shingle was appreciable; thus the crest of the beach running from the Life Boat House along to Pinchen's creek by the "Britannia" must have travelled inwards about 3 feet on the average.

The proper method of preventing such encroachments is (1) to plant shingle plants (especially *Suaeda*) where the crest is too low, with a view to letting it build itself up; (2) to encourage Psamma to grow and form extensions of the dunes at threatened points, and (3) to break up the lows with transverse "bulk-heads" that will oppose the circulation of the tides.

The wells which were overwhelmed by the tide made a remarkably speedy recovery, as the following table from data supplied by Dr. Sarah Baker will show. It may be mentioned that 3.19 per cent. salt is the normal contents of sea water at Blakeney Point.

Date (1916).	Per Cent. Salt.	
Sept. 14, a.m.	3.19	Low flooded.
Sept. 16, p.m.	3.23	Water still in low.
Sept. 21, a.m.	1.46	Low empty.
Sept. 22, p.m.	1.19	
Oct. 2.	.53	

On September 15th and 16th heavy rain fell.

The samples were collected from Well No. III, and by October 2nd, *i.e.*, in less than three weeks, the salt percentage

had fallen to .53. No determination has been made since, but there is every reason to suppose that progress towards the normal has continued. At ordinary times this well contains about .015 per cent. salt.

A very striking effect of the tide was shewn by the Mosses which occur in sheets on the slopes of the stabilised dunes bordering several of the lows. Whenever the tide reached the Mosses (of which *Tortula ruraliformis* is the most abundant) the characteristic yellow green of summer gave place within 48 hours to a ruddy copper, so that as the waters subsided the extent of the tidal invasion was clearly defined on the slopes by a colour line.

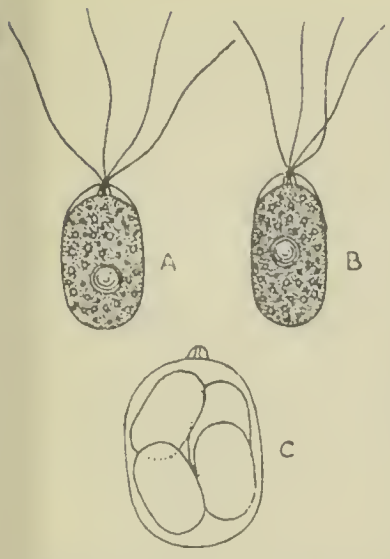
Glaux Low.

This depression lying just north of the laboratory has been frequently referred to in Blakeney Point publications. When first examined in 1910 it was already colonised by a few patches of *Glaux maritima*. In wet weather and in winter it is liable to flooding by fresh water, and generally shows a characteristic fresh water algal flora, including several Desmids, Nostoc, Chlamydomonas and other flagellate organisms. Among the latter Professor G. S. West of the University of Birmingham has discovered a new species of Carteria which he has named *Carteria Oliveri*. As this alga is, so far as we know, peculiar to Blakeney Point, we reproduce in full Professor West's description.[1] "Carteria Oliveri, sp. nov. Cellulæ vegetativæ (=zoogonidia) submagnæ, oblongo-cylindricæ, polis late rotundatis; membrana cellularum firma, ad polum anteriorom cum verruca rotundato-conica perforante et ciliis longis quottuor; chromatophora singula, permagna, valde granulata et cum pyrenoide magno singulo submediano vel extremo posteriori versus; stigma conspicua in parte anteriori cellulæ. Propagatio: cellula matricalis ad duas directiones oblique longitudinales in quattuor dividit.

Long. cell. 22—32 w; lat. 13—18 w; long. ciliorum 40—44 w. (Fig. 3, A—C).

Hab. In the "Glaux Lagoon," Blakeney Point, Norfolk (coll. F. W. Oliver, 1913).

[1] Journal of Botany, 1915, p. 73. We are indebted to the Editor, Mr. James Britten, for permission to reproduce this description.



TEXT-FIG 3. A—C, *Carteria Oliveri*. A and B vegetative cells. C, four daughter-cells within mother-cell wall. ×460

This species occurred in considerable quantity in a collection made by Professer F. W. Oliver at the above-named locality. It scarcely requires comparison with other species of the genus because its characters are quite distinctive. The cells are cylindrical with hemispherical ends, and at the anterior pole there is a perforated, bluntly conical wart through which the four cilia pass. The cell-wall is firm, and at the anterior end of the cell there is in active specimens a clearly evident mucous cap, which attains a thickness equal to the height of the perforated wart. The chloroplast is most massive, apparently leaving but little space for the lodgment of the nucleus. It contains a large globular pyrenoid, situated either in a median position or slightly towards the posterior end of the cell. The pigment-spot, or stigma, is very conspicuous, and it is located laterally about half-way between the pyrenoid and the anterior end of the cell.

Four daughter-cells arise in the mother-cell as a result of the formation of two obliquely longitudinal division-planes. The wall of the mother-cell becomes distended, and in some cases remains for a relatively long time around the daughter-cells.

C. Oliveri is nearest to *C. obtusa* Dill,[1] but differs in the cylindrical cells, with blunter extremities, in the position of the pyrenoid, the much more massive chloroplast, and in the situation of the stigma nearer the pyrenoid than the anterior end of the cell. The region of insertion of the cilia is also of a different character from that in *C. obtusa*."

Glaux Low is an oblong depression (400 by 100-ft.) the long axis lying S.W.—N.E. Its floor is rising an inch or two yearly by the accretion of sand blown from neighbouring dunes, and its N.E. end is being closed by growing sand hills which are developing around rapidly expanding tufts of Marram Grass (Cf. Pl. II.)

[1] E. O. Dill, "Die Gattung *Chlamydomonas* und ihre nächsten Verwandten," Jahrb. f. wiss. Botanik, XXVIII., 1895, p. 345, t. 5, f. 39-41.

After a long period of isolation Glaux Low was over-run by the sea by very high tides in November, 1915 and again in September, 1916, and it remains to be seen what permanent effects will result from these invasions by salt water.

Since 1910 *Glaux maritima* has spread as a carpet over more than half the low, whilst by July, 1916, single plants of *Juncus Gerardi* and *Sagina maritima,* and two specimens of *Triglochin maritimum* had become established. These introductions are probably attributable to the tidal entry of the preceding November. As a detailed survey of the low was completed before the inception of these recent changes the materials exist for a full record of change in this particular locality.

Meanwhile our plate II. may serve to illustrate some of the features. Photo. 3, taken in January, 1913, shews the low with a few inches of rain water covering the central parts. Although at that season the Glaux itself was not actually visible on the surface, the shaded patches on the photograph mark its position with absolute fidelity. These patches are really due to the scratching and digging activities of rabbits which visit the hummocks in search of cherished morsels of the underground rhizomes. Photo. 4 (September 1916) was taken after the tidal invasion; the low is filled to the edge with salt water about 1 foot deep. The floor being covered, the carpet of Glaux is invisible. The principal feature of change is the Psamma, of which an almost continuous belt of hummocks has sprung up at the back—just beyond the water's edge—and also along the left hand side. On the right a broken row of Psamma tufts has appeared, whilst in the centre the top of an isolated patch just emerges. It will be noticed that the position of the camera in Photo. 4 was rather nearer the head of the low than in Photo. 3, and that different cameras have been employed.

Sources of Pebbles on Blakeney Point.

In August, 1914, Dr. A. K. Coomaraswamy, the well known geologist, happened to be staying as a member of one of our parties on the Point and at my request he very kindly made a fairly exhaustive collection of examples of the various sorts of pebbles from the beach, other than flints. The great bulk of Blakeney pebbles are flints from the chalk, the foreign elements (which alone are tabulated here) representing approximately not more than one half per cent. of the whole.

Plate II.

Photo. 3. Glaux Low, 1913.

Photo. 4. Glaux Low, 1916.

Dr. Coomaraswamy made provisional determinations on the spot, the pebbles being subsequently submitted to Professor E. J. Garwood and Dr. E. V. Elsden of the Geological Department at University College, London, for further examination and comparison with authentic specimens. The table which follows embodies the final identifications together with the localities where similar rocks occur *in situ*.

The agency which brought the majority of these stones into the district was doubtless glacial, whilst the final stage of transport to the beach was the sea. The presence of specimens 19 and 20 (from the Yorkshire coast) might on the other hand be explained as the result of continuous coast-wise transport under the influence of tidal currents; however, no useful purpose will be served by the further consideration of this question on imperfect data. We are much beholden to the three gentlemen named for the provision of the materials and for the report upon them.

No.	Description.	Locality where similar rocks occur *in situ*.
1	Pyronene Andesite.	Cheviot Hills.
2	Dolerite.	S. Scotland.
3	Porphyrite.	Quenast, Belgium (much used on E. Coast for road metal).
4	Rhomb Porphyry.	Scandinavia.
5	Granite.	Scotland.
6	Garnetiferous Gneiss.	Scandinavia probably; but possibly Scotland.
7	? Augite Syenite.	Scandinavia.
8	Amygdaloid Basalt.	Scotland.
9	? Porphyrite.	Scandinavia.
10	Dolerite.	Scotland.
11	Gabbro.	Carrock Fell and Scandinavia.
12	Gneiss.	Scandinavia or Scotland.
13	Gneiss.	,, ,,
14	Dolerite.	Scotland, or possibly Whin Sill.
15	Granulite or Granulitic Quartzite.	Archaean, ? Scandinavia.
16	Quartzite.	,, ,,
17	Sandstone, ? Carboniferous.	Midlands or Scotland.
18	Chert, ? Carboniferous.	,, ,,
19	Sandstone, ? Jurassic.	Yorkshire Coast.
20	Marlstone (Liassic).	Yorkshire Coast.

