









S. 296.

TRANSACTIONS
OF THE
NORFOLK & NORWICH
NATURALISTS' SOCIETY



The Norfolk and Norwich Naturalists' Society
has for its objects :—

1. The practical study of Natural Science.
2. The protection, by its influence with landowners and others, of indigenous species requiring protection, and the circulation of information which may dispel prejudices leading to their destruction.
3. The discouragement of the practice of destroying the rarer species of birds that occasionally visit the County, and of exterminating rare plants in their native localities.
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.
5. The publication of Papers on Natural History contributed to the Society, especially such as relate to the County of Norfolk.
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TRANSACTIONS

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Norfolk and Norwich

NATURALISTS' SOCIETY

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VOL. XI

1919—20 to 1923—1924

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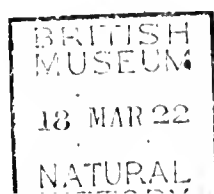
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2. The protection, by its influence with landowners and others, of indigenous species requiring protection, and the circulation of information which may dispel prejudices leading to their destruction.
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Elected.

- 1906 Buxton R. G., Petygards, Swaffham, Norfolk
 1906 Buxton W. L., Bolwick Hall, Marsham, Norwich
 1920 Buxton Capt. Redmond, Fritton Hall, Great Yarmouth

C

- 1909 Calvert E. M., St. Faith's Lane, Norwich
 1901 *Campbell Donald F., F.G.S., 119, Adelaide Road, London. N.W.
 1909 Campbell-Taylor J. E., "Kingswood," Church Road, Thornton-
 le-Fylde, Lancs.
 1909 Cann Miss F. A., Norfolk and Norwich Hospital, Norwich
 1907 Caton Rev. R. B., Great Fakenham Rectory, Thetford
 1902 Cator John, Woodbastwick Hall, Norfolk
 1911 Chamberlin Rev. C. M., Witton Rectory, Norwich
 1881 Chase R. W., Herne's Nest, Bewdley, Worcestershire
 1919 *Chasen F. N., Castle Museum, Norwich
 1907 Christie J. A., Framingham Manor, Norwich
 1888 Christy Miller, F.L.S., Chignal St. James', Chelmsford
 1894 Clarke W. G., F.G.S., 12, St. Philip's Road, Norwich
 1911 Cleather Rev. W. S., Barningham Rectory, Norfolk
 1887 *Cocks A. H., M.A., F.Z.S., Poynetts, Skirmett, Henley-on-Thames
 1909 Coke Right Hon. Viscount, Holkham, Norfolk
 1903 *Colman Miss, Carrow House, Norwich
 1903 *Colman Miss H. C., Carrow House, Norwich
 1881 Colman Russell J., Crown Point, Norwich
 1919 Copeman W. O., 5, Claremont Road, Norwich
 1906 Corder John, London Street, Norwich
 1912 Cremer W. C., Crapstone House, Yelverton, S. Devon
 1871 Cresswell George, King's Lynn
 1886 Cross J. M., Mile End Road, Norwich
 1919 Currie Lt.-Col. J. W., Old Catton

D

- 1910 Dalby Rev. Alan, M.A., The Rectory, Hevingham, Norwich
 1920 Davey Guy, Aldborough, Norwich
 1914 Davies H. C., Old Lakenham, Norwich
 1901 Day Donald D., F.R.C.S., Surrey Street, Norwich
 1917 Deacon G. E., Hethersett, Norwich
 1891 Digby A., Fakenham
 1918 Donnison H., Boston, Lincolnshire
 1916 Doughty Chester G., Gordon House, Gorleston-on-Sea
 1889 *Duleep Singh H.H. Prince Frederick, F.S.A., Blo' Norton Hall,
 Norfolk

E

- 1919 Eastman Rev. C. T., Suffield Park School, Cromer
 1911 Easter W. C., 99, City Road, Norwich
 1877 Edwards J., F.E.S., *Hon. Mem.*, Colesborne, Cheltenham
 1897 Evans H. Muir, M.D., Turret House, South Lowestoft
 1919 Evans-Lombe Major E., Marlingford Hall, Norwich

F

- 1885 Falcon Michael, Horstead, Norfolk
 1873 Farn A. B., Ganarew, Monmouth
 1880 *Feilden Col. H. W., C.B., F.G.S., C.M.Z.S., *V.P.*, Burwash,
 Sussex
 1912 Fisher Rt. Rev. Bishop, D.D., Burgh House, Fleggburgh,
 Norfolk
 1880 *Fletcher W. H. B., Aldwick Manse, Bognor
 1883 Forrester J. B., Thorpe Road, Norwich

Elected.

- 1889 Fowler W. Warde, M.A., Kingham, Chipping Norton, Oxfordshire
 1877 Fryer H. F., The Priory, Chatteris

G

- 1887 *Gainsborough The Right Hon. the Earl of, Exton Park, Rutland
 1902 Garstang Walter, D.Sc., The University, Leeds
 1903 Geldart Miss Aliee M., Cotman Road, Norwich
 1908 Gilbert R. T. E., Ashby Hall, Norfolk
 1909 Goodehild Herbert, The Chestnuts, Unthank Road, Norwich
 1901 Goose A. W., 10, Sandringham Road, Norwich
 1912 Gould Russell P., "Albemarle," Eaton, Norwich
 1919 Greatorex H. A., Witton, Norwich
 1918 Gresham School The, Holt, Norfolk
 1913 *Grey The Rt. Hon. Viscount, K.G., Falloden, Lestbury, Northumberland
 1920 Gudgin S. H., "Homeland," Cley Road, Swaffham, Norfolk
 1869 o.m. Gunn T. E., F.L.S., St. Giles' Street, Norwich
 1918 Gurney Major C., Caistor Old Hall, Norwich
 1902 *Gurney Miss Cicely, Keswick Hall, Norwich
 1896 *Gurney Sir Eustace, M.A., F.Z.S., V.P., Sprowston Hall, Norwich
 1893 *Gurney Gerard H., F.Z.S., Keswick Hall, Norwich
 1869 o.m. *Gurney J. H., F.L.S., F.Z.S., V.P., Keswick Hall, Norwich
 1901 Gurney Q. E., Bawdeswell Hall, Norfolk
 1894 *Gurney Robert, M.A., F.Z.S., *Hon. Treasurer*, Ingham Old Hall, Norfolk
 1918 Gurney Mrs. Robert, Ingham Old Hall, Norfolk

H

- 1892 *Haigh G. H. Caton, Grainsby Hall, Great Grimsby
 1905 Halls H. H., 130, Hall Road, Norwich
 1908 Hamond Lieut. C. E., R.N., Twyford Hall, East Dereham
 1906 *Hamond Major Philip, D.S.O., Morston Hall, Holt, Norfolk
 1919 Harker Miss Sylvia, Blofield Hall, Norwich
 1908 Harker William, Blofield Hall, Norwich
 1871 Harmer F. W., F.G.S., Hon. M.A. Cantab., V.P., Cringleford, Norwich
 1881 *Harmer Sir Sidney, K.B.E., F.R.S., 30, Courtfield Gardens, London, S.W. 5
 1906 Harris Rev. G. H., St. Paul's Vicarage, 47, Trafalgar Road, Moseley, Birmingham
 1893 *Hill Alexander, M.D., F.R.S., Highfield Hall, Southampton
 1920 Hiller Rev. H. G., Cathedral Close, Norwich
 1919 Hinde Dr. E. B., Gurney Court, Magdalen Street, Norwich
 1891 Hinde F. C., *Hon. Librarian*, 4, Quebee Road, Norwich
 1915 Hitchcock Arthur, Leyton House, Gaywood Road, King's Lynn
 1919 Horsfall Charles, Stody Lodge, Melton Constable, Norfolk
 1884 Hotblack G. S., Brundall, Norfolk
 1919 Howard Miss D. D., West Parade, Norwich
 1919 Howard H. J., 94, Rosary Road, Norwich
 1887 Howard R. J., M.B.O.U., Shear Bank, Blackburn
 1915 Hutchinson Donald, M.D., St. Ann's, Lowestoft

J

- 1891 Jarrold W. T. F., Thorpe St. Andrew, Norwich
 1896 *Jodrell Sir Alfred, Bart., Bayfield Hall, Norfolk
 1909 Jickling Colonel C. M., Smallburgh, Norfolk
 1885 Jones Sir Lawrence, Bart., 39, Harrington Gardens, London, S.W., 7.

K

Elected.

- 1897 Kerrison Colonel E. R. A., C.M.G., Burgh Hall, Alysham,
Norfolk
1904 Kinder Rev. E. H., Kirby Bedon Rectory, Norfolk
1909 King E. L., 4, Princes Street, Norwich
1898 Knight Edward, Keswick Old Hall, Norwich

L

- 1914 Laffan Major de Courcy, Little Aeton, Wrexham, N. Wales
1918 Laseelles Miss Susan, Crepping Hall, Stutton, Ipswich
1915 Laurence H. L. B., King's Lynn
1869 o.M. Laurenee Rev. J. A., Dilham Rectory, Norwich
1894 Laurence R., Felthorpe Hall, Norfolk
1889 Lee Warner Henry, Swaffham
1909 Leicester The Right Hon. the Earl of, G.C.V.O., C.M.G., F.P.,
Holkham
1899 Leney F., Castle Museum, Norwich
1898 Lennard Sir T. Barrett, Bart., Horsford Manor, Norwich
1881 *Lindley The Right Hon. Lord, V.P., East Carleton, Norwich
1881 Long F., The Close, Norwich
1899 Long S. H., M.D., F.Z.S., M.B.O.U., *Hon. Sec.*, 31, Surrey Street,
Norwich
1907 Long Mrs. S. H., 31, Surrey Street, Norwich
1919 *Long Miss E. M., 31, Surrey Street, Norwich
1913 Lyttelton Hon. and Rev. Edward, D.D., Overstrand, Norfolk

M

- 1894 Manby Sir A. R., M.V.O., M.D., East Rudham, Norfolk
1905 Mann Sir Edward, Bart., Thelveton Hall, Norfolk
1909 Manning Rev. C. U., M.A., 28, Huntingdon Road, Cambridge
1906 Marriott F. W. P., 2, Upper King Street, Norwich
1892 Marsham Major H. S., Rippon Hall, Marsham, Norfolk
1912 Mason A., 17, Camberley Road, Eaton, Norwich
1911 Master George, M.D., Bury St. Edmunds
1893 Mayfield A., M.C.S., Mendlesham, Stowmarket
1898 Meade-Waldo Edmund G. B., Hever Warren, Hever, Kent
1877 Miller Henry, Bomsere House, Norwich Road, Ipswich
1919 Montague Rt. Hon. E. S., Breceles Hall, Norfolk
1919 Morris S., Earlham Hall, Norwich
1919 Moxey Llewellyn, Framingham Hall, Norwich
1920 *Mullens Major W. H., Westfield Place, Battle, Essex
1920 Myhill Miss M., Church Farm, Hethel, Norwich