NOTES.

Nos. 7 and 9 are difficult of determination in the absence of microscopical sections.

No. 3 probably derived from road metal or ballast.

Rate of Accretion of Silt.

Some account was given in the Blakeney Reports for 1914 (pp. 20, 21) of a method specially devised for the purpose of determining with accuracy the rate at which silt is being deposited on various parts of our tidal marshes. Briefly, the method consists in laying down at appropriate spots on the surface of the marsh small circular areas of coloured soils to serve as datum planes from which to measure after the lapse of time the depth of silt by which they have become overlaid.

In practice we employ for this purpose the coloured sands derived from Alum Bay in the Isle of Wight, and preferably the red and plum coloured varieties, as being unlikely to be confounded with any of our local soils. The coloured sands are pulverised and delivered onto the ground through a fine-meshed sieve in such a way as to leave a circular disc of colour the same size as the sieve and approximately 1 mm. in thickness.

Circular areas of this kind were laid down in 1914 on several of our marshes at measured intervals along lines ranged between known points. The spots may be recovered at any time by stretching a tape and reading off the booked distances.

Many of these datum areas were examined by members of our party in August 1916 with the following general results.

The greatest amount of accretion recorded was on the Samphire Marsh, which abuts on the main channel south of the Hood. Here the readings averaged $2\frac{1}{2}$ inches of silt in 2 years, corresponding to about a foot in 10 years. On spots where the embedded *Fucus vesiculosus* form *limicola* was abundant the records reached 3 inches in the same period.

On the marshes of the Marams which are much older and higher, and consequently visited by fewer tides, the depth of accretion ranged from $\frac{1}{4}$ to $\frac{1}{2}$ inch—equivalent to 1 foot in 25 to 50 years.

On the Salicornia-Pelvetia marsh of the Headland a line of records stretching right across the marsh shewed increments of 1—$1\frac{1}{4}$ inches on the lower central parts whilst the readings gradually dimininished towards the sides where they registered $\frac{1}{4}$ inch or less.

The general outcome of these preliminary observations shews (1) that accretion is greatest on muddy areas newly

colonised by vegetation. In this connection we have been much impressed with the efficiency of the bedded in Fucus as an accretor—(2) That there is a close relation between the amount of accretion and the number of tides per cycle which cover a given spot. As a consequence sloping or concave marshes tend in time to become level, a condition which is normal in all our older and higher marshes.

In practically all cases the coloured sand remained in place where the surface carried a vegetation. With bare ground the method is less satisfactory as there is a liability for the sand to be washed away by the first tide. It is proposed to try a new method for these bare areas and to report upon it on a future occasion. With this exception the coloured sand method has given complete satisfaction and is being adopted in the continuation of these investigations.

Losses in the War.

It is with deep regret that we report the death of the following members of Blakeney Point parties.

Frank Austin Rogers (Queen's Westminster Rifles) was a regular member of our summer parties (1911 and 1912) and put in much useful work with one or other of the field survey sections. An active member of the University of London O.T.C. he joined up at once on the outbreak of hostilities. He fell in action in France on July 1st, 1916.

Ernest Alan Fulton (25th Middx. Regt.) was a member of the staff of the Department of History at University College, London. He was at Blakeney Point only once, viz., in April 1915 when the College Staff Squad camped there for ten days military training under Lieutenant Wilkinson. He was killed in action on the Somme on Oct. 4th, 1916.

Albert Stanley Marsh (Somerset Light Infantry) a member of the Cambridge Botany School, was a botanist of great promise and versatility. He was attached to the study of plant ecology and in conjunction with some of his Cambridge colleagues carried out (in 1913 and 1914) an investigation and survey of the vegetation of the Holme Salt Marshes near Hunstanton.[1] It was as a preliminary to this work that Marsh paid a visit to Blakeney Point (1912) with a view to comparing our vegetation

[1] The results are given in his paper "The Maritime Ecology of Holme-next-the-Sea, Norfolk," Journal of Ecology, Vol. III., June, 1915.

with that at Holme. He was killed in the front trenches near Armentieres on January 6th, 1916, shot by a sniper.

Gifts to the Laboratory.

We have pleasure in acknowledging the following gifts since the issue of the last Report :—

Complete set of Transactions of the Norfolk and Norwich Naturalists' Society, from the Society.

An Angle Meter and Wynne's Exposure Meter, Mr. E. P. Farrow ; Bellows, Mr. G. N. Oliver ; Force Pump, Miss Ethel Sargant ; Dr. E. de Fraine, 10s. ; Prof. W. P. Ker, £1 ; Mr. B. K. Hunter, £1.

Mr. Hunter also creosoted the laboratory weather-boarding.

Though the Laboratory is free from debt there are certain fixed annual charges, such as rates, taxes, insurance and upkeep, amounting to about £5. In the absence of any fund for the purpose these charges have to be met from private sources. Those who are disposed to help in the matter with donations or subscriptions should forward these to me at University College, London, preferably in March, April or May.

Donations of books and papers dealing with the History, Topography (including old maps), Agriculture, Archæology and Natural History of Norfolk and especially of the Northern part of the County will be very gratefully received. In this way it is hoped that a small reference library may gradually be assembled. In exchange we shall be happy to give such parts of our own publications as the donors may care to select.

The Grant from the Percy Sladen Trust.

As was duly recorded in the Report for 1914 a grant of £100 was received in May of that year in support of the scientific work carried on at the Point. Up to December 31st, 1916, the following sums have been debited to this grant :—

Erection and upkeep of recording tide gauge, £14 8s. ; Dinghey for tidal work, and upkeep, £4 5s. ; Materials for construction of shingle wells, £5 8s. 1d. ; Recording rain gauge (Casella), £7 14s. ; Chemical equipment for Soil investigations, £8 19s. : total £40 6s. 9d., leaving a balance of £59 13s. 3d., which with bank interest accrued makes the balance available at the beginning of the year £63 15s. 6d.

PUBLICATIONS.

Appended is a list of papers, arising out of the work, that have appeared during the years 1915 and 1916.

No. 13. The Blakeney Point Ternery, by Wm. Rowan; British Birds, Vol. VIII, No. 11, 1915, pp. 250-266, 12 figs.

,, 14. The Ecology of the Maritime Lichens at Blakeney Point, Norfolk, by R. C. McLean; Journal of Ecology, Vol. III, 1915, pp. 129-148, 3 text-figs., and one plate.

,, 15. The Morphology and Anatomy of the Genus Statice as represented at Blakeney Point. Part I., *Statice binervosa*, G. E. Smith, and *S. bellidifolia*, D.C. (= *S. reticulata*), by E. de Fraine. With Systematic and Ecological Notes by E. J. Salisbury; Annals of Botany, Vol. XXX, 1916, pp. 239-282, 28 text-figs. and one plate.

,, 16. On the Brown Seaweeds of the Salt Marsh. Part II. Their Systematic Relationships, Morphology, and Ecology, by S. M. Baker and M. H. Blandford; Linn. Journ., Bot. Vol. XLIII, 1916, pp. 325-380, 18 text-figs. and 3 plates.

,, 17. The Little Tern, some Observations from Blakeney Point, Norfolk, by Wm. Rowan; Wild Life, April, 1916, pp. 7, 11 figs.

F. W. OLIVER,
For the Trustees of the Laboratory.

V.

ANNOTATED LIST OF THE BIRDS OF BLAKENEY POINT, NORFOLK.

By Wm. Rowan.

INTRODUCTION.

It has been my fortune in the last six years to visit Blakeney Point a number of times during the four main bird seasons—Summer and Winter, when things are more or less stationary; Autumn and Spring, when bird movements occur. But on this basis alone I should not presume to produce a list of local birds: it would be an act of impertinence. It has, however, been my privilege to meet most of the well-known Blakeney Point bird enthusiasts, and it is only on the strength of their kind co-operation that I take this step. My thanks are due in particular to Messrs. F. I. Richards, E. C. Arnold and J. H. Gurney, whose names must always be associated with the Point. My thanks are also due to those well-known Wild Fowlers of Cley, Mr. R. J. Pinchen and, more particularly, to Mr. Edward Ramm, for information gleaned from numerous pleasant chats.

The seasons of collectors are the migratory, and it is quite impossible to get too many notes on these periods as one year may differ so widely from another. It is for notes on the migration seasons—chiefly the Autumn—that I am most deeply indebted to all those who have been kind enough to help me. Perhaps I myself am as well acquainted with the breeding birds as any other regular visitor to the Point. The following notes, so far as they relate to these, are written entirely on my own responsibility.

A word in regard to shooting is not out of place, I think. Numerous sentimentalists object to this practice at any time

of the year. The compiler of this list must differ from them, and on the following grounds. I do not suppose that a single one of the Blakeney Point breeding birds ever remains through the Autumn and Winter, so that shooting during the legitimate season can scarcely affect these. Moreover, all those numerous records of rarities that the Point can claim are isolated examples of birds that come either from the north of Continental Europe or from America, birds that never have and never will nest in our own country, and the shooting of these can affect neither our native bird population nor that of the localities from which these individuals hail. For the chances are that having got out of the usual road of migration their fate would be sealed in any case.

However expert a man may be at identifying birds on the wing, many of his records are bound to be received with scepticism by other ornithologists. Many closely-related birds are so alike, particularly in winter plumage, that an element of doubt must always creep in. In short, the use of the gun, while it does little conceivable harm during the legitimate season, renders a great service to ornithological knowledge. Without it, such a list as the following would be a mere farce.