N

- 1904 Napier A. J., *Hon. Mem.*, Teviotdale, Netley Abbey, Hants
1910 Nash J. T. C., M.D., D.P.H., Shirehall, Norwich
1911 Newman L. F., School of Agriculture, Cambridge
1893 Newton E. T., F.R.S., *Hon. Mem.*, H.M. Geological Survey
Office, 28, Jermyn Street, London
1913 Newton W. C. F., The Meadows, Saham Toney, Watton
1878 Nicholson F., F.Z.S., Ravenscroft, Windermere
1889 Nicholson W. A., *Hon. Mem.*, 81, Surrey Street, Norwich
1915 Nightingale S. R., Scratby Hall, Great Yarmouth
1915 Norwich Public Library
1919 Norgate Philip, Swanington, Norfolk

O

- 1914 Oliver Prof. F. W., F.R.S., *Hon. Mem.*, University College,
London

P

- 1889 Page G. W., Fakenham, Norfolk
1919 Pain Percy, Dersingham, King's Lynn
1913 Paine Rev. N. W., Great Melton, Norfolk
1919 *Palmer Mrs. P. Hurry, "Red Roofs," North Drive, Great
Yarmouth
1912 Parker H., 10, Aspland Road, Norwich
1883 *Parkin Thomas, M.A., F.Z.S., High Wickham, Hastings
1873 Partridge Rev. W. H., M.A., St. Peter's, Sandown, I. of W.
1889 Patterson Arthur H., *Hon. Mem.*, 32, Lichfield Road, Great
Yarmouth
1920 Patteson Mrs. F. E., Great Hautbois House, Norfolk
1901 *Paul J. J. Dawson, Eaton Grove, Norwich
1911 *Payler Donald, Castle Museum, Norwich
1916 Peabody Institute, The, Baltimore, Md., U.S.A.
1903 Petre Col., Westwick Hall, Norfolk
1872 Pigott Sir T. Digby, C.B., F.R.G.S., Sheringham, Norfolk
1909 Platten Rev. T., The Close, Norwich
1880 Preston A. W., F.R.Met.Soc., Christ Church Lodge, Norwich
1919 Preston Sir E., Bart., Beeston Hall, Norfolk
1900 Preston F., Thorpe Mansions, Norwich
1913 Purdy T. W., Aylsham
1887 Pycraft W. P., A.L.S., F.Z.S., British Museum (Natural History),
London, S.W.

R

- 1869 o.m. Reeve J., F.G.S., V.P., 2, Lower Clarence Road, Norwich
1912 Riley W. A., 100, King Street, Norwich
1911 Rising A. P., The Manor House, Ormesby, Great Yarmouth
1908 Riviere B. B., F.R.C.S., M.B.O.U., St. Giles' Plain, Norwich
1893 Roberts E. T., 34, Carlisle Road, Norwich
1919 Robinson F., Watton, Norfolk
1869 o.m. Robinson H. S., Eaton, Norwich
1908 Rogers Commander F. S., R.N., Ingham New Hall, Norfolk
1909 Rogers Rev. Henry, Clarendon, Lowestoft
1884 *Rosebery The Right Hon. the Earl of, K.G., 38, Berkeley Square,
W. 1
1908 *Rothermere Rt. Hon. Lord, Hemsted Park, Cranbrook, Kent
1897 *Rothschild Rt. Hon. Lord, F.Z.S., Tring, Herts.
1879 Royal Microscopical Society, President of the, *Hon. Mem.*, 20,
Hanover Square, W.
1918 Rudd A. J., London Street, Norwich
1906 Rumbelow P. E., 27, Rodney Road, Great Yarmouth
1919 Russwurm Mrs., Scarning Grange, E. Dereham
1901 Rye Walter, 66, Clarendon Road, Norwich

S

- 1909 Seymour Col. C. D., J.P., Barwick House, King's Lynn
1919 Sier N. W., 2, Willow Lane, Norwich
1919 Simpson F., Sheringham, Norfolk
1917 Smalley F. W., Windermere, 4, Blackheath Park, S.E. 3
1918 Smith H. F., Didlington Hall, Norfolk
1915 Smith Mrs., Ellingham Hall, Bungay

Elected.

- 1891 Smith W. R., Harleston, Norfolk
 1909 Snow T., The Craig, Windermere
 1917 Sowels Miss, Thetford
 1911 Spurrell J. T., St. Faith's, Norfolk
 1919 Suffield Rt. Hon. Lord, Gunton Park
 1896 Sutton W. Lincolne, F.I.C., Eaton, Norwich

T

- 1878 Taylor Shephard T., M.B., The Mount, Edgefield, Melton
 Constable
 1906 Thomson D. G., M.D., C.B.E., Thorpe End, Norwich
 1886 Thouless H. J., Corfe, College Road, Norwich
 1910 Ticehurst C. B., M.B.O.U., Grove House, N. Lowestoft
 1896 Tillett Wilfrid S., 2, Claremont Road, Norwich
 1902 Todd R. A., B.Sc., 82, Semley Road, Norbury, London, S.W.
 1913 Tomes Sir Chas., LL.D., F.R.S., Mannington Hall, Norfolk
 1910 Tracy N., 3, King Street, King's Lynn
 1896 True F. W., *Hon. Mem.*, U.S. National Museum, Washington,
 U.S.A.
 1883 Tuck W. H., 5, Southgate Green, Bury St. Edmunds
 1906 Turner Miss E. L., F.Z.S., H.M.B.O.U., Langton Close, Girton,
 Cambridge
 1920 Todd Lt.-Col. Eardley, Mundham House, Brooke
 1871 Upcher H. M., F.Z.S., V.P., Sheringham Hall, Norfolk
 1869 o.m. Utting S. W., Stanley Avenue, Thorpe, Norwich

V.

- 1880 Vaughan Matthew, The Limes, Marlborough
 1917 Vincent James, Hickling, Norfolk

W

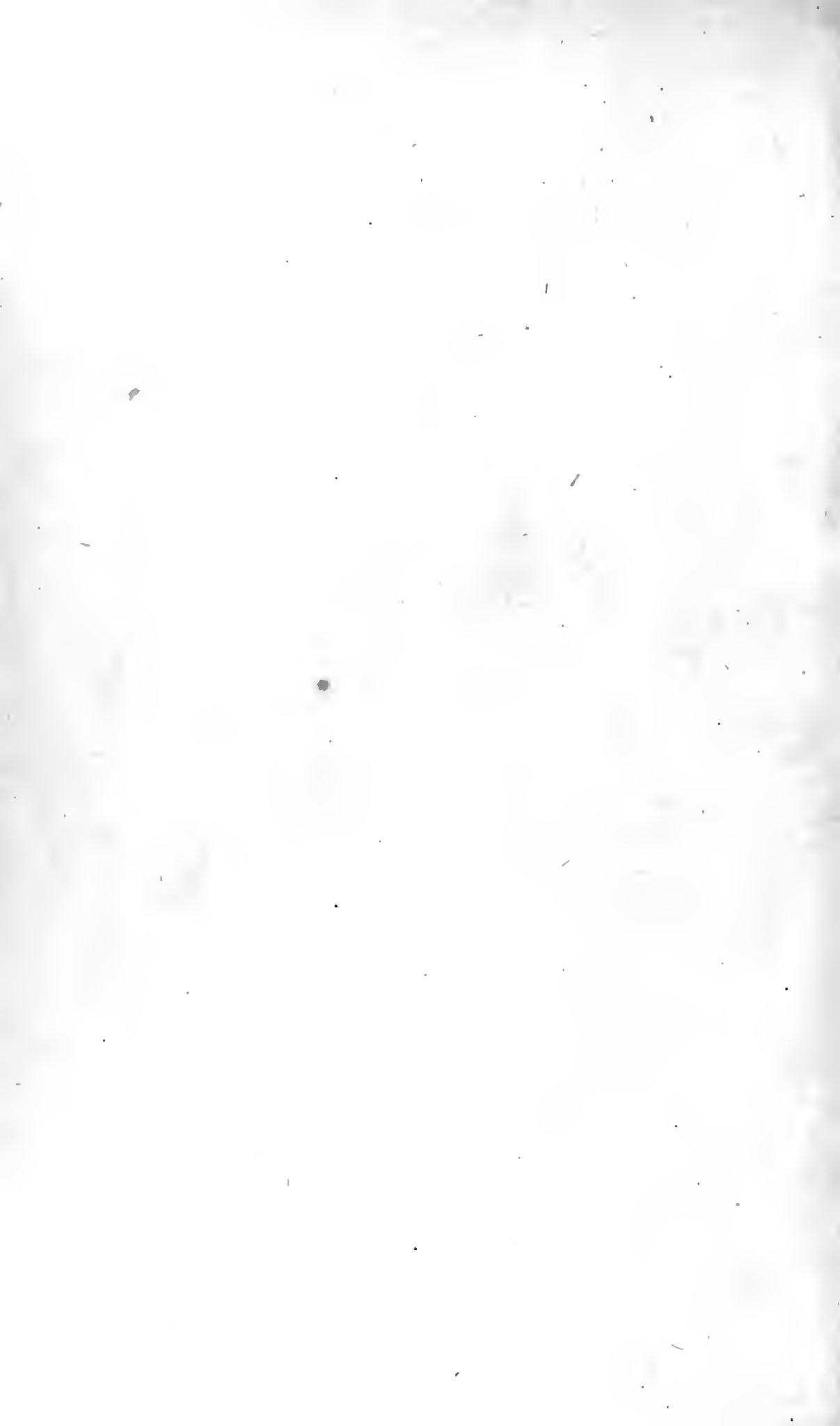
- 1910 Wade Dr. E. W., Harleston
 1875 Walter J. H., F.Z.S., Drayton Hall, Norwich
 1886 *Watling R. A., Great Ormesby, Great Yarmouth
 1906 Watson Innes, Swanington Court, Norfolk
 1872 Wheeler F. D., M.A., LL.D., Hellesdon, Norwich
 1883 *Whitaker Joseph, F.Z.S., Rainworth Lodge, Mansfield
 1913 Wigston A. E., 5, Mill Stream, Mundesley-on-Sea
 1901 Wild Edward, The Hawthorns, Eaton, Norwich
 1913 Williams Miss Margaret, 7, Queen Street, Norwich
 1909 Witherby H. F., F.Z.S., 326, High Holborn, W.C.
 1919 Woods Miss Amy, "Camiers," Mundesley-on-Sea
 1899 Woodward Dr. Henry. F.R.S., V.P.Z.S., F.G.S., *Hon. Mem.*,
 Tudor Cottage, Clay Hill, Bushey, Herts
 1907 Wormald Hugh, M.B.O.U., Heathfield, East Dereham
 1911 Worthington R., Lowestoft
 1903 Wright Miss Helen, 25, Surrey Street, Norwich
 1920 Wyllys Hugh, "Shrublands," Southtown, Great Yarmouth

Y

- 1915 Yarmouth Free Library, The, Great Yarmouth

TOTAL.

Honorary Members	...	...	11
Life	..	...	36
Ordinary	..	...	215
			262



ADDRESS

Read by the President, J. H. GURNEY, F.Z.S., to the Members of the Norfolk and Norwich Naturalists' Society, at their Fifty-first Annual Meeting, held at the Norwich Castle Museum, April 27th, 1920.

LADIES AND GENTLEMEN,

LET me in the first place thank you, and through you the Committee, for the compliment of an invitation to occupy the Presidential chair for the fourth time. Needless to say, such an honour is greatly appreciated, and the more so because the year just concluded marks our jubilee, as Dr. Long has reminded us in his preface to the volume of our Transactions just completed (Vol. X.). During the tenure of my Presidency, as the successor of Mr. Edward Bidwell, several reflections have presented themselves, and upon some of them I hope I may be permitted to dwell this evening.

First of all, neither you nor I can sit here without thinking of the birth of our Society, more than half a century ago. Let me ask you to go back in thought to a certain memorable day in the year 1869. It was the 30th of March of that year when at an informal meeting held at the old Museum in St. Andrew's Street a few seekers after Nature's secrets—about twenty in all—banded themselves together, and decided to hold evening gatherings for the purpose of scientific discussion, and to print and issue transactions. It was a bold step, for there was but little money, and the Committee had not yet got the public at their back ; but perseverance succeeded, and the effort has been met with a merited reward. Neither my father nor I was present at the meeting, but we were soon informed of the result ; indeed, I can place on the table a letter from Mr. James Reeve, written the following day, in which he informs my

father that about fifty names had already been accepted for membership.

A month afterwards, on April 27th, the first regular meeting was held, and our union came into a real and tangible existence. The Rev. Joseph Crompton was our first President, while among his warmest coadjutors were Henry Stevenson, Michael Beverley, Thomas Southwell, Herbert Geldart, and James Reeve. Of one hundred and nineteen names then handed in only seven appertain to men who are still living, viz. : Dr. Michael Beverley, the Rev J. A. Laurence (who is with us this evening), Mr. S. W. Utting, Mr. James Reeve, Dr. H. S. Robinson, Mr. T. E. Gunn, and myself. •

At first things did not altogether prosper with the new venture. The list of members had fallen to one hundred and fourteen in its second year, and in the third year to one hundred and ten; but Stevenson, Bridgman, Beverley, Geldart, and a few others put their shoulders to the wheel, and an effort was made to recover lost ground. In 1873-74 the membership had risen to one hundred and thirty-two, and since then, with various fluctuations, the roll of names has grown to be about two hundred and forty, in one year reaching as high as two hundred and eighty-four.

As was to be expected, with the increase of members our Transactions have advanced in bulk, and your Committee have under consideration a proposal that in future a Volume should consist of four Parts instead of five as in the past; and this would seem to be a much wiser course to adopt than the alternative one of rejecting valuable papers. Assuredly Vol. X., recently completed, does not fall behind its predecessors in quality, and I think our excellent Hon. Secretary, by whom it has been edited, may be proud of his literary offspring. Among the illustrations, which are decidedly a feature of it, are the six admirable photographs of the Bitterns' nest and young by Miss E. L. Turner, and the beautiful coloured drawing by Mr. Riviere of his hand-reared Red-backed Shrike.

We have now published a substantial set of thick volumes, which have established for themselves a reputation beyond

Norfolk, and which will bear comparison with the Proceedings of any kindred society in the United Kingdom.

Perhaps an outsider might be disposed to ask what has been the secret of the success of this Norfolk society, at first so small and comparatively unknown. To what would you attribute the good fortune which so far has attended its career? Most of those who are sitting here this evening would, I apprehend, be of opinion that it is due to the zeal and ability of a succession of good honorary secretaries, for the holders of this office are the backbone of a scientific club.

Our first Secretary was Thomas Southwell, and no one has ever done more to maintain the honour and reputation of the Society than he did. With the exception of one year, Southwell held office until 1879, when he was followed by Mr. F. D. Wheeler, who in 1881 gave place to Mr. W. H. Bidwell, brother to our late President.

In 1891 we enlisted the services of Mr. W. A. Nicholson, who remained loyally at his post until 1911, a period of twenty years, when our present Honorary Secretary, Dr. Sydney Long, succeeded. Dr. Long is a very busy man, and our best thanks are due to him for all he has done in the past and continues to do for a Society in which he takes so much personal interest.

Nor must we forget the services of the Honorary Treasurer, Mr. Robert Gurney, without which we should come off badly, here with his help I should like to say a few words on our present financial position.

Our Treasurer states that there are at present about two hundred ordinary members of the Society, from whose subscriptions he informs me an income of about £75 may be expected. On the other hand, he considers that the cost of publishing the Transactions amounts to nearly £100; so that it cannot be said that the Society is paying its way. In fact, if it were not for the money received as donations from a few members especially interested in Science and Natural History, it would be almost impossible to continue publishing our Transactions in their present form. The Committee have had under consideration the advisability of raising the annual

subscription, but at present they hesitate to take that step, although other societies of a like nature have done so. Meanwhile the Committee and their Treasurer can only suggest that those who are interested in the welfare of the Society, and the maintenance of the present high standard of its Transactions, should voluntarily pay either a larger annual subscription, or give to the Special Publication Fund.

SUMMER EXCURSIONS.

During the summer an attempt was made to resume the field-day outings, which before the War had been a popular means of bringing us together, and accordingly three excursions were arranged for by Dr. Long and Mr. Leney. The first was to South Walsham Broad, on June 26th, by invitation of the late Major Herbert Jary; and the second was to Keswick, on July 3rd, but on both occasions the weather was unkind to us; yet, in spite of rain, there was a tolerable attendance.

On the third excursion we were more favoured. It was a bright, sunny afternoon when, on September 4th, about thirty friends met on the historic heath of Mousehold. After inspecting the Aerodrome sheds, we proceeded under the leadership of Sir Eustace Gurney to the woods at Sprowston, where members were invited to remark the thriving plantations of Corsican Pine, Douglas Fir, Scotch Fir, and Larch. A few wild flowers were gathered and named by Mr. Nicholson and Miss Geldart, and altogether we had a delightful afternoon stroll, ending with tea at Sprowston Hall.

WINTER MEETINGS.

After an interval of five years' discontinuance, owing to the War, it was now possible to resume our monthly meetings at the Castle Museum, and, in accordance with arrangements made by Mr. Leney, four meetings have been held. The first on November 25th, was devoted to botanical discussion. A few papers were produced, and the exhibition of plants previously arranged for by Miss Geldart, who kindly opened the meeting, was most satisfactory in every way. Mr. Clarke exhibited

samples of a Liverwort from the courtyard of Suckling's house, which is in the heart of Norwich, and Mr. Nicholson showed a selection of Syrian plants from the Lowne herbarium.

Our second gathering was arranged for January 27th, when Mr. Robert Gurney and Mr. Chasen laid on the table the skins of a number of closely-allied species of birds, and explained some of their points of difference. They also drew attention to the fact that very slight differences in plumage had often resulted in the separation of two or more sub-species, which was far from being always a matter of assistance to the ornithologist.

The third meeting was held on the 24th February, when Mr. H. J. Howard gave a demonstration of various species of the *Mycetozoa*. Being away from Norfolk at the time I was unable to be present.

At the last meeting, on March 30th, Mr. H. E. Hurrell and Mr. Howard brought their large microscopes, and explained the correct method of working them. Mr. Hurrell also gave a description of the micro-fauna of Coldham dyke, Surlingham, while Mr. Robert Gurney showed slides dealing with the Plankton of the Broads.

HENRY STEVENSON,
AUTHOR OF "THE BIRDS OF NORFOLK,"
HIS FRIENDS AND CONTEMPORARIES.

In 1914 our then President, Miss A. M. Geldart, devoted the chief portion of her Address to the lives and labours of some of the celebrated botanists of Norfolk. She traced in particular the life-work of Sir James Smith, the founder of the Linnean Society, and practically the starter of the Norwich Museum, which came into being in 1824. Miss Geldart's idea was a good one, and might be imitated with advantage in other branches. Accordingly, I propose this evening to follow her lead, and to do for ornithology what she has done so successfully for Norfolk botany.

Let us then consider the services of one whose name is a household word to many, Henry Stevenson, and of some of his contemporaries. That we should begin with Stevenson is fitting, because he was one of the most earnest promoters of this Society, as well as Honorary Secretary to the Museum for more than thirty years.

As showing Stevenson's early love for birds, it may be mentioned that when he was little more than a boy he began to keep a Natural History journal, and continued it until within a few weeks of his death. This diary commences when he was sixteen, and the first entry about birds, under date of January 23rd, 1850, is as follows:—

“ A Northern Diver shot near Lowestoft, Black-throated Diver ditto, also several Bohemian Waxwings in various parts of Norfolk during this cold weather. Jan 24th.—Wind like a hurricane, doing great damage amongst the chimney-pots. Jan. 25th.—A specimen of the Scaup and another of the Golden-eyed Duck in our market this week, caught in the Decoys with the common Wild ones, of which also great numbers have been taken during this cold month, and lots of Waterhens, Redshanks, etc.”

Nothing particular is entered during February, but the notes begin again in March.

“ March 14th.—Mr. Peto's decoy [at Fritton Lake] has been visited this season by great quantities of wild fowl, and in the very cold weather some rare specimens were captured. Within the last week a large quantity have been forwarded from thence to our fish-market, including Wigeons, Teal, and several of the Pintail Duck.”

“ June 18th.—I had a day on Surlingham Broad with Mr. Hore. The Broad is bounded with marshes more or less fit for walking, which are dotted over with small bushes, where numbers of the Sedge and Reed birds and Black-headed Buntings are to be found. We saw a Shoveller and a Garganey Duck, but too shy to be approached within shot distance, and were best let alone, since no doubt they are breeding in some part of the Broad. A large Heron got up near me in fine

style. . . . Mr. Hore got a young bird of the Bearded Tit or Reed Pheasant, exactly similar to Yarrell's vignette. We saw and heard several Snipe, Crows, and a Coot, but could not find a nest. I procured a beautiful specimen of the Reed Warbler's nest, with two fine eggs. The former I have perfect, with the three reeds through it, as it stood by the water's edge. The Broad was alive with Sand Martins, of which we got a specimen. . . .