The area concerned with the following list is rather restricted, being only the Point proper, from the Railway Hut and Cley Beach outwards, and the waters adjacent to it, *i.e.*, the Channel, the Bar and the Narrows. There are probably few places with such a limited area on the British coast that could produce a longer or more interesting list of birds.

It should be added that the notes on the various birds are merely meant to give some indication of the seasons in which they occur, and in what sort of numbers. Unfortunately, certain records have been unprocurable, and in many cases the full data are not available. Therefore a certain number of omissions and errors will be found in these pages, for which I tender apologies.

The order and nomenclature adopted in the following lists are taken from the B.O.U. "List of British Birds," 2nd Edition, 1915.

NESTING SPECIES.

STARLING (*Sturnus vulgaris*).—There is usually a nest on the new lifeboat-house. Starlings may be seen at all times of the year, but are never numerous and seldom seen in flocks of any size.

LINNET (*Acanthis cannabina*).—Resident, and breeding in small numbers, the nest being placed usually in Suæda bushes, rarely on the ground.

SKY-LARK (*Alauda arvensis*).—Resident and breeding extensively, but probably less so than the Meadow-Pipit. Nests have been taken from most parts of the Point, but the Beacon Hills appear to be the favourite site. This bird is in evidence all the year round, but it is likely that, in common with the other residents, the breeders go South, and are replaced in autumn by immigrants from Northern Europe. The average clutch is three.

WAGTAIL, PIED (*Motacilla lugubris*).—Resident. Hitherto only the Pied Wagtail has been found nesting. It nests on the slope of the dunes (sometimes on the level ground), usually in the roots of some tussock, probably six or eight pairs annually. It is most plentiful in the autumn and early winter, when several other Wagtails are also in evidence.

MEADOW-PIPIT (*Anthus pratensis*).—Resident and nesting in considerable numbers. Nests have been taken from the marams, and from all other parts of the Point, except perhaps the Hood. Found most frequently on the more solid moss-covered parts. It nests usually in the open, but I have seen a clutch laid in an empty golden syrup tin. The average number of eggs is four. This bird is seen all the year round in large numbers.

WHEATEAR (*Œnanthe œnanthe*).—Breeds in limited numbers —two, or probably three pairs at the outside every season. A pair nests in the Long Hills in the neighbourhood of the "Yankee" most years. Entirely absent in December, January, and February.

MARTIN (*Delichon urbica*).—This species has nested, I believe, for the first time during 1915, and again in 1916, when two nests were built under the eaves of the lifeboat-house. In previous years this bird has merely been an occasional straggler in the spring and more rarely in the autumn.

SHELD-DUCK, COMMON (*Tadorna tadorna*).—Resident and breeding in small numbers. Six to eight pairs are probably the limit. It lays early in May and shows a preference for the Beacon Hills, although the only nest I have found myself was in the Long Hills four feet down a rabbit burrow. Seen least in July, August, and September, it is most plentiful in the winter months, when considerable flocks of immigrants come and go.

REDSHANK (*Totanus totanus*).—Resident and breeding annually. Usually one pair only, occasionally two. Eggs usually laid early in April, but on July 4th, 1914, I found three newly-hatched chicks and a chipped egg. Always appear to nest in dunes S.E. of Great Sandy Low. Most plentiful in autumn and spring, scarcer in winter.

PLOVER, RINGED (*Egialitis hiaticula*).—Resident and breeding in fair numbers. The nests are scattered and occur on the open beach and in the lows. There is a decided preference for lows with a shingly bottom. The number of breeding birds varies considerably, and probably never exceeds twenty pairs in a season. A good many of these at all events are double brooded, fresh eggs in July being of common occurrence. These birds appear to be most numerous in autumn, when they gather in small flocks, and less abundant in winter, when they are also extremely shy. *In July, 1912, I found a fresh clutch of eggs belonging to this bird which were perfectly white, with the faintest possible suggestion of spots towards the round end. As far as I can ascertain,

* British Birds. Vol. 6, No. 5, p. 160.

the clutch was unique. The site also was quite unusual, the eggs being laid on moss.

OYSTER-CATCHER (*Hæmatopus ostralegus*).—Nests sparingly here, and at Wells. Not more than three clutches have been found in one season on the Point. A clutch of six eggs was laid in 1913, constituting, I believe, a record in point of numbers for the British Isles. I took these eggs (one had been broken) in July after the birds had deserted them. All were infertile, similar in ground colour and markings, and incidentally of one of the rarer types, and so doubtless the product of one bird. The Oyster-catcher is resident, but probably the breeding birds go south in the autumn, and are replaced by birds from the north. At no time of the year is it plentiful.

(British Birds, Vol. 7, No. 7, p. 200),

TERN, COMMON (*Sterna hirundo*). — Summer resident, numbers increasing irregularly. In July, 1914, when there were about 600 clutches of eggs and innumerable young of all sizes, the settlement seems to have reached the largest numbers on record. The average number of eggs to a clutch is three. Four, laid by one bird, have been taken once (1914).

———, LITTLE (*Sterna minuta*).—Summer resident; as elsewhere an erratic breeder, its numbers varying enormously, and quite unaccountably. There are rarely less than ten pairs or more than forty (1912 and 1914 had 40 and 42 clutches respectively). The average number of eggs to a clutch is two. About 6% contain three. Four I have only taken once (1914). This species usually arrives a few days in advance of S. hirundo, normally in the first week of May, though frequently during the last days of April. Both species leave at the end of August and beginning of September. Birds seen later are passage migrants from the north.

PARTRIDGE, RED-LEGGED (*Caccabis rufa*).

† Blakeney Point Publication No. 13 (Reprinted from British Birds, Vol. 8, No. 11).

PARTRIDGE (*Perdix perdix*).—Both these species nest sporadically, and stragglers may occur at other seasons.

CROW, HOODED (*Corvus cornix*).—Fairly regular winter visitor, mostly between Cley and the Hood.

ROOK (*Corvus frugilegus*).—The same may be said of this as of the previous species.

JACKDAW (*Corvus monedula*).—A few every summer, mostly June and July, apparently on marauding expeditions. Less common than the Rook.

STARLING (*Sturnus vulgaris*).—Nesting species. See above.

GREENFINCH (*Chloris chloris*).

SISKIN (*Spinus spinus*).—Rare. Taken two or three times in September (September 12th and 13th, 1901, Richards).

SPARROW, HOUSE (*Passer domesticus*).—May appear occasionally at any time. I have only seen it once myself (July, 1912).

———, TREE (*Passer montanus*).—Taken once. Shot while leaving the *Sueda* bushes (Ramm).

CHAFFINCH (*Fringilla cœlebs*).—Both this and the Greenfinch are represented irregularly, mostly by single individuals, during the winter months.

BRAMBLING (*F. montifringilla*).—The Brambling has been seen and taken at the end of September and during October in various years.

LINNET (*Acanthis cannabina*).—Breeding species. See above.

REDPOLL, MEALY (*A. linaria*).—In autumn, some years only, in very small numbers.

———, LESSER (*A. linaria cabaret*).—Said to have been seen two or three times, but there is some doubt as to the authenticity of these records.

TWITE (*A. flavirostris*).—Irregular winter visitor; more frequent, however, than Siskin.

CROSSBILL (*Loxia curvirostra*).—An irregular late summer immigrant to East Coast; it has been taken at least once on the Point (October 2nd, 1909).

BUNTING, CORN- (*Emberiza calandra*).—Rare, though fairly abundant on the mainland, but has rarely been observed or taken on the Point.

YELLOW HAMMER (*E. citrinella*).—Occasional; chiefly autumn.

BUNTING, ORTOLAN (*E. hortulana*).—Vagrant; taken several times in September.

———, YELLOW-BREASTED (*E. aureola*).—Taken twice by Mr. E. C. Arnold—September 21st, 1905, and September 4th, 1913. The third specimen was taken near Wells (opposite the Point on the mainland) on September 5th, 1907 (Witherby's Hand-List of British Birds). Mr. Arnold tells me that his second bird was shot less than a quarter of a mile from the spot on which the first was secured.

———, LITTLE (*E. pusilla*).—Taken once only (October 19th, 1908). This is one of six records for England. One thought to have been seen in September, 1909.

———, REED- (*E. schœniclus*).—Fairly regular visitor through autumn and winter. These are probably Continental birds.

———, LAPLAND (*Calcarius lapponicus*).—Irregular autumn migrant; fairly plentiful some years.

———, SNOW- (*Plectrophenax nivalis*).—Fairly regular visitor (September to March) in varying numbers.

LARK, SKY- (*Alauda arvensis*).—Breeding species, see above.

———, WOOD- (*A. arborea*).—Quite sporadic. One was taken on October 20th, 1908, and I am fairly certain that I saw one at the mouth of the Glaux Lagoon in July, 1913.

———, SHORE- (*Otocorys alpestris*).—Regular visitor in varying numbers, October to March, and more rarely September (Richards, September 29th, 1902; September 29th, 1905). This interesting bird entered the British list in March, 1830, when it was first observed on the Norfolk coast. Till the early eighties it was quite irregular, since when it has become an annual migrant.

It is very rarely seen inland. I identified and recorded a Shore-Lark taken on the Dunstable Downs (border Beds. and Herts.) the last week of October, 1913, which I believe is the only record for the Midlands of England. "British Birds," Vol. 7, No. 8.

WAGTAIL, WHITE (*Motacilla alba*).

———, PIED (*M. lugubris*).—Breeding species. See above.

———, GREY (*M. boarula*).—Both periodically, September and October, I have seen *M. boarula* in the spring (April, 1914).

———, YELLOW (*M. raii*).—Taken once on the sandhills, and I believe observed more than once (spring).

———, BLUE-HEADED (*M. flava*).—Occasional, September. It has been observed several times, and taken at least twice (September 10th, 1906: September 23rd, 1908).

PIPIT, TREE- (*Anthus trivialis*).—Fairly regular, though never abundant (September).

———, MEADOW- (*A. pratensis*).—Breeding species. See above.

———, TAWNY (*A. campestris*).—One of the two Norfolk records of this species was secured here by Mr. F. I. Richards on September 15th, 1910.*

Bull: B.O.C. XXVII., p. 16.

———, RICHARD'S (*A. richardi*).—Rare. This bird, like many other rare British species, appears to come over in small numbers some years and not at all in others. In the former case the bird may occur on the Point, but may be entirely missed. In October, 1907, three were taken in the locality, but outside our area. One of these was secured near the Railway Hut. During another year two were shot on the Cley Beach by Ted Ramm, while a few days later another was shot on the Point near the Lifeboat House by Mr. W. Bishop. This constitutes, I believe, the only definite record for the area. Another is said to have been shot and mistaken for a Thrush.

———, ROCK (*A. petrosus*). Regular autumn and winter.

I have seen it also, as have others, in July. My suggestion that it had bred here (1915) has been scouted by most Blakeney men, though Mr. J. H. Gurney thought it probable. I made the suggestion after finding a clutch of four eggs which I took at first to be those of a Meadow-Pipit. On closer examination, however, I found they conformed exactly with what one usually regards as type eggs of the Rock-Pipit: greenish ground colour, well marked zonation and no streaks. The nest of dried grasses was in the centre of a tussock of Psamma and well covered. On measuring the eggs I found that they were 1·5 mms. above the average of all the Meadow-Pipits' eggs available. I regret that I one only took. It unfortunately was so badly broken before it reached the Rev. F. C. R. Jourdain, who kindly promised to examine it, that he was unable to offer an opinion. It should be added that I found the eggs on the last day of my visit and did not see the parent birds. I had to report at camp at Richmond the following day, and was moreover travelling by motor-bike, so that I could take no chances, and it was quite impossible to stay even an extra hour to see the bird and prove the point.

Goldcrest (*Regulus regulus*).—Regular, September and October. Some of these are probably examples of *R. r. regulus*, the Continental Goldcrest, which has been identified from various parts of the Norfolk coast, but not yet from the Point. (There is said to be one instance, but date unavailable.)

Fire-crest (*R. ignicapillus*).—Taken once near the Watch House (Nov. ?). Ramm.

Titmouse, British Great (*Parus major newtoni*).

———, British Long-tailed (*Ægithalus caudatus roseus*).—Both occasional, various times of the year.

Shrike, Great Grey (*Lanius excubitor*).—Ted Ramm tells me he has been present at the death of three of these birds on the area. There are grounds for believing

that the far rarer Lesser Grey Shrike, *L. minor*, was shot in the Sueda bushes many years ago by Ramm himself.

SHRIKE, RED-BACKED (*L. collurio*).—A casual visitor during summer months. Occasional, September.

WAXWING (*Ampelis garulus*).—In those years when the Waxwing arrives in large numbers on the British coasts a few are usually observed. A specimen secured in October, 1903, was one of several.

WHITETHROAT (*Sylvia communis*).

———, LESSER (*S. curruca*).

WARBLER, GARDEN- (*S. simplex*).

BLACKCAP (*S. atricapilla.*)—All regular, September, in small numbers, *S. atricapilla* being least common. *S. simplex*, at least, has been observed in spring.

WARBLER, BARRED (*S. nisoria*).—Rare migrant. Appears to be getting more frequent. Most of the Norfolk records (10) come from Cley and Blakeney Point. All examples taken here, 1902, 1908, 1910, 1912, and 1913, have been secured in September.

———, GRASSHOPPER- (*Locustella nævia*).—Fairly regular. September visitor.

———, REED- (*Acrocephalus streperus*).—Occasional in September.

———, MARSH- (*A. palustris*).—Has probably never been seen or taken. There is the bare possibility that birds observed as *A. streperus* may in some cases have been this species.

———, SEDGE- (*A. schœnobœnus*).—Although a British summer resident, distributed throughout the country, it is rare here. September only.

———, AQUATIC (*A. aquaticus*).—Rare migrant. Has been secured at least four times (September 21st, 1903; September 25th, 1911; September 16th, 1913). Howard Saunders (Manual of British Birds) records another "shot at Blakeney on September 8th, 1896." This was shot by Mr. T. E. Gunn at the foot of the Blakeney Point Sandhills.

———, Icterine (*Hypolais icterina*).—Rare migrant. At least five of the nine Norfolk records are from the Point. (September 5th, 1899, E. C. Arnold; September 18th, 1903, F. I. Richards; September 12th, 1907, J. V. Young; also obtained by F. Power and R. Gurney).

———, Willow- (*Phylloscopus trochilus*).

———, Wood- (*P. sibilatrix*). There is but a single record of this species as far as I can determine, a bird obtained by Mr. J. H. Gurney near the Watch House (no date). It has never been observed by anyone else of my acquaintance.

Chiffchaff (*P. collybita*).—Both *P. trochilus* and this bird are fairly regular September, and irregular October visitors, but while the former species often turns up in considerable numbers, the latter is comparatively rare.

———, Yellow-browed (*P. superciliosus*).—Rare passage-migrant, mid-September and October.

———, Pallas' (*P. proregulus*).—The only record for England was shot on October 31st, 1896, by Ted Ramm, against the old Railway Hut.

Thrush, Missel- (*Turdus viscivorus*).

———, British Song- (*T. musicus clarkii*).—Single individuals of these species may occasionally be seen at any time of the year. None is common. *T. merula* is perhaps oftenest seen, particularly on the marams.

Redwing (*T. iliacus*).

Fieldfare (*T. pilaris*).—Both October to April. Occasional September and May. *T. iliacus* most frequent October. *T. pilaris* more frequent spring migration than the former.

Blackbird (*T. merula*).

Ouzel, Ring- (*T. torquatus.*)—Occasional on passage, September and Octoberr Rare spring.

Redstart (*Phœnicurus phœnicurus*).—Regular in varying numbers, September and October. Some years quite

plentiful in September; also occasional March and early April.

———, BLACK (*P. titys*).—Irregular, but by no means rare; chiefly in October, though I have seen it in January (1913).

REDBREAST, CONTINENTAL (*Erithacus rubecula*). — Apparently of regular occurrence, September and October. Has been identified several times. (Richards).

———, BRITISH (*E. rubecula melophilus*). — Occasional throughout the year. Commonest August and in September.

NIGHTINGALE, COMMON (*Luscinia megarhyncha*).—Has been taken, I believe, more than once, and observed in September.

BLUETHROAT, RED-SPOTTED (*Cyanosylvia suecica*).—Annual passage-migrant in small numbers, September. Unrecorded some years, *e.g.*, 1902, 1906, and 1916. In such years the tide of bird migration appears to miss the Point altogether, the other passerine migrants also being absent. Thus in 1902, with the exception of a Barred Warbler taken by Catling, there was no sign of migration. Similarly in 1916 there was nothing beyond several Whinchats and one Redstart. Pied Wagtails, Linnets, Skylarks, Meadow-Pipits and a few Wheatears and fewer Starlings are always present during the month, and are no indication of bird movements.

STONECHAT (*Saxicola rubicola*).—Most years September and October, occasionally through winter and early spring.

———, INDIAN (*S. indica*). — A male secured by S. F. Arnold on the Point on September 2nd, 1904, is the only record for England.*

WHINCHAT (*S. rubetra*).—Regular passage-migrant, September and early October. Less frequent in April.

WHEATEAR (*Œnanthe œnanthe*).—Breeding species. See above.

* Bull. B.O.C., XVI., p. 10.

———, GREENLAND (*Œ. œnanthe leucorrhoa*). — Rare. Taken twice by E. C. Arnold (September 7th, 1907; September 20th, 1909). It has rarely been observed in other years.

———, WESTERN DESERT (*Œ. deserti.*)—A male Desert Wheatear of the Western variety was taken here on October 31st, 1907. Three or four others have been secured in the British Isles.

SPARROW, HEDGE- (*Accentor modularis*).—Frequently on passage, September and October.

WREN (*Troglodytes troglodytes*).—Occasional, September and October.

FLYCATCHER, SPOTTED (*Muscicapa grisola*).

———, PIED (*M. atricapilla*).—Both irregular, September, the latter species being the more frequent. *M. atrica. pilla* usually appears towards the end of August.

———, RED-BREASTED (*M. parva.*)—Rare migrant. Half the Norfolk records (10) are from here. All September, and all immature except one taken on September 24th, 1908, which is, I believe, the only adult taken in Norfolk.

SWALLOW (*Hirundo rustica*).—March to September. An occasional swallow may be seen at any time during these months.

MARTIN (*Delichon urbica*).—Nesting species. See above.

WOODPECKER, BRITISH GREAT SPOTTED (*Dryobates major anglicus*).—There appears to be but a single authentic record of this bird for the Point.

———, GREEN (*Picus viridis*).—Has been taken three or four times in autumn.

WRYNECK (*Lynx torquilla*).—Fairly frequent, though irregular, September visitant.

CUCKOO (*Cuculus canorus*). Rare. Occasional in September and October.

SWIFT (*Micropus apus*).—Rare, but has been observed several times.

NIGHTJAR (*Caprimulgus europœus*).—Has been taken two or three times in September.

KINGFISHER (*Alcedo ispida*).—Was taken on September 20th, 1916, by Mr. Clifford Borrer. I can find no other records, though it is commonly to be seen at Cley.