"October 26th.—A few days since a cream-coloured Swallow was shot at Lowestoft, and also a fine specimen of the Osprey or Sea Eagle on the grounds of C. Steward, Esq., of Blundeston. Both were preserved by Mr. Thurtell, of Lowestoft. On Saturday Sayer [John Sayer, Birdstuffer, St. Giles' Street] received three fine specimens of these rare and elegant little birds, the Grey and Red-necked Phalarope."

Many other memoranda follow, nearly always treating of his favourite hobby, Norfolk birds, but further quotations would take up too much space. In 1888 the journal closes, and in seven weeks' time from the last entry its author died.

For many years an active correspondence was carried on between Henry Stevenson and my father, some small portion of which, after the former's death, was handed back to me by the executors. Unfortunately, some of the interest of these letters is lost through our not possessing many of Stevenson's replies, but a few extracts may be given, which I believe will not be unacceptable.

J. H. GURNEY TO HENRY STEVENSON.

"Easton [Lodge, near Norwich], 27 January, 1853. The Little Bustard [shot at Winterton on December 29th] is a male; you are doubtless aware that the absence of the black on the neck simply indicates the winter dress. . . . The stomach of this specimen was literally crammed with vegetable matter, not grass, but almost entirely consisting of fragments of some rather large leaf with a rough surface and a serrated edge. [Probably White Turnip.] Sayer [the Norwich birdstuffer] sent me with the body of the Bustard, the carcass of a

Merganser, which from the plumage I supposed to be a young male in change, as it had a good deal of black about the head, but on dissecting the bird it proved to be a female."

"8 June, 1854. I am particularly obliged by your letter about the Bee-eater [shot at Surlingham on June 3rd]. If you saw them in the flesh I should be very glad to buy them of Sayer if you do not want them. The eggs which Sayer last year received from the river bank were decidedly smaller and longer than those of the Bee-eater generally are."

[No further memorandum is discoverable about these eggs.]

"12 June, 1854. I am much obliged by your note of the 10th, and would on no account interfere with your purchase of the Bee-eaters. . . . When you have examined the carcasses, would you oblige me by forwarding them to my friend, Mr. Alfred Newton, of Elveden Hall, Thetford, who is forming a collection of the sterna of British birds." [Now in Cambridge Museum.]

The next five letters refer to a supposed hybrid between a Fowl and a Pigeon.

"30 April, 1864. I am disposed to think the bird at Sayer's a genuine hybrid [between a Pigeon and a Bantam], and I asked him to obtain me the refusal of the specimen. He gave me the carcase, which I handed to Mr. Bartlett [Superintendent of the Zoological Gardens], who promised to dissect it jointly with Mr. Parker" [Professor at the Royal College of Surgeons].

"27 May, 1864. Mr. Bartlett writes to me that Mr. Parker, after dissecting the body of the supposed hybrid Bantam, can find no trace of Pigeon in it, but of Fowl only."

[The egg from which this bird was hatched was laid in the aviary of Mr. Engall, game-dealer, St. Augustine's, Norwich. Pigeons were also kept in the aviary, and Mr. Engall often observed them mating with the Bantams, which led to the belief that a cross had taken place.]

HENRY STEVENSON TO J. H. GURNEY.

"May 28th, 1864. I have seen Sayer about the hybrid, and he will at once look after the man who is said to have bred

it, and get all particulars he can. In looking carefully at the beak and claws you will see a most singular double formation.

“ June 2nd, 1864. Sayer has tried in vain to see the man who bred the quasi-hybrid. Mr. Parker's opinion, formed from osteological evidence, is, I suppose, conclusive against the hybrid theory, and yet this renders the external appearance of the bird even more extraordinary, for a more perfect compound of Pigeon and Fowl in one I never saw.”

“ August 3rd, 1864. I think I told you in a former letter that Sayer can make out nothing further about the Bantling Pigeon. He saw the lad who had it, and he says that a Pigeon used to frequent the same yard with his Bantams, and was seen at times apparently treading a hen.”

At the sale of Natural History specimens belonging to the well-known collector, Mr. Frederick Bond, which took place at Stevens' auction rooms in May, 1890, much interest was excited by Lot 102, which was represented as being a hybrid between a Bantam fowl and a Pigeon, and after a smart competition it was knocked down to Mr. Gerrard, a London dealer, for £2 15s. 0d. This was the supposititious hybrid referred to in the above correspondence, but its claim to be anything more than a diminutive speckled Bantam hen was finally disposed of in “ The Field ” newspaper of May 24th, 1890, where a good portrait of this anomalous bird is given, with an article on it from the pen of Mr. W. B. Tegetmeier.

As has already been said, Stevenson was for many years connected with the Norwich Museum, the interests of which institution he had greatly at heart. It appears from a letter still extant that in June, 1854, he made an offer to assist the Committee in the care and arrangement of the British birds, and was accordingly appointed an honorary curator of the vertebrate animals. It was perhaps as some slight acknowledgment of his services to the Museum that a beautiful Chinese Sparrow-hawk—figured by Joseph Wolf in “ The Ibis ” (Vol. V., p . 447)—received the appropriate name of *Accipiter Stevensoni*, a compliment which I believe gave him some pleasure at the time.

Stevenson's collection of Norfolk birds, which in its day was considered one of the best in England, was dispersed under the hammer on September 12th, 1887. It contained a large number of local rarities, of which, as can be seen by the marked catalogue, a good share fell to the Museum, while others were purchased by the late Mr. J. J. Colman. Mr. Southwell was commissioned to buy for the Museum, and a short account of what he did will be found in Vol. IV., p. 500, of our Transactions.

The Surlingham Bee-eaters which were referred to in the previous correspondence, and a pair of Golden Orioles, shot as near to the city as Lakenham, fell to Mr. Upcher, while other rarities were secured by Mr. Connop, and have since passed from his executors to Mr. Lysaght, of Chepstow.

Continued ill-health and loss of money clouded the latter years of Stevenson's life, and accordingly it is not surprising that "The Birds of Norfolk," the work by which he will always be best known (Vol. I. of which had appeared in 1866, and Vol. II. in 1870), remained unfinished when he passed away, to the infinite regret of a circle of scientific friends, on the 18th August, 1888, at the early age of fifty-five.

It is certainly very singular that no memoir of Henry Stevenson was published in our Transactions, nothing indeed beyond a short obituary notice inserted in the next Presidential Address after his death. It is true that this omission is partly remedied in a short but very good life by his friend, Thomas Southwell, with an excellent portrait, with which the third volume of "The Birds of Norfolk" is very properly prefaced. Both Stevenson and Southwell served their generation as good naturalists, and now they rest together, not far apart, in a graveyard beyond the precincts of the City.

ALFRED NEWTON, F.R.S.

With regard to Stevenson's friends, perhaps the foremost of them, and in any case the most eminent, was Professor Alfred Newton, author of the well-known "Dictionary of Birds," and many learned memoirs, as well as of the "Ootheca Wolleyana." We cannot quite claim Professor Newton, and his

brother, Sir Edward Newton—who was our President in 1887–88—as Norfolk men, for the home of their early life lay just over the border. A taste for natural history is born in some people, and with Newton a passion for observing the habits of birds, combined with egg-collecting, began in very early days. But it was not egg cabinets only in his case, for a practical acquaintance with animal life is evinced by his earliest contribution to science—a letter about a Sea Eagle, written when he was only fourteen. (“Zoologist,” 1844, p. 443.) Other communications, either private or for publication, soon followed, and a brisk correspondence presently sprang up with Mr. J. H. Gurney, at that time living at Easton, near Norwich. This was productive of a friendship which extended over many years, and led among other things to the support which Newton was always ready to lend to the museum at Norwich, of which he became an honorary curator.

Another of Newton's Norfolk friends was Thomas Southwell, at that time living at King's Lynn, to whom he writes sometimes on bird matters. Indeed, one of his communications, which happens to be among Southwell's papers, is too characteristic not to be quoted. Writing from Elveden Hall, near Thetford, under date of May 31st, 1854, he says:—

“ I am much indebted to you for your note and your map. I am afraid that I shall not be able to get over to Roydon, or rather Grimstone, this year, but perhaps my brother—who is a keener ornithologist than myself, may be able to make a tour of inspection there. I am glad you like the extracts from Lloyd. I must say that I think that it has not been established that the Polish Swan is a good species, and as I hate having to halt between two opinions, I much wish the point were settled one way or the other. I think that one may expect the Harriers to breed again this summer near where they did last year, for I presume by your letter that the ground has undergone no change. It would be as well for you, I think, when you go to look for them, to be provided with a couple of small hen's eggs to leave in the place of any Harrier's eggs that you may find. For I believe that the Harriers, like the Owls, lay their

eggs at intervals far apart, and that probably, as in the case of most of the Owls, the eggs last laid are partly brought to maturity by the heat of the young birds which are first hatched. This will explain the fact of the three nests you mention having only two eggs a-piece, when I know on good authority that six or more are frequently laid."

In 1863 there took place a very remarkable immigration of Pallas' Sand-grouse from Asia, in which Prof. Newton was greatly interested. The full and lucid account which he at that time drew up for "The Ibis," then almost a new journal, has always been considered one of the most thorough articles he ever wrote, and one of the best contributed to "The Ibis," of which, two years later, he became the editor.

In 1888 occurred a second and still greater irruption, and at the request of Dr. P. L. Sclater, the then editor, Professor Newton again undertook the task of collecting details. A considerable mass of information, some portion of it referring to Norfolk and Suffolk, was got together, but foreign correspondents were so long in submitting details required from them that the report was put aside, and in the end the materials were offered to the present writer, who did not feel himself either able or qualified to undertake it. Newton, however, printed an account of a chick Sand-grouse discovered in Scotland ("Ibis," 1890, p. 207), and details of the migration were fully chronicled, as far as Norfolk was concerned, by Mr. Southwell. ("Zoologist," 1888, p. 442.)

THOMAS SOUTHWELL.

This well-remembered member died in 1909, in the seventy-ninth year of his age, to the great loss of our Society, which never possessed a more ardent supporter. His life and labours are the subject of an excellent memoir by Dr. Sydney Long, which will be found, together with a good portrait, in the ninth volume of our Transactions.