OWL, LONG-EARED (*Asio otus*).—Has been taken only by Ted Ramm (late autumn ?) as far as I can determine.

———, SHORT-EARED (*A. accipitrinus*). — Irregular. Re-Recorded several times between October and April.

HARRIERS.—As far as I can determine, no Harriers have been obtained on the Point itself. Mr. E. C. Arnold tells me that on September 15th, 1903, he saw a bird which was almost certainly a female or immature Hen-Harrier, *Circus cyaneus*. An immature bird of this species was shot on the Morston Marshes on September 10th, 1907. It was seen to rise from the sandhills on the Point and cross the channel (Arnold).

HAWK, SPARROW- (*Accipiter nisus*).—Occasional, mostly between September and April. I have only once seen it (January, 1913) on the marams.

BUZZARD, HONEY- (*Pernis apivorus*).—Taken once by Mr. Richards, near Pinchen's Creek (September 5th, 1913).

FALCON, PEREGRINE (*Falco peregrinus*).—Taken October 19th, 1909. and on one or two other occasions. It has also been observed several times.

MERLIN (*F. æsalon*).—An irregular, but fairly frequent winter visitor. A specimen picked up dead by Pinchen and sent on to me by Mr. J. H. Gurney in October of last year had been shot

KESTREL (*F. tinnunculus*).—Fairly regular, though not abundant winter visitor. Has also been observed more than once in September.

CORMORANT (*Phalacrocorax carbo*).

SHAG (*P. graculus*).—Both these species are irregular, but common on the Point. They usually appear singly and practically in every month of the year. The former is the commoner.

GANNET (*Sula bassana*).—Some years (*e.g.*, 1900) the Gannet

is quite plentiful, chiefly in September. A few appear now and then throughout the winter.

GOOSE, GREY LAG- (*Anser anser*).—One was taken in the channel on October 14th, 1901 (Richards).

———, WHITE-FRONTED (*A. albifrons*).—Beyond the fact that it has actually been secured within the area, further details are not procurable.

———, PINK-FOOTED (*A. brachyrhynchus*).—Regular winter visitant; often seen crossing the Point in considerable numbers, usually *en route* for the Holkham marshes.

———, BRENT (*Branta bernicla*).—Probably more plentiful than *a. brachyrhyncus*. Both species occasionally feed on the mud flats of the Point, but much more frequently seen on passage.

———, BARNACLE- (*B. leucopsis*).—Taken once within the area. Possibly observed on one or two other occasions.

SWAN, WHOOPER (*Cygnus cygnus*).—Rare. In severe weather they have several times been observed passing high over the Point.

———, BEWICK'S (*C. bewicki*).—One was shot many years ago by Mr. Wm. Smith when owner of the "Britannia." Has been observed on two or three occasions since then (always in winter).

———, MUTE (*C. olor*).—Occasional in small numbers, chiefly winter, more rarely autumn and summer. A few of the winter ones may be genuinely wild birds.

DUCK, COMMON SHELD- (*Tadorna tadorna*).—Breeding species. See above.

*———, WILD OR MALLARD (*Anas boschas*).

*GADWALL (*A. strepera*).

*TEAL, COMMON (*Querquedula crecca*).

*WIGEON (*Mareca penelope*).

SHOVELER (*Spatula clypeata*).—One of the rarest of the Ducks on the Point, though not uncommon towards Salthouse.

*PINTAIL (*Dafila acuta*).

POCHARD, RED-CRESTED (*Netta rufina*).—Taken once in the

channel near the beach. The solitary record of this rare Duck is of interest in view of the fact that the plentiful Common Pochard, *Nyroca ferina*, which moreover breeds in Norfolk, is unknown on the Point.

*Scaup (*Nyroca marila*).

Duck, Tufted (*N fuligula*).—Uncommon. A few have been secured, and several seen during winter months in various years, mostly over the channel.

Goldeneye (*Glaucion clangula*).—Uncommon. There are a few records secured in winter.

Duck, Long-tailed (*Clangula hyemalis*).—Many occur every winter, though not frequently recorded. Almost invariably immature. An adult male was secured in the Narrows on October 8th, 1901 (Richards).

———, Eider (*Somateria mollissima*).—Has been taken at least once (Ramm) and has been seen several times—in winter.

*Scoter, Common (*Œdemia nigra*).

———, Velvet- (*Œ. fusca*).—Fairly regular, though scarce in winter months. A large flock flew over the Point last September, on one of the last days of the month, during our visit.

Goosander (*Mergus merganser*).—Taken once in the channel, near the beach.

*Merganser, Red-breasted (*M. serrator*).*—All these Ducks are British breeding species, whose numbers are swelled by migrants in winter, mostly East Coast. All are fairly frequently recorded from the Point during the winter months. Wigeon, Teal, Mallard are probably the commonest, the most plentiful of all being the Wigeon; Gadwall, Pintail, and Scaup are the rarest. I have seen a single Scoter on the Point in July and once a small flock of Mallard in the same month.

Smew (*Mergellus albellus*).—Rare. An adult male was secured some winters back. Immature birds have been observed several times.

Heron (*Ardea cinerea*).—May apparently cross over from

the mainland at any time of the year. Never common. I have seen it twice (solitary birds) in April and July, and it has been taken in September.

BITTERN (*Botaurus stellaris*).—Used to breed in Norfolk regularly till 1868. Since then only twice, the last occasion being in 1911 (E. L. Turner). It is now an annual visitor in small numbers, but has only been taken once in this area (Pinchen).

SPOONBILL (*Platalea leucorodia*).—Used formerly to breed in Norfolk. Now fairly regular passage-migrant, but rarely reaches the Point. It was seen here in May and August, 1903.

PHALAROPE, GREY (*Phalaropus fulicarius*).—I believe there is but a single record of this scarce passage-migrant having been taken (October 2nd, 1911), though others have been observed.

———, RED-NECKED (*P. lobatus*).—This bird, probably rarer than the former on the East Coast in general, has been taken here several times (September, 1901; October 8th, 1903; September 1st, 1905; September 14th, 1906).

*WOODCOCK (*Scolopax rusticola*).

*SNIPE, COMMON (*Gallinago gallinago*).

———, GREAT (*G. media*).—Taken once on the Sandhills (Ramm).

*———, JACK (*Limnocryptes gallinula*)*.—These three species appear to be merely occasional. All have been taken, perhaps *S. rusticola* more often than either of the other two; October to February.

SANDPIPER, BROAD-BILLED (*Limicola falcinellus*).—There are only 15 records for England. A bird of this species was shot on the Point on August 13th, 1895, by Pinchen.

KNOT (*Tringa canutus*).—Annual in large numbers, from end of August to May, getting scarce towards mid-winter, especially in a severe year.

STINT, LITTLE (*T. minuta*).—A few, most years, in

September. Never abundant. Usually associated with flocks of their larger congeners. Some years much more plentiful than others.

———, TEMMINCK'S (*T. temminckii*).—Rare and irregular autumn passage-migrant. It has been taken several times. In recent years it was taken September 24th, 1902 (Richards), and September 14th, 1907 (Catling).

SANDPIPER, AMERICAN PECTORAL (*T. maculata*).—I believe one was taken here some year prior to 1896. Mr. E. C. Arnold is convinced that one was seen and heard by him and his party on September 2nd, 1908. The bird is familiar to him.

———, PURPLE (*T. maritima*).—Occasional, September to December.

DUNLIN (*T. alpina*).—Though seen throughout the year, it is most numerous in autumn and spring. It is probably the commonest of the Point waders.

SANDPIPER, CURLEW (*T. ferruginea*). Annual in small numbers, September to middle of October, and more rarely April. Some years very plentiful in autumn.

———, BUFF-BREASTED (*Tryngites subruficollis*). There are about 18 British records of this American species. One of those was obtained here on September 8th, 1899, by Mr. E. C. Arnold.

SANDERLING (*Calidris arenaria*).—Annual in considerable numbers, September to April. Much scarcer in winter months. Unlike most of the waders, it prefers the sandy seaward side of the Point, where it is usually seen in small flocks. It has been noted in summer.

RUFF (*Machetes pugnax*).—Uncommon, though a few are seen in most Septembers, and, more rarely, spring.

REDSHANK (*Totanus totanus*).—Breeding species. See above.

———, SPOTTED (*T. fuscus*).—Rare passage-migrant in September. Rarer in spring. There is one winter record, February 20th, 1904 (Richards).

GREENSHANK (*T. nebularius*).—Regular, though uncommon passage-migrant in autumn.

SANDPIPER, COMMON (*T. hypoleucus*).—Regular autumn passage-migrant. Never plentiful. Occasional in summer.

———, GREEN (*T. ochropus*).—Has been taken more than once, on the Marrams (Ramm). On September 8th, 1910 (Arnold).

———, WOOD (*T. glareola*).—Observed on one occasion near the Watch House (Gurney).

GODWIT, BLACK-TAILED (*Limosa limosa*).—This species used to breed in Norfolk. Last nested in 1847 (Witherby) It is now an irregular passage-migrant to the coasts of this country. It is reported to have been seen here on the Point more than once, but has never been taken.

———, BAR-TAILED (*L. lapponica*).—Regular visitor in some numbers; autumn to spring. It is most plentiful during September and early October, but many stay through the winter.

CURLEW (*Numenius arquata*).—Most numerous in the autumn and spring, scarcest in the summer. This bird is present the year round, its weird and not at all unpleasing calls being one of the characteristics of the Point.

WHIMBREL (*N. phæopus*).—A regular early autumn and irregular spring visitor, I have seen it in summer.

AVOCET (*Recurvirostra avocetta*).—This species used to breed in Norfolk up to the early part of the 19th century. It is now but an irregular spring migrant. It was taken here on May 19th, 1905. Four were seen near the Watch House on September 2nd, 1907. There used to be a small colony at Salthouse up to 1825 (Stevenson, "Birds of Norfolk"), and probably the bird was once a fairly common sight in the marshes on the Point.

PLOVER, GOLDEN (*Charadrius apricarius*).—Regular, and by no means uncommon. September to December every year.

———, GREY (*Squatarola squatarola*).—Middle September to March every year, in fair numbers. Most plentiful

on the muds. Some years exceptionally large numbers (*e.g.*, 1908).

———, RINGED (*Ægialitis hiaticula*).—Breeding species. See above.

———, INTERMEDIATE RINGED (*Æ.* ——— ?).—Occurs singly most Septembers and more frequently spring. It has only been recognised in recent years.

———, KENTISH (*Æ. alexandrina*).—Taken once, many years back, by Mr. J. H. Gurney off the Hood. The bird was immature.

DOTTEREL (*Eudromias morinellus*).—A rare September visitor. It was taken in 1901 and 1902 (E. C. Arnold), and in 1903 in breeding plumage.

PLOVER, SOCIABLE (*Chettusia gregaria*).—An immature specimen was seen, though not secured by E. C. Arnold and his party on September 3rd, 1903.

LAPWING (*Vanellus vanellus*).—Mostly September, but some also in October. Large flocks frequently cross the Point in these months. Probably immigrants from the Continent, and birds on passage from the North.

OYSTER-CATCHER (*Hæmatopus ostralegus*).—Breeding species. See above.

TURNSTONE (*Arenaria interpres*).—One or two Turnstones may be seen during any month of the year. I have seen them in July (1914) off the Hood, and in January (1913). Plentiful in September, and again, though less so, March to April. The summer birds, though non-breeders, are, of course, in breeding plumage.

GULL, COMMON (*Larus canus*).—Except for the Kittiwake, the least common of British breeding gulls here. Fairly abundant some autumns and winters; a few throughout most summers.

———, HERRING- (*L. argentatus*).—Present throughout the year. Plentiful in winter. In varying numbers in summer.

———, GREATER BLACK-BACKED (*L. marinus*).—Present throughout the year. Plentiful even in summer. In

autumn the sandbanks in the Channel and on the bar are often black with them, the vast majority then being adults.

———, British Lesser Black-backed (*L. fuscus affinis.*)—Present throughout the year. Never, with exception of some summers, as abundant as *L. argentatus*. Most numerous in autumn.

———, Glaucous (*L. glaucus*).—Fairly regular winter visitor in small numbers. December to March.

———, Iceland (*L. leucopterus*).—Rare winter visitor. It was taken on September 30th, 1905 (Richards).

———, Black-headed (*L. ridibundus*).—Plentiful throughout the year.

———, Little (*L. minutus*).—Rare autumn and winter visitor. It has been recorded several times. At least five are authentic (October 17th, 1896; September 2nd and 10th, 1904; September 20th and November 2nd, 1906).

———, Sabine's (*Xema Sabinii*).—Immature birds are said to have been seen during the autumn. None have been obtained in the area, though there are at least three records for the locality.

Kittiwake (*Rissa tridactyla*).—The scarcest of the British breeding gulls here. More plentiful some winters than others. Occasional in summer.

Tern, Common (*Sterna hirundo*).—Breeding species. See above.

———, Arctic (*S. paradisea*).—Irregular autumn passage-migrant, probably more frequent than supposed.

———, Roseate (*S. dougalli*).—Vagrant. It has been identified beyond doubt on several occasions, and is said to have been taken twice during the month of August.

———, Little (*S. minuta*).—Breeding species. See above.

———, Sandwich (*S. sandvicensis*).—Annual passage-migrant in small numbers, September and early October. Less common spring. During the whole of the breeding season of 1914, three or four of these birds were present

on the Point. We could find neither eggs nor young, so presumably they did not breed. They associated freely with the Common Terns. Appears to be on the increase as a summer visitor.

———, BLACK (*Hydrochelidon nigra*).—This is another species that used to nest in Norfolk. The last recorded instance of its breeding in this country was in 1858 (Stevenson). It is now a regular spring and autumn passage-migrant. A few are recorded on the Point annually, during those seasons.

———, WHITE-WINGED BLACK (*H. leucoptera*).—One was seen in August, 1902, near the Beacon Sandhills.

SKUA, RICHARDSON'S (*Stercorarius parasiticus*).—A regular autumn passage-migrant, in small numbers. If not taken, it is certainly observed nearly every September on the bar.

———, BUFFON'S (*S. longicaudus*).—Irregular and uncommon autumn migrant. It was secured in 1906 by Ramm. Also in 1900 (Richards), and again in 1912 (S. F. Arnold). All in September.

———, POMATORHINE (*S. pomarinus*).—This bird has been observed on several occasions (autumn) beyond the bar, but has never, to my knowledge, been taken. Mr. Gurney believes that one was shot in the area in 1879.

RAZORBILL (*Alca torda*).—Fairly regular in small and varying numbers; August to November. May occur at other times of the year. I picked up a dead specimen in good condition in July, 1912.

GUILLEMOT, COMMON (*Uria troille*).—Usually puts in its first appearance in October and is often seen up to the beginning of March, in small numbers, usually singly. Often picked up dead.

———, BLACK (*U. grylle*).—Was picked up on one occasion only, I believe, in an exhausted condition on the beach.

AUK, LITTLE (*Alle alle*).—Irregular, but by no means uncommon. Some winters numerous.

PUFFIN (*Fratercula arctica*). —Has been picked up exhausted on the beach. More frequently found dead.

PETREL, STORM- (*Thalassidroma pelagica*).—Has been seen, and I believe taken on the bar; chiefly in autumn, rarely in spring.

———, LEACH'S (*Oceanodroma leucorrhoa*).—Irregular in autumn. Has been taken twice on the bar.

SHEARWATER, MANX (*Puffinus puffinus*).—Rare vagrant. It was taken on September 11th, 1895.

FULMAR (*Fulmarus glacialis*).—Has been seen rarely. It was taken in September, 1912. In the same month last year (1916) a fine specimen in full breeding plumage was picked up from the Channel, on the landward side, by Mr. Richards. Several others have also been picked up dead in various years.

DIVER, BLACK-THROATED (*Colymbus arcticus*).—An infrequent visitor, the rarest of the Blakeney Divers. It has seldom been taken here. Mr. Richards secured one on December 27th, 1905.

———, GREAT NORTHERN (*C. immer*).—More plentiful than the former, but still uncommon. October to April. Occurring in winter plumage, identification may be doubtful sometimes, as a close approach is not always feasible. Mr. J. H. Gurney tells me he thinks that this species is rarer than the foregoing.

———, RED-THROATED (*C. stellatus*).—A common sight throughout winter months in the Channel and in the Narrows.

GREBE, GREAT CRESTED (*Podiceps cristatus*).—The commonest of the Grebes, and fairly often seen in the Channel. It has mostly been taken between September and January.

———, RED-NECKED (*P. grisegena*).—The rarest of the Grebes here. It was taken in the Channel on January 5th, 1906.

———, SLAVONIAN OR EARED (*P. auritus*).—Occasional in the Channel in winter months.

———, Black-necked (*P. nigricollis*).—Decidedly uncommon. One was obtained by Mr. Borrer, Sen., on our visit in 1916, on September 20th. I know of only one other record of its having been taken, but it may occur more frequently. Mr. Borrer's bird was first seen by me off Pinchen's Creek. I took it to be a Little Grebe. Later Mr. Richards and Ramm saw it. They also took it to be *P. fluviatilis*. It was then seen and shot by Mr. Borrer between Morston Creek and the Point, and correctly identified.

———, Little (*P. fluviatilis*).—Of fairly regular occurrence, chiefly in the Channel, autumn to spring.

Rail, Water- (*Rallus aquaticus*).

Crake, Corn- (*Crex crex*).—A specimen of each of these two species was taken in the autumn of 1902.

Moor-Hen (*Gallinula chloropus*).—Taken once on the Point itself, amongst the Suæda bushes. I believe it has also been seen in the Channel.

Coot (*Fulica atra*).—Has been taken once, December 31st, 1906.

Dove, Stock- (*Columba œnas*).—Used to breed in the Sandhills.

———, Ring- or Wood-Pigeon (*C. palumbus*).—A few usually stray over during the autumn. Occasional in spring.

Grouse, Pallas' Sand- (*Syrrhaptes paradoxus*).—Two (?) specimens of this beautiful and uncommon visitor to the British Isles were obtained by Pinchen in the Beacon Hills in the summer of 1888. Others were observed by Mr. Gurney the same summer. It is quite probable that during other invasions they have also occurred here.

VI.

METEOROLOGICAL NOTES, 1916.

(From observations taken at Norwich.)

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

January.

The most remarkable meteorological feature of this month was its extraordinary mildness. Not only was there hardly a vestige of frost, but the temperature exceeded 50 deg. on as many as 15 days, and on New Year's Day the high reading of 56·2 deg. was reached. The mean for the month (44·5) was just 7 deg. above the average. The only figure approaching that value in recent years was in 1898, when the mean for January was 43·1 deg.; older records show that in 1834 and 1846 the month was about as warm as in 1916, but it would appear that we have to go back to 1796 for a milder January. There was no snow, and the rainfall did not much exceed the average. The earlier garden flowers, such as snowdrops, crocuses, &c., bloomed in considerable profusion, but the season was hardly as early as in 1913, when the premature start of vegetation was even more remarkable.

February.