Southwell's early life was spent at King's Lynn, where he made many useful observations on birds. Among the papers

consigned to the Museum after his death is a long article written in 1851, and apparently intended for publication, entitled "Remarks on the Birds of the County of Norfolk, but more particularly the neighbourhood of King's Lynn," but it was never printed, and would now be thought out of date. From Lynn with his Quaker friend, Daniel Burlingham, Southwell explored the country-side, and spent his holidays in searching for plants and birds, during many a ramble such as the one of which copious detail is given with great felicity of description in Morris' "Naturalist." (Vol. V., p. 97, 1855).

At all times fond of the country, Southwell generally had something to jot down in his journal about birds. On June 5th, 1882, we find him noting that he had driven from Thetford to the Wretham meres, where he had seen with delight plenty of Coots, Grebes, Gulls, Tufted Ducks, Pochards, Shovellers, and Mallard. During the ensuing fortnight he was again at these enticing ponds, and of this second visit, on June 27th, his diary relates:—"Paid another visit to the Wretham Meres with Mr. Stevenson and J. H. Gurney. We saw in addition to the birds enumerated above, Gadwall on Lang-mere, and Mr. Gurney thought a Garganey Teal, but was not quite certain, many Common Teal, two pairs of Great Crested Grebes on Lang-mere, and three pairs on Mickle-mere, two nests of Little Grebes on Ring-mere, with one and three eggs respectively. . . . Some of the birds still had nests, as evidenced by their anxiety, notably an old female Shoveller, and J. H. G. caught a young Teal; the old bird started out of the bushes, and her young ones scattered in all directions."

He was a not infrequent visitor to the Broads on the eastern side of the county, and his journal contains entries about them also, from which I could quote more fully were there space.

"7th May, 1885. Hickling and Horsey Broads. H. G. Barclay, J. H. G., and self. Very cold and stormy. Nudd, the Broad-keeper, showed us two Water-rails' nests, containing nine and seven eggs, one Bearded Tit's nest with five eggs, one Shoveller Duck's nest, four eggs. Bearded Tits have largely increased in numbers the last two years, Redshanks numerous."

“28th June. H. G. B. and self; lovely morning on Stalham Broad. . . . Dennis Gray, the Broad-man, showed us a Montagu's Harrier's nest with three eggs; it had been mowed over three days before and was forsaken. A place about twenty inches in extent had been broken down in the tall sedge, which was about two feet high, in the centre of which was the nest; the whole structure was about sixteen inches by twelve in the centre. . . .”

Southwell's principal works, besides numerous scientific papers—many of them of great value—were the continuation of Stevenson's “Birds of Norfolk,” and a most useful and important reprint of Sir Thomas Browne's “Norfolk Natural History,” as well as an excellent edition of Lubbock's “Fauna of Norfolk.” In these publications he received much help from his friend, Professor Newton, an assistance which he was always ready to acknowledge. In 1885 he attended the sale of the Rising collection at Horsey with the writer, when the Buffle-headed Duck and other good things were secured for the Museum. Mr. Rising gave five pounds for this duck, and thought it dear, but on the present occasion it was knocked down to Southwell, after some spirited bidding, for twenty-six pounds, five shillings.

In May, 1896, Southwell delivered a lecture to a large audience, with the Dean of Norwich in the chair, entitled “Birds, their Enemies and their Protection,” a subject in which he had long taken a great interest, for, although no sentimentalist, he had bird-life very much at heart. This address, which was given at the Castle, attracted considerable attention, but although printed in full by the newspapers at the time, it was never republished. He was, however, at all times better known as a writer than as a lecturer, and many a good magazine article emanated from his fruitful pen, several of which are enumerated by Dr. Long.

EDWARD CLOUGH NEWCOME.

Newcome the falconer was well-known to Henry Stevenson, who was proud of some birds mounted by this clever amateur

taxidermist. The keeper of Newcome's hawks was John Madden who, one day when on Southacre heath in the spring of 1850, had the luck to obtain a totally unknown species of Petrel. It was this bird which at first was quite an enigma, and which led to a large amount of letter-writing on the part of Gurney, Yarrell, and Alfred Newton, for it was a considerable time before the stranger was satisfactorily identified by the last-named as a Capped Petrel (*Pterodroma hasitata*). By August, 20th 1852, the matter was settled, and under that date Yarrell writes to my father that the Petrel was to go back at once to its owner, Mr. Newcome, who had desired that Mr. Gurney should see it. In a second communication, dated September 15th, he says: "I received a letter from Mr. [Alfred] Newton on Friday last, referring me to Temminck's 'Planches coloriés,' No. 416, which I examined next day, and find that Temminck's figure exactly represents Mr. Newcome's bird [i.e. the Capped Petrel]." And he goes on to say that he has been to the British Museum and has had the help of Mr. George Gray and A. D. Bartlett in identifying the Norfolk Petrel.

For many years Mr. Newcome lived at Feltwell Hall, near Brandon, where the writer has a delightful recollection of being introduced to his fine collection of birds, and here he passed away, in 1871, at the age of sixty-one.

JOSEPH WOLF.

Wolf, the great artist, may certainly claim to have been another of Stevenson's friends, for some beautiful plates in "The Birds of Norfolk" were the product of his artistic brush. Two of the best of them, viz., Paget's Pochard, now recognised as a hybrid, and the Capped Petrel before alluded to were not issued until the publication of the third volume after Stevenson's death. In June, 1872, Wolf was taken by Mr. Stevenson to see the Black-headed Gulls on Scoulton Mere, Professor Newton also being one of the party, and he then drew the inimitable sketch which forms so suitable a frontispiece to the third volume of "The Birds of Norfolk."

ABRAHAM BARTLETT.

Abraham D. Bartlett could hardly be called more than an occasional correspondent of Stevenson's, but he was doubtless acquainted with him. Whether Bartlett ever showed him his model of the Dodo, which was destroyed by fire in 1866, does not appear, but I can remember it. The bill and head were an exact model of the Oxford specimen, very carefully done after the skin had been soaked in water and turned back by Dr. Melville. (See Letter to H. E. Strickland in "Wild Animals in Captivity," (1898), by Mr. Bartlett's son.)

Bartlett was a man of great originality, and always ready for a chat about birds or beasts with any kindred spirit. In spite of the great knowledge he possessed, he was a learner to the last, and at the same time very good in imparting information to a beginner, which I remember with gratitude. He once told me that he could recollect as a young man going to see several Great Auks—seven or eight at least—at the shop of a dealer named Tucker, somewhere in Regent Street. It was probably one of these Auks which was offered to my father, who must have known Bartlett before he became Superintendent of the Zoological Gardens. Unfortunately, he refused it, but Bartlett bought one of them for himself, and afterwards re-sold it to Mr. Troughton. It is quite likely that our Museum specimen came from the same source, for Professor Newton was unable to trace it beyond Leadbeater, a London taxidermist. (See N. & N. Nat. Trans., Vol. IX., p. 215).

FRANK NORGATE.

No enumeration of Norfolk naturalists would be complete without the name of Frank Norgate, a man who as an outdoor observer had few equals, but he had not much taste for literary work. The last time I saw Norgate was in March, 1899, when he invited me to go to Bury St. Edmunds and have some of our old bird-talks, but he was in very poor health, and too feeble to walk back to the station afterwards. Fond of writing letters, he was in frequent communication with some of the

leading naturalists of the day, who freely admitted the extent of his knowledge, and he was even able to afford assistance to Charles Darwin, some of whose replies are in the hands of his widow.

On the day of my visit many of his best egg-drawers were brought out, and he also showed his large collection of Neolithic flint implements. Among the eggs I particularly recall three well-marked Kites', several fine Buzzards', three clutches of Norfolk-taken Hobbies', now so rare, and good sets of various Ducks' eggs, Gadwall, Shoveller, etc., mostly with the down, from West Tofts and Foulmere, as well as a large series of Stone Curlews' eggs, one pair of which were lying when found, beside a couple of Ringed Dotterel's eggs. And lastly, what he most prided himself upon, his Cuckoo drawers, containing *inter alia* two or three dwarf eggs, of the identity of which he felt no doubt, though their determination by any one else might have been open to question ; but Norgate knew more about Cuckoos' eggs than any man living. Some of his Norfolk Cuckoo notes have been published in our sixth volume, and very remarkable they are, although now superseded by the observations of later workers. After its owner's death, this fine collection was disposed of to Mr. G. Jefferies, for £140, by no means an adequate sum for it.

Although very much crippled from boyhood by asthma, a complaint which he was never able to shake off, he lived to the age of seventy-six, thanks to an outdoor life and very temperate habits at all times.

JOHN HENRY GURNEY.

I hope I may be permitted to say something of my father, as he was one of the founders of our Society, and also of the British Ornithologists' Union, where his name stands sixth on the roll of original members. I know that he was present at the first meeting in 1858, but how far he attended subsequently I am unable to say. Before he was 20 he had formed the acquaintance of William Yarrell, at that time looked up to as the *doyen* of ornithologists, and no doubt it was with some

hesitation that he made more than one call at the bookseller's shop in Ryder Street, which still bears the well-known naturalist's name.

By Yarrell's advice, given apparently in 1834, he bought the "Manuel d'Ornithologie" of Temminck (whose museum at Leyden he is believed to have visited in 1842), and no doubt found it a useful book of reference, though not in the English language. Yarrell's well-known work, the "History of British Birds," was at that time in preparation, the first part appearing in 1837, and evidently a considerable number of communications were received by the author from his youthful Norfolk correspondent. These letters are lost, but some of Yarrell's replies are in my possession. But Mr. Gurney's principal efforts were directed to the study of Hawks and Owls, two groups which had not received much attention up to then, and which he now began to work at in earnest. A story is told in the "Historical Accounts" of the Natural History Museum of how his attention became first drawn to the birds of prey. After terming him "the greatest authority on the *Accipitres* of his day," the narrator, Dr. Bowdler Sharpe, proceeds to give the following anecdote (Historical Accounts of The Natural History Museum. Dept. of Zoology, ed. by Dr. R. B. Sharpe, p. 378):—When it was resolved by the Zoological Society in 1885 to give up their museum, and confine themselves entirely to live birds, an agent was entrusted by Mr. Gurney, on behalf of the Committee, with some money to buy a selection of the birds for the Norwich Museum, which was then rising into some prominence. The sale commenced in the customary sequence with the *Accipitres*, which in those days always stood at the head of any arrangement, and the agent bid with diligent persistence until all his money was gone, with the result that he bought only birds of prey. With this foundation to start upon, Mr. Gurney determined to devote himself for the present to a special study of these birds, to the neglect of other groups, and thus was commenced the celebrated collection at Norwich.