The earlier part of the month was mild, though less so than in January. A heavy snowstorm occurred on the morning of the 15th, lying to the depth of 6 ins. on the level. This soon thawed, but further snowfalls occurred daily from the 21st to the 27th, which period was very winterly, although the frost was at no time severe. On the 24th the depth of snow reached 10 ins. on the level, which is the deepest snow measured

here since the remarkable snowstorm of Boxing Day, 1906, when it was 11 ins. deep. Thunder occurred during a snowstorm on the early morning of the 23rd. The total rainfall of the month (4·52 ins.) was greater than in any February since 1866. A severe gale from the N.W. occurred on the 16th.

March.

This was an extremely ungenial and unpleasant month, with frequent snow and but little sunshine. Snow fell on thirteen days, and the total rainfall was again very excessive. The most notable feature of the month was a great blizzard and furious gale on the evening of the 28th, which caused much havoc in all parts of the country. The force of the wind as registered at Great Yarmouth was 70 miles an hour, equalling, though of less duration than, that of the great gale of the 24th March, 1895 (see Vol. VI., p. 99), and so much destruction was wrought among the telephone and telegraph wires that Norwich was quite isolated from the outer world for several hours.

April.

The first three weeks were chiefly cold, and the second and third weeks were very showery and unsettled. A severe thunderstorm occurred on the afternoon of the 12th. On the 23rd (Easter Day) a welcome change set in, and from that day until the end of the month much dry, sunny weather prevailed, with considerable heat for so early in the year, the thermometer reaching 70 deg. and upwards on four consecutive days. Bright sunshine was 33 hours in excess of the average, and there was a sudden and rapid outburst of growth. The display of fruit blossom at the end of the month was very fine.

May.

During the first fortnight the weather was generally unsettled, with about double the normal rainfall, and was somewhat cool for the season. A great improvement set in on the 15th, and during the remainder of the month very fine

weather prevailed. The week ending the 23rd was exceedingly warm for the time of year, and on the 21st (the first day of "Summer Time") the thermometer reached 83 deg. Very rapid growth occurred during the last fortnight. There was heavy thunder in several parts of the county on the afternoon of the 28th. Bright sunshine during the month was 20 hours deficient, owing to the smallness of the amount registered during the first sixteen days. A brilliant spell of sunshine occurred during the five days 17th to 21st, the sun shining on an average of $12\frac{1}{4}$ hours a day.

June.

This was a cold, cloudy, and unseasonable month. Rain fell on twenty-two days to a total of 3·23 ins. Temperature was greatly deficient, the thermometer failing to reach 60 deg. on thirteen days, and on seven days the temperature fell short of the maximum of January 1st. The mean temperature of the week ending the 17th was only 0·8 higher than that of the week ending January 7th, whereas a normal June day should be about 20 degs. warmer than a normal January day. There was a great prevalence of cloud on most days.

July.

Down to the last week of the month the weather was cool, cloudy, and unseasonable, with frequent light falls of rain. A great improvement set in at the latter part of the month, with daily increasing heat, the thermometer rising to 82 degs. on the afternoon of the 30th, this having been the first "80" recorded since May 21st. Sunshine was greatly deficient, but the rainfall was only about a third of the average fall, notwithstanding that rain was recorded on fourteen days. Thunder occurred on one day only.

August:

The fine and hot weather which set in on July 25th continued until August 12th, which period of eighteen days was absolutely rainless. The remainder of the month was very

showery, culminating on the 29th with a great downpour, reminding one in many of its characteristics of the flood-rain of the 26th August, 1912. In Norwich 1·23 ins. was gauged between 2 p.m. on the 29th and 9 a.m. on the 30th, with a further ·33 ins. up to 5 p.m. on the latter day. The mean temperature of the month was about a degree above the average, and the thermometer reached 70 deg. and upwards on nineteen days. Harvest commenced unusually late, and wheat cutting was not general until the last week of the month.

September.

The first three weeks were showery and cool for the season, with considerable thunder on the 3rd and 4th. The last week was warm, dry, and pleasant. Taken as a whole, the month was colder and drier than usual, the deficiency of temperature being more marked by day than by night. Bright sunshine was as much as 41 hours under the normal amount, but the second half of the month gave considerably more sunshine than the first half. The frequency of light rains during the early part of the month much hindered the ingathering of the harvest, but during the drier and warmer days which followed, farmers made considerable progress, and by the end of the month most of the fields were cleared.

October.

The weather of the first half of the month was exceedingly mild, the thermometer ascending to 60 deg. in the shade on twelve successive days, a rare occurrence in October. During this period there was much wind, with rain at intervals. On the 16th a considerable drop in temperature occurred. Frost was registered on some nights, and on the 21st the day temperature failed to touch 48 deg. The last week was rather milder, but very stormy, and there was much lightning and distant thunder on the evening of the 27th, when a thunder-storm of great severity passed over the districts of Watton and

Reepham. The mean temperature of the month was 1·5 above the average, and the rainfall very nearly normal.

November.

The first week was mild and stormy, with a great deal of rain. This was followed by a rainless period (lengthy for November) of nine days, many of which were exceedingly fine and warm. On the 11th the thermometer reached 60 deg., a height not attained here in November for ten years past. A drop in temperature occurred in the third week, and the first snow of the season fell on the 18th, but was soon followed by rain. On the 25th the thermometer reached 57 deg., but on the morning of the 28th it fell to 26·2 deg. in the screen and to 20 deg. on the grass. The mean temperature of the month was 1 deg. above the average, and was 5 deg. higher than that of the previous November.

December.

There was much dull, gloomy weather throughout he month, with a raw air, and a great tendency to fog on many days. Down to the 28th the weather was colder than usual, and while there was hardly any snow, and the frosts, though frequent, were of no great intensity, the day temperatures failed to reach 45 deg. during these four weeks. A sudden outburst of damp heat occurred on the 29th, with a rise of over 20 deg. of temperature in a few hours, and this warmth was maintained until the close of the month. Rainfall was nearly an inch in excess of the average, but was considerably less than in the two previous Decembers. Sunshine was very scanty, no less than 18 days having been absolutely sunless.

The Seasons.

The following 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 December to February inclusive; Spring, March to

May; Summer, June to August; and Autumn, September to November:

TEMPERATURE.

Seasons.	1911.	1912.	1913.	1914.	1915.	1916.	Average.	Departure of 1916 from average.
	degrees.	degrees.	degrees	degrees.	degrees.	degrees.	degrees.	degrees.
Winter -	40·2	40·8	41·2	40·3	39·7	41·7	38·4	+3·3
Spring -	47·8	49·4	48·6	48·5	46·4	47·6	46·3	+ 1·3
Summer -	63·6	60·0	58·4	61·8	60·2	58·8	60·2	— 1·4
Autumn -	50·9	47·6	52·3	51·0	48·6	50·6	50·1	+0·5
Year - - (Jan. to Dec.)	50·5	49·6	49·8	50·5	48·8	49·3	48·8	+ 0·5

RAINFALL.

Seasons.	1911.	1912.	1913.	1914.	1915.	1916.	Average.	Departure of 1916 from average.
	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.
Winter -	8·55	8·00	6·34	4·66	13·35	10·41	5·37	+ 5.04
Spring -	6·11	3·60	5·84	5·45	5·18	8·20	5·13	+ 3·07
Summer -	4·50	17·25	4·88	5·25	7·47	7·63	6·87	+ 0·16
Autumn -	8·02	7·58	9·15	6·38	6·58	7·39	8·38	— 0·99
Year - - (Jan. to Dec.)	26·67	35·03	24·42	27·62	29·97	32·68	25·75	+ 6·93

The Winter, for the seventh year in succession, was above the average temperature, and the warmest of the seven (in fact, it was the mildest since 1903, due chiefly to the abnormal January). The Spring was somewhat warmer and the Summer rather colder than usual, but the Autumn did not depart much from the average temperature for the period. The Winter was again excessively wet, although somewhat less so than the preceding. Rain was also considerably above the normal during the Spring period. The Summer rainfall coincided very nearly with the average, but that of the Autumn was an inch deficient.

The Year.

From a Naturalist's point of view an interesting feature of the year was the early set-off of vegetation caused by the extraordinary mildness of January. To have two years so near together as 1913 and 1916, exhibiting this phenomenal occurrence, is very remarkable, and some garden notes taken on each occasion may be of interest if reproduced here They show, as above stated, that the start was not quite so early as in 1913, notwithstanding that the mean temperature of the January of that year was 5 2 deg. lower than that of 1916. The warmer November which preceded it had, however, caused a more premature set-off.

1913.	1916.
Jan. 1st.—Garden gay with aconites, also a few snowdrops, hepaticas, and other flowers.	Jan. 1st.—An aconite in flower.
Jan. 4th.—Three yellow crocuses out in garden.	Jan. 20th.—Four yellow crocuses flowered.
Jan. 26th.—Counted 142 yellow crocuses in flower in garden. Myrobella in flower. Hawthorn in leaf.	Jan. 27th.—Counted 61 yellow crocuses out in garden.
Feb. 6th.—Counted 820 yellow crocuses out in garden.	Feb. 6th.—Counted 619 yellow crocuses out in garden.

As, from observations extending over a period of 37 years, February 4th is the average date of the appearance of the *first* yellow crocus bloom, the unusual character of the two above seasons can be gauged from the evidence yielded by the blooming of this flower alone, and the greater rapidity with which the flower came into bloom in 1916 shows the effect of the much milder January. Among the other remarkable features of 1916 were the gale and snowstorm of March 28th, the very cold June, and the sunless character of a large portion of the Summer. All the months gave more than their usual share of rain (except July, September, and October, which were somewhat deficient), but the year was a very wet one, the total rainfall at Norwich having been 32·68 ins., which is the largest amount of rain recorded in any year since these observations were commenced in 1883, with the exception of 1912 (the year

of the "Norwich Flood"), when the total was 35.03 ins. Harvest commenced unusually late, and was considerably retarded by showers during the early part of September. Sunshine was 322 hours deficient. The brightest month was April with 193 hours, and the dullest December with less than 27 hours. Mr. Willis has again kindly supplied the returns from his Campbell-Stokes Sunshine Recorder.

MR. PRESTON'S METEOROLOGICAL RECORDS FOR 1916.

Month.	Barometer.					Thermometer.					Hygrometer.	Sunshine.	Rainfall.		Wind.								Mean estimated force
															Direction and Days.								
	Highest.	Date.	Lowest.	Date.	Mean.	Highest.	Date.	Lowest.	Date.	Mean.	Mean Relative Humidity 9 a.m.	Hours.	Inches.	No. of Days.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	
	in.		in.		in.	°		°		°	%												
Jan.	30.52	31	29.57	1	30.090	56.2	1	30.0	12, 23	44.5	86	53.2	1.83	16	3	0	0	1	6	9	7	5	3.8
Feb.	30.46	1	29.04	4	29.722	53.6	15	27.4	20	38.7	86	71.3	4.52	22	2	0	5	5	4	2	7	4	3.5
March	30.37	31	29.11	28	29.651	61.0	19	25.5	9	39.5	87	65.8	3.69	25	4	7	7	4	0	3	3	3	3.1
April	30.35	1	29.05	18	29.846	75.4	27	30.0	8	48.0	72	192.9	1.93	15	3	2	2	3	2	4	4	10	3.3
May	30.45	19	29.31	5	29.904	83.0	21	37.0	9	55.3	73	184.8	2.58	14	1	4	3	6	4	4	5	4	2.2
June	30.27	16	29·26	5	29.869	71.5	22	40.7	3	53.9	75	135.8	3.23	22	9	1	0	0	4	5	8	3	3.1
July	30.33	29	29.48	7	30.003	82.0	30	47.1	1	60.2	79	96.4	1.05	14	5	**6**	3	2	3	3	6	3	2.2
Aug.	30.34	5	29.40	30	29.901	80.2	11	43.2	31	62.2	79	173.4	3.35	16	7	0	4	3	6	5	2	4	2.3
Sept.	30.37	7	29.56	18	30.000	71.0	26	39.2	15	55.9	86	108.2	1.57	14	8	5	1	5	2	3	2	4	2.8
Oct.	30.30	20	29.26	30	29.828	67.7	12	29.7	21	51.4	80	79.7	2.92	24	1	1	3	2	9	5	7	2	3.7
Nov.	30.41	15	28.63	18, 19	29.748	60.0	11	26.2	28	44.4	87	71.7	2.90	17	1	1	2	3	11	4	7	1	3.5
Dec.	30.20	27	28.90	12	29.602	55.0	29	26.4	20	37.3	94	26·8	3.11	24	**3**	2	3	4	4	5	5	5	**3**.0
Means					29.847					49.3	82	1260.0											3.0
Extreme & Totals	30.52	Jan. 3, 1	28.63	Nov. 18, 19		83.0	May 21st	25.5	Mar. 9th				32.68	223	47	29	33	38	55	52	63	48	

VII.

MISCELLANEOUS NOTES AND OBSERVATIONS.

Birds of Texel.

With reference to what has appeared in the "Transactions" about the birds of Texel, perhaps these few comments may be useful to readers.

Marsh Harrier.—I saw two (probably a pair) in May, 1907. One was a very light coloured bird, apparently similar to the plate in H. L. Meyer's "Coloured Illustrations of British Birds," and probably an adult male. The other was of a uniform brown. I saw the former bird again a few days later.

Stonechat.—On heath land near Koog, May, 1907.

Great Reed-Warbler.—This does occur. I found a nest and eggs.

Crested Lark.—Probably does breed. I saw birds in two places near Hoorn on the 25th May. The Crested Lark is a very stay-at-home bird; its distribution is usually sporadic and local.

Mealy Redpole.—On the 19th May I watched a very mealy bird in a row of willows. I think it was a female.

Hooded Crow.—I have seen twice in early May, but the Carrion Crow is the breeding species.

Hoopoe.—On the 8th May I saw what I have no doubt was a Hoopoe. But I saw it (on the wing) against a strong evening light against which it looked merely dark coloured. The shape of the wings and the peculiar flight, with which I was at one time quite familiar, were, I think, not to be mistaken.

Black-winged Stilt.—I saw three at a small mere on the west coast on the 14th May. One of them seemed to have a good deal of dark colour about the head and neck—perhaps a first year's bird.

Common Snipe.—Certainly scarce, but probably breeds. I flushed one from marshy ground on the 15th May; and on

the 24th in the following year I saw and heard one "drumming."

SPOONBILL.—Occurs in some numbers. I have seen thirty in a flock.

EARED OR BLACK-NECKED GREBE.—On the 14th May I watched for a long time a pair of these birds, in full summer dress, inhabiting a mere with big reed beds and points of brushed land running out into it. They kept going in and out of the edge of the reed bed, and I have no doubt they were nesting, or going to nest there. Their frequent cries were the ordinary "*blidder*" repeated several times. From the many *blidders* which came from the interior of the reed bed I should think there were other Eared Grebes in there. When I went to Texel the next year, a little later in the season, I was disappointed to find that access to this mere was denied to visitors, so that I could learn no more about the birds.

LITTLE GREBE.—I saw a nest of four eggs in a reedy drain.

I strongly doubt the accuracy of some of the statements about Texel birds in Vol V., p. 166.

O. V. APLIN.

BIRD NOTES FROM SUFFOLK FOR 1916.—On January 17th a male Great Grey Strike was shot at Cockfield. On April 30th two Little Owls were caught in rat traps at Rougham. For some years past two or three pairs of Turtle Doves have come to our window, where we have fed them with white peas or turnip seed; the last date upon which one appeared this year was September 23rd. On December 15th a Ruddy Sheld-Duck was seen at Bardwell; it was probably an escape.

W. H. TUCK.

THE GREAT BUSTARD (*Otis tarda*) IN DISPLAY.—Through the kindness of Trooper F. L. Berney, Australian Light Horse, and with the approval of Mr. D. Seth-Smith, we are able to produce the accompanying excellent photograph of

A 3-year old Great Bustard in Display

the Great Bustard in display. Mr. Seth-Smith, writing from the Zoo, says: "We have Mr. Eldred's birds here, but the one photographed was not one of these. The photograph represents rather a young bird, about three years old, and the display was not quite so complete as it would be in an older bird."

EDITOR.

WOLFERTON WILD BIRDS' PROTECTION SOCIETY.—The Honorary Secretary, Col. G. Cresswell, reports favourably of this Society's work during the year 1917. He says: "Owing to the brilliant weather of May and June the season was better than for the last two years. About the same number of birds arrived as last year, but there were no high tides and consequently no eggs were washed away and the hatch was certainly larger. The watcher was on duty for 12 weeks." Owing to the War and to his having been on service, Colonel Cresswell reports (*in litt.*) that he has no reliable records of the nests since 1915, but in that year 168 nests of the Common Tern were noted and marked, 86 of the Little Tern, and 68 of the Ringed Plover.

THE WELLS TERNERY.—On July 15th, 1917, Mr. Robert Gurney and the writer visited this breeding-ground. The number of Common Terns nesting here was certainly less than it was ten to fifteen years ago. At that time a majority of the nests were placed on the salt marsh adjacent to the sand-dunes; this year the greater number of the nests were found in the dunes themselves. At the time of our visit most of the eggs were hatched off, and for some not obvious reason there had been a heavy mortality amongst the chicks. There were never many nests of the Little Tern to be found at Wells, and on the day of our visit only one pair of this species was seen. A few pairs of Ringed Plover continue to breed on this ground. In the neighbourhood of the Mow Creek, well out on the salt marsh, we found about thirty nests of the Black-headed Gull, some containing eggs, others chicks. It is also worth recording that amongst these nests, which are about half a mile from the Tern ground, we found two nests containing eggs of the Common Tern.

EDITOR.

OBITUARY NOTICE.

Clement Reid, F.R.S. (1853—1916), died on the 10th of December, 1916. He was an honorary member of this Society, his connection dating back to 1883-4. The valuable work done by him in Geology and Botany is so well known that it is superfluous to say much about it here. As a member of the Geological Survey, he spent some years in the Eastern Counties, and enriched the knowledge of the geology and palæo-botany of Norfolk in his "Geology of the Country around Cromer," and in numerous other papers. Amongst his many contributions to our "Transactions," commencing with one on "Norfolk Amber" (Vol. III., p. 601), there are papers on "The Fauna and Flora of the Cromer Forest-bed," "Well-borings at Mundesley, etc.," and the "Natural History of Isolated Ponds." His book on "The Origin of the British Flora" (1899) is a work of great importance on the subject. His studies, in conjunction with Mrs. Reid, of the Fossil Flora of this country and of Holland produced results of great interest. He invented his own methods of preserving such intractable material as fossil seeds. Clement Reid was elected F.G.S. in 1875, and became a Vice-President in 1913. In 1899 he was elected F.R.S. He was the recipient of the Murchison Geological Fund award in 1886 and the Bigsby Gold Medal in 1897.

W. A. N.

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Ladies or Gentlemen distinguished for their attainments in Natural Science, or who have rendered valuable services to the Society, may be nominated by the General Committee as Honorary Members, and elected by a show of hands at the next meeting of the Society. Such Honorary Members have all the privileges of Ordinary Members.

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