After some years of ill-health he passed away on April 20th,

1890, at the age of seventy. The collections in the Norwich Museum were constantly in his mind to the last, and only ten days before his death he presented an example of *Scops Kennicotti* and a *Tinnunculus sparverius* from British Columbia, the last of a long series of donations.

RICHARD LUBBOCK.

Among the friends of Henry Stevenson must he counted the Rev. R. Lubbock, of Eccles, who devoted much of a life of seventy-eight years to sport and ornithology. His "Fauna of Norfolk" contains a description of the decoy and its working, which has been so often quoted that it has become almost a classic in natural history. This meritorious "Fauna" was founded on a series of lectures delivered in 1844, the originals of which—without the subsequent emendations—are preserved in the Castle muniment room. The task of editing a second edition in 1879 was entrusted to Mr. Southwell, and in reviewing it the editor of "The Field" comments on the high character of Lubbock's work and the thorough manner in which Southwell had done his part in the re-issue.

In 1872 Lubbock was elected an honorary member of the Naturalists' Society, and we have in the Museum his letter addressed to Mr. Stevenson acknowledging the honour paid to him on that occasion. A good many of Lubbock's MS. notes are preserved, and in the possession of his nephew, Sir Hugh Beevor, who prizes them highly. One of them refers to a bird once common, now very rare, the Kite, of which he says: "Scarce in this district, and hardly ever to be found breeding in our woods. . . . In March, 1849, I observed one of these birds near Wymondham, the first I had seen for many years." Apparently, when a younger man, he was accustomed to meet with the Kite. Of the Little Auk he makes rather a singular observation, to the effect that "Miss Lloyd, of Martlesham, Suffolk, is in possession of one of these birds, taken from the belly of a dogfish."

Of the Great Auk: "Becoming very scarce and valuable as a specimen in a collection. Mr. Lombe valued his at seven

guineas." Beneath this, in pencil, is an addition by Stevenson, written in 1877, to the effect that the price had gone up to £100. This was the Great Auk which is now in our Museum, one of the finest examples known, and worth a great deal more than £100 to-day. Its plumage is, fortunately, but very little faded, and as long as it is kept from the light its value can hardly be less than £400, although not quite that sum has been reached for a specimen at present; the egg selling proportionately for a good deal more than the bird.

WILLIAM R. FISHER.

W. R. Fisher was the joint author of the first complete published list of Norfolk birds, "An Account of the Birds found in Norfolk." In 1881 a copy of this little book sold for four guineas. But there is only one member of our Society living who knew him, and that is Sir Digby Pigott, who has given us some of his recollections this evening.

Fisher was the son of a solicitor at Great Yarmouth, and became himself a rather eminent barrister, practising in London, where he brought out a book on mortgages, which is still consulted. He possessed considerable skill as an artist, and drew several illustrations for the *Fev. F. O. Morris*, to whom he lent a copy of his Norfolk catalogue, which is in Sir Digby Pigott's possession. His name is generally associated with Paget's Pochard, now regarded as a hybrid, of which he may be said to have been the discoverer.

ROBERT RISING, 1801-85.

SIR EDWARD NEWTON, 1832-1897.

Of these ornithologists it is unnecessary to do more than refer to their published memoirs in our Transactions (*see N. & N. Nat. Trans.*, Vol. VI., p. 79 & 409). In 1862 Edward Newton presented four species of birds of prey from Madagascar, and one from the Seychelles, to the Museum, all of which were new to the collection. My father in a letter to Mr. Reeve at the time remarks that only one of them (*Accipiter francesci*) was

to be seen in the British Museum, though no doubt plenty have found their way there since.

JOHN SAYER.

Sayer was a Norwich bird-stuffer, who had many rare birds through his hands. His shop, which adjoined Mayes' Court in St. Giles' Street, was consequently a frequent resort of Stevenson's, and it was there that some of his best records and notes were acquired. Sayer died in 1866, at the age of fifty-one, and was buried in the Rosary Cemetery, where his grave is still to be seen.

THOMAS KNIGHTS.

Stevenson also employed a bird-stuffer named Knights, whose shop was in King Street, though he afterwards moved to St. George's Street. Knights likewise received many Norfolk-killed varieties, and besides working for Stevenson, stuffed many of the birds now in the Museum; but as he gave up using arsenic as a preservative, his specimens have not in all cases withstood moth. With him this list of worthies may appropriately come to an end, but we must not altogether leave out

NORFOLK BIRD-MEN WHO ARE STILL LIVING.

We are fairly entitled to consider the strides which British Ornithology has made since the inauguration of the Norfolk and Norwich Naturalists' Society as largely due to the enterprise of men like Henry Stevenson, Southwell, the two Newtons, and others who belonged to it. The friends of Henry Stevenson have passed away to another land, but there still remain plenty of staunch men, and in saying this no doubt there will come before your minds the well-known names of Arthur H. Patterson, H. N. Pashley, E. C. Saunders, B. Dye, W. G. Clarke, T. E. Gunn, J. Vincent, M. C. Bird, Miss E. L. Turner, C. Ticehurst, S. H. Long, B. B. Riviere, R. Gurney, Sir T. D. Pigott, N. Tracy, W. H. Tuck, H. Wormald, C. Borrer, and several others.

To these naturalists is bequeathed a heritage and a task—the heritage of all the good work their predecessors have accomplished, the task of augmenting further the reputation of their mother county, and of making the next fifty years as profitable to science as has been the half-century which recently came to a close.

II.

ON THE SURFACE AND DIP OF THE CHALK IN NORFOLK

WITH NOTES ON THE UNCONFORMITY OF THE TERTIARY
DEPOSITS AND THE CHALK SURFACE IN THE
EAST OF ENGLAND*

BY P. G. H. BOSWELL, A.R.C.Sc., D.Sc., M.I.M.M., F.G.S.,
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I. INTRODUCTION AND LITERATURE.

Economic geology in East Anglia—since the probability of the absence of Coal Measures in Norfolk and Suffolk has been realised—is usually confined to considerations of soils and agriculture, brick and pottery manufacture, and water-supply questions. From the point of view of the last, undoubtedly the most important geological formation which occurs in the East of England is the Chalk; it yields (except in cases which are dealt with later) an abundant supply of excellent water, the hardness of which is rarely objectionable, and can be treated or tolerated at will. The formation is also less important economically as providing a dressing for land, as a source of lime, and for the making of Portland cement.

* This paper was prepared for publication early in 1914, but has been held up by the War. The boring records were brought up to that date. Few wells and borings have, however, been put down since, for all such operations were suspended during the War.

Towns and villages in Norfolk have been using water obtained by sinking shallow wells into the Crag and Glacial Beds above the Chalk to a greater extent than those in Suffolk and Essex. A greater thickness of the former deposits occurs in Norfolk than in Suffolk, and, being an excellent natural filter, these beds provide good water where freedom from surface drainage and contamination can be ensured. The supply of water from this source is, however, much more limited in quantity than from the Chalk, and this fact, together with the desire to avoid any chance of contamination, has ensured that a greater proportion of wells and borings made in recent years have pierced the Chalk.

It is undoubtedly owing to the slow accumulation of boring records giving data about the Chalk surface, that no map showing the form of the Chalk surface in Norfolk has hitherto been published.† As long ago as 1891, Mr. W. H. Dalton, of H.M. Geological Survey [Essex Naturalist, Vol. V., 1891, p. 113, and plate III.], prepared a map of Essex showing the contour-lines for the surface of the Chalk (referred to Ordnance datum). In 1913, Dr. L. J. Wills, in a Water Supply Memoir on the London area [London Wells. L. J. Wills and G. Barrow, Mem. Geol. Surv., 1913] published a similar map of the district under consideration. At almost the same time, the writer published maps of Suffolk [Notes on the Chalk of Suffolk. Journ. Ipswich & Distr. Field Club, Vol. IV., 1913, pp. 17-26. On the Age of the Suffolk Valleys, etc. Q.J.G.S. Vol. 69, 1913, p. 597.], prepared some two years previously, showing the Chalk-surface contours and the unconformity of the Eocene deposits. The value which the maps and accompanying information as to the dip and surface of the Chalk proved to water-engineers and others in recent undertakings in Suffolk, induces him to put forward here a similar map of Norfolk, together with a few remarks about the Norfolk Chalk.

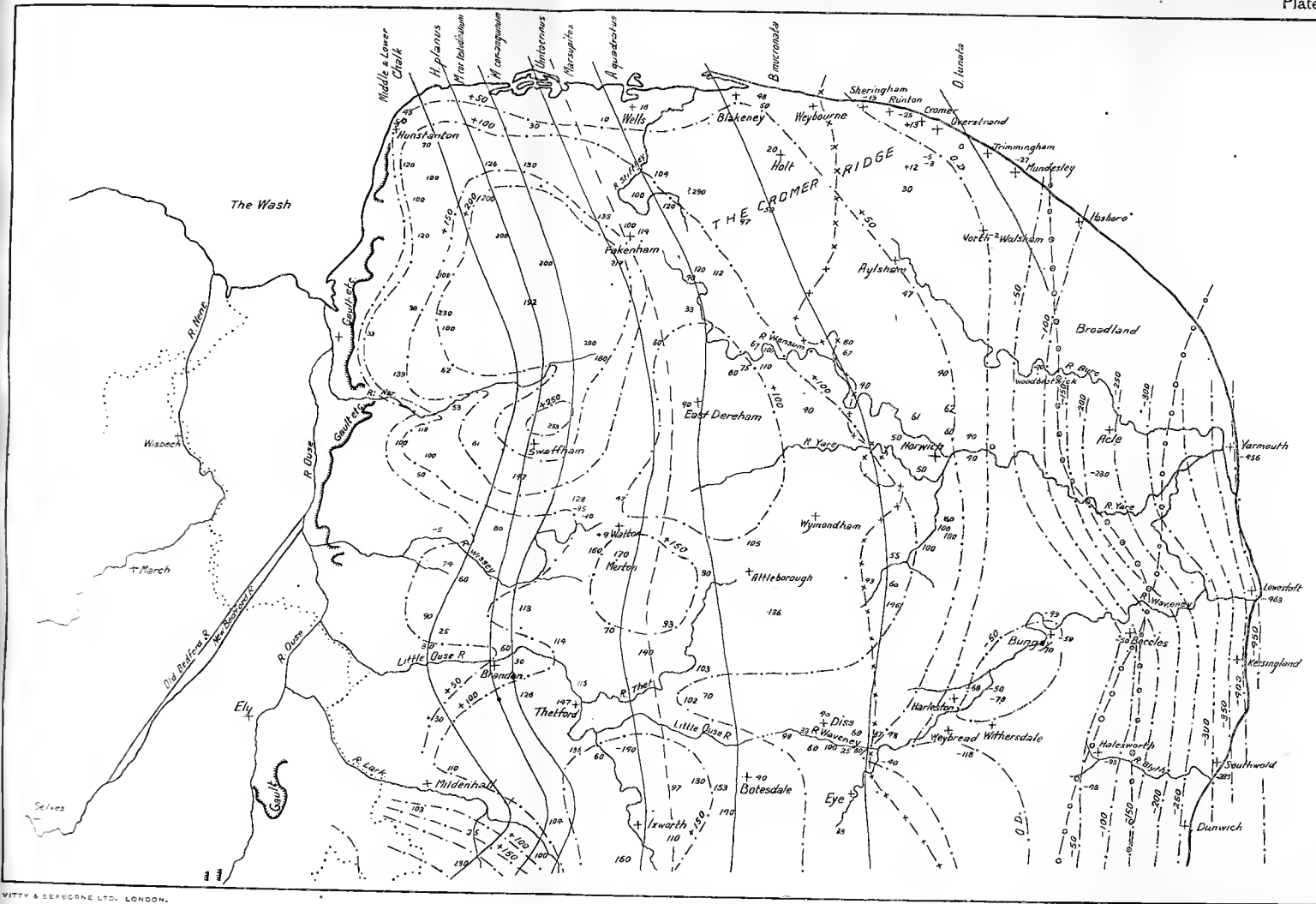
†My friend Mr. F. W. Harmer, M.A., F.G.S., attempted to make a sub-drift contoured map of Norfolk, but owing to the unsatisfactory divisions of the beds in well records, etc., abandoned the attempt as of little value.

LITERATURE.

The records of wells and borings in Norfolk have not yet been collected together in a volume on Water Supply in the series being issued by the Geological Survey, although it is hoped that the county will be dealt with in the near future. Most of the earlier accounts of wells, etc., were collected together and published in the Sheet Memoirs of the Geological Survey. [Memoirs on Sheets, 50, 51, 65, 66, 67, 68 and 69] These included notes on wells and borings by J. Taylor [Proc. Geol. Soc., II., 93 (1838), and Trans., Ser. II., Vol. I. (1824), pp. 374-378], Sir J. Prestwich [Q.J.G.S., Vol. XVI. (1860), p. 449 (Yarmouth boring)], C. B. Rose [Proc. Geol. Assn., Vol. I. (1862), p. 226], J. Gunn [Proc. Geol. Assn., Vol. III. (1872), p. 117 (Dip of the Norfolk Chalk)], W. Whitaker [Proc. Norwich Geol. Soc., Vol. I., pp. 16 and 250], J. H. Blake [Proc. Norwich Geol. Soc., Vol. I. (1880), p. 126], and C. Reid [Proc. Norwich Geol. Soc., Vol. I. (1880), p. 129 (Cromer Waterworks)] The first discussion of the stratigraphical divisions of the Chalk of Norfolk other than the three-fold divisions adopted by S. Woodward [Hard Chalk, Medial Chalk, and Soft Chalk, (Geology of Norfolk, 1836)] and Mr. W. Whitaker [Upper Chalk with flints, Middle Chalk with few flints, and Lower Chalk] was published by Prof. Ch. Barrois, in his classical paper in 1876 ["Recherches sur le Terrain Crétacé Supérieur de l'Angleterre et de l'Irlande." Lille, 1876]. A notice and summary of this paper was published in the Proc. Norwich Geol. Soc., Vol. 1 (1878), p. 35. In the same volume, A. J. Jukes-Brown wrote upon "The Sub-divisions of the Chalk" (1880, p. 113), and H. B. Woodward contributed "Notes on the Norfolk Chalk" (1882, p. 239), in which papers approximate thicknesses are given of certain of the zones as calculated from the dip and breadth of the outcrops.

II. THE FORM OF THE SURFACE OF THE CHALK.

Of the 406 wells and borings which have been put down in Norfolk up to the end of 1914 (those which have not yet been published being added in an appendix to this paper), a large



Approximate Boundaries of Chalk Zones

Position of Base of Chalk

+50
Chalk Surface Contours in feet

Boundary of Lower London Tertiaries

Boundary of London Clay

Boundary of Crag

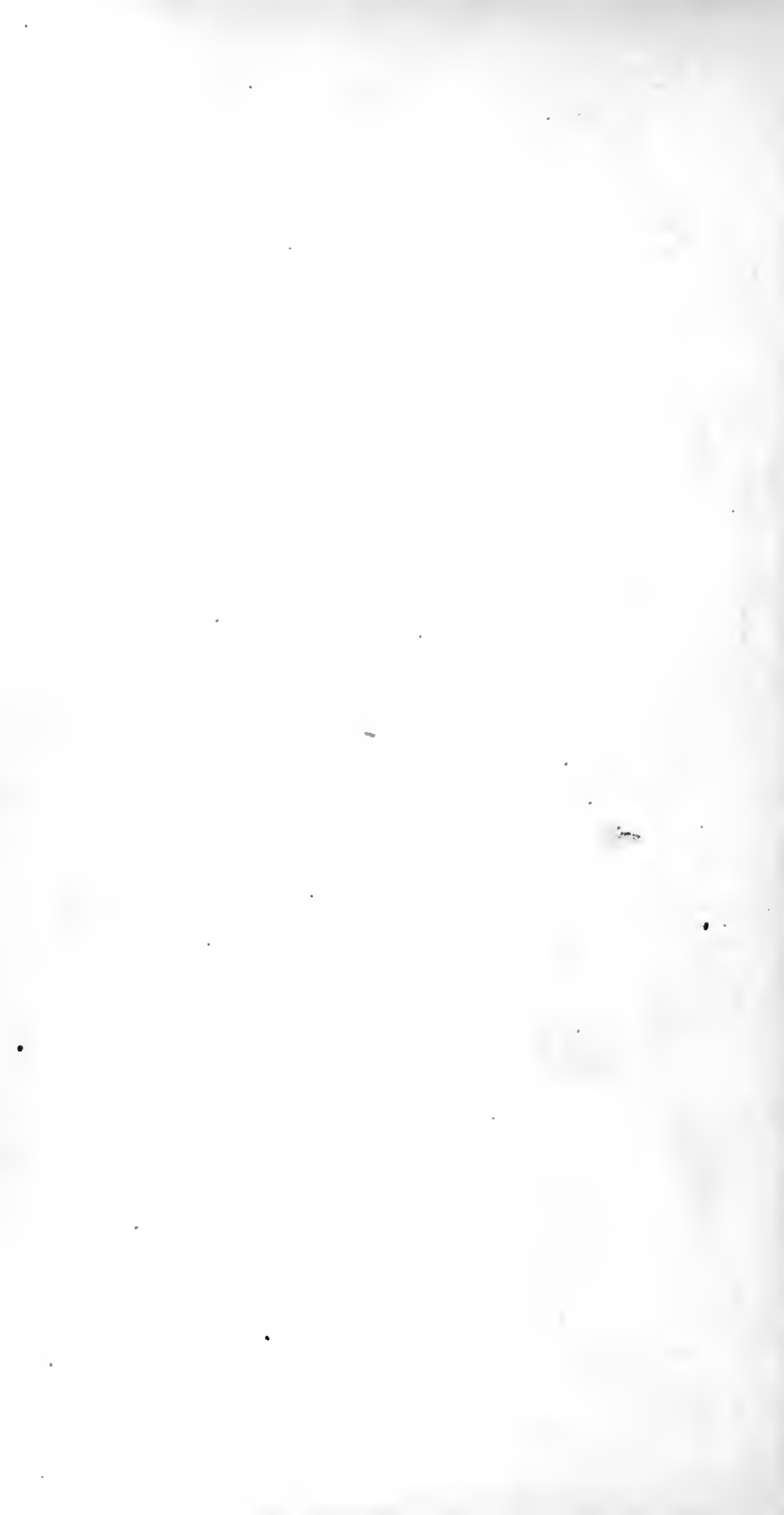
County Boundary

MAP OF NORFOLK

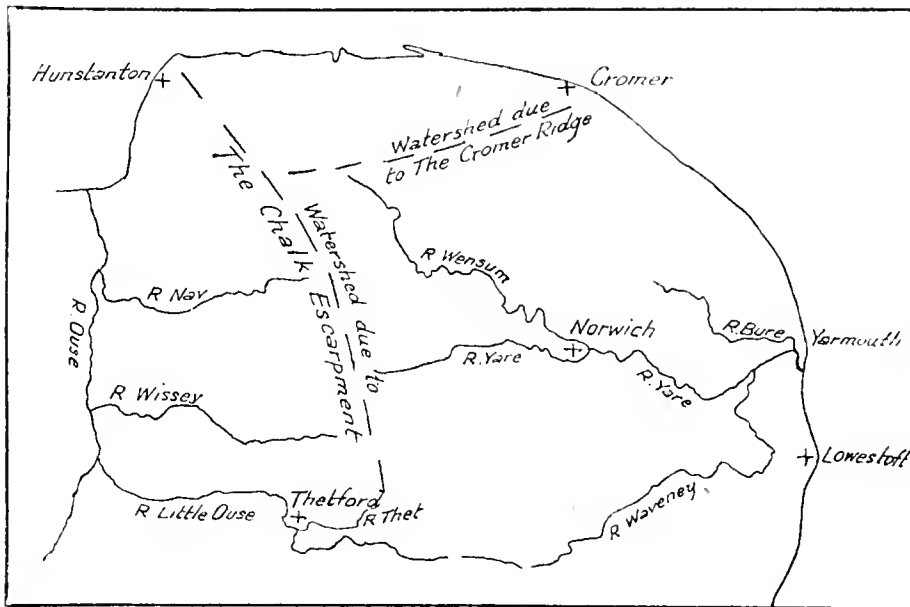
showing contours for the surface of the Chalk and the distribution of Chalk zones and Eocene and Pliocene deposits.

Scale 8 miles to the inch.

NOTE.—The zonal boundaries are approximate, they have not been made to "V" in the valleys.



proportion, namely 264 (65 per cent.), do not reach the Chalk, being mainly in Drift; 131 (32 per cent.) are driven into Chalk, often through overlying beds; and 11 (2.7 per cent.) are sunk into beds lower than Chalk. The proportion of wells in Glacial, Crag, and Eocene deposits is larger for Norfolk than for Suffolk and Essex, so that our knowledge of the form of the Chalk-surface in Norfolk is relatively less definite. The time, however, seems to have arrived for the first approximation, such as the map, Pl. 1, indicates. The numerals indicate the height of the Chalk-surface referred to Ordnance datum, the prefixed negative sign indicating depths below.



Scale: About 20 miles to 1 inch

Fig. 1. Sketch-map of Norfolk, showing the present Watersheds and River-systems.

Contour-lines at intervals of 50 feet have then been drawn, in part by interpolation, which is a method involving least error.

Approximate as these Chalk-surface contours are, many interesting points are brought out by the map. The present watersheds of Norfolk consist mainly of two divides almost at right angles, (a) the Chalk escarpment running a few degrees

West of North, (*b*) the Cromer Ridge of Glacial Drift, with an alignment W.S.W.—E.N.E. (see Fig. 2). Of the more important Norfolk rivers, the Wensum and the Yare rise on the east of the Chalk escarpment, whilst the Bure and other smaller streams have their source in the Cromer Ridge. The Nar and Little Ouse are obsequent streams breaching the Chalk escarpment. When, however, the overburden of Tertiary Beds is removed from the Chalk and the surface of the latter revealed, we find that the Cromer Ridge has been wiped out of existence (although the highest parts of Norfolk to-day are located upon it), and the Chalk escarpment forms the only “watershed.” This fact emphasizes Messrs. Wood and Harmer’s contention of the origin of the Cromer Ridge as a bank of Glacial *débris* (“the terminal moraine of the North Sea Ice-sheet”). Although these hummocks reach a height of over 300 ft. and are probably as thick, they are purely a surface feature.

In order to understand the form and trend of the Chalk-surface contours in Norfolk, it is necessary to trace them into adjoining counties. The Chalk escarpment is seen to be breached in a marked manner at two places, (*a*) the Wash Gap, (*b*) the Little Ouse-Waveney Gap, each where the strike of the Chalk changes, and where geographical conditions seem to have determined the early county boundaries. At the Wash the Chalk changes in strike from almost N.W.—S.E. in Lincolnshire and Yorkshire, to N.N.W.—S.S.E. in Norfolk, and at the Little Ouse—Waveney depression, to N.—S. in mid-Suffolk. In South Suffolk the strike swings round to E.N.E.—W.S.W., the important estuaries of the Deben, Orwell, and Stour marking the point at which the change occurs. Large rivers and valleys occur at each of these “points of deflexion” in the escarpment, and the suggestion may be advanced that the change of strike (and of dip frequently, in amount as well as direction) is possibly due to the bending of the Chalk over “knees” of the Palæozoic floor beneath, during the great post-Eocene earth-movements. Owing to the absence of Mesozoic sediments and to the presence

of only a small thickness of Lower Cretaceous rocks, the Palæozoic floor occurs at no great depth under the Norfolk Chalk.*

Lines of weakness were thus developed where the strike changed, with the production of through-valleys, such as that of the Waveney—Little Ouse. Depression of the area has more or less drowned these breaches, as in the case of the Wash, or has turned the lower portions of the valleys into estuaries, as in the cases of the Waveney-Yare and Deben-Orwell-Stour systems, etc. The change in strike of the Chalk is not so well marked in the outcrop of the formation as a whole, as by the alteration in trend of its component zones. These are indicated approximately upon the map, Pl. 1. The distribution of the zones in Norfolk is based on the notes of the officers of the Geological Survey, Prof. Chas. Barrois, Dr. A. W. Rowe, and upon field observations. The writer has had the pleasure of studying the Norfolk Chalk in the field with Dr. Rowe. The distribution of the zones in Mid and East Suffolk is inserted from the writer's own observations, and in the west of the county and Cambridgeshire from the work of Mr. Henry Woods, F.R.S. For the records in South Suffolk and North-West Essex the writer is also responsible.

The through-valley in the Chalk on the southern border of Norfolk is not revealed until the coverings of Crag and Eocene deposits, as well as Glacial Drift, are stripped off. The following table gives the position and details of wells, etc., in the valley, and the evidence on which the contours are plotted.

*At Lowestoft the deepening of the East Anglian Ice Company's boring in 1908–11 revealed :—Chalk, 1050 ft., Upper Greensand, 11 ft., Gault, 45 ft., Lower Greensand, 41 ft., and Palæozoic mudstones, 205 ft.

At Culford (Suffolk), 73 ft. of Gault and 32½ ft. of Lower Greensand separated the Chalk from the Palæozoic floor.

I. TABLE OF BORINGS IN THE NEIGHBOURHOOD OF THE LITTLE OUSE-WAVENEY THROUGH-VALLEY.

Place.	Height O.D.	Depth to Chalk.	Chalk Surface.
	ft.	ft.	ft.
Yarmouth, Lacon's Brewery ...	20	476	-456
Lowestoft, East Anglian Ice Company	12	475	-463
Southwold, Waterworks ...	40	323	-283
Halesworth, West Hall ...	60	152	- 92
Bungay, 7/8ths mile S. of Church	60	130	- 70
Ditto, Broome Place	? 50	150	? -100
Beccles, Waterworks	107	157	- 50
Cantley, ¼ mile S.E. of Station Wheatacre	about 5 60	183	-178
		no Chalk at 229'	below -169
Southwood Oaks	10	240	-230
Ditchingham, Malt Kilns ...	? 40	84	? -44
Harleston, Wood Farm, Needham	120	198	- 78
Ditto, Dr. Candler's	? 70	128	- 58
Bramfield	120	166	- 46
Thorndon, Reformatory ...	120	87	...33
Eye, Brewery, 1887	about 90	90	0
Blo' Norton	about 100	142	- 42
Stuston	31	6	...25
Scole	60	—	...60
Palgrave	140	35	...105
Billingsford, Rectory	142	55	...87
Diss, Aldrich's Mat Factory ...	133	97	...36
Ditto, Waterworks	138	93	...45
Garboldisham, Uphill Farm ...	130	60	...70
Ditto, Flint Hall	162	60	...102
Hoxne, Oakley Park	97	137	- 40
Ditto, Rectory	? 112	163	? - 51
Wortham, Rectory	162	64	...98
Brandon, District Council ...	81	0	...81
Ditto, Park	128	0	...128
Ditto, Hockwold Hall	30	0	...30

The V's in the contours running eastwards up the Little Ouse valley are no doubt in part post-Pliocene, but may in part be earlier in origin. In the eastern portion of the area, that is, in the Waveney Valley, the contours V up the valley westwards under the Pliocene (Norwich Crag, Chillesford Beds, etc.), but this form ceases when the eastern boundary of the Eocene strata is approached near Beccles, with the result that an apparent hollow or closed ring is produced in

the Chalk contours (50 ft. below Ordnance datum). The boundary of the Eocene is thrown down the valley eastwards in a very broad V form (as indicated by the borings at Halesworth, Beccles, Bungay, Wheatacre, Southwood, Cantley, etc.). Under the Eocene deposits the Chalk-surface contours are closely crowded (see later, p. 30), but run fairly directly northwards and southwards. Thus, the evidence would appear to indicate that much of the erosion of this through-valley took place at a post-Eocene date, when the border of the Eocene was thrown down the valley eastwards (though not to a very marked extent, owing to the greater dip of their base and their rapid thickening eastwards). The erosion of the valley was post-Pliocene, for the contours under the Pliocene strata are similar to those of the bare or Drift-covered Chalk; and the denudation may therefore be referred to the Miocene Age, when so much of the existing topography of England was developed, and so many of the larger valley-systems initiated.

III. GENERAL SLOPE OF THE CHALK-SURFACE.

The contoured map (Pl. I) indicates that the Chalk-surface reaches its greatest height above sea-level in the west of the county, forming a ridge running N.N.W.—E.S.E. from south-east of Hunstanton, near Swaffham and Watton, towards Ixworth, in Suffolk. The ridge, however, is not continuous, being broken up by the valleys of the Wissey and Thet-Little Ouse system. The Nar does not cut entirely through it. The highest portion of the ridge appears to be a small oval hill, just over 250 ft. above Ordnance datum, on the north-east of Swaffham, in approximately the zone of *Micraster cor-testudinarium*. The contours indicate that, except for local variations, the surface slopes somewhat gradually both eastward and northward, but east of Norwich, near the western boundary of the Eocene, the crowding-up of the contours shows that the slope of the Chalk-surface has considerably increased. The form of the surface where covered by Pliocene deposits (Crag, etc.), east of the boundary shown on the map,

is rather similar to that where the Chalk is bare or merely covered by Glacial Drift; certainly it does not show such a rapid increase of gradient as in the sub-Eocene portion. Even allowing for subsequent solution of the Chalk surface, the inevitable conclusion is that the important erosion of the Chalk, producing the slope of lower gradient, was post-Eocene and pre-Pliocene.

Some of the gradients of the Chalk-surface, where it is not covered by Eocene deposits, may be estimated from the following figures (referred to Ordnance datum):—

Merton (160 ft.) to Norwich (50 ft.): 110 ft. in 22 miles,
or about 5 ft. per mile E.N.E.

Merton (160 ft.) to Woodbastwick (-80 ft.): 240 ft. in
28 miles, or about 8 ft. per mile E.N.E.

Toftrees (217 ft.) to Cromer (0 ft.) or N. Walsham (-2 ft.):
217 ft. in 22 miles, or nearly 10 ft. per mile E.N.E.

Buckenham (136 ft.) to Beccles (-50 ft.): 186 ft. in 21
miles, or nearly 9 ft. per mile due E.

The general average of these gradients is rather higher than that of the similar ones in South Norfolk [Journ. Ipswich and Dist. Field Club. Vol. IV., 1913, p. 18.], where the figure is nearly 7 ft. to the mile, that is, about 1 in 760.

The steeper slope under the Eocene deposits yields the following gradients:—

Beccles (-50 ft.) to Lowestoft (-463 ft.): 413 ft. in 8
miles, or nearly 52 ft. per mile E.N.E.

Southwood (-230 ft.) to Yarmouth (-456 ft.): 226 ft. in
8 miles, or over 28 ft. per mile, slightly S. of E.

(The greatest slope of the sub-Eocene surface is clearly becoming more north-easterly here, so that the line connecting these borings is not along the true dip.)

Cantley (-175 ft.) to Yarmouth (-456 ft.): 281 ft. in 9
miles, or 31 ft. per mile, eastwards.

(Again not the direction of true dip.)

With these may be compared the similar gradients in Suffolk:—

Framlingham (55 ft.) to Leiston (-239 ft.) or to Orford (-204 ft.), *i.e.*, about 24 ft. per mile, E. or E.S. Eastwards.

Thus, the gradient of the ultra-Eocene Chalk surface is :—
about 1 in 590 (about $1/10^\circ$).

and that of the sub-Eocene surface :—

about 1 in 160 (about $1/3^\circ$), the slopes of both being generally Eastwards.

The slightly greater spacing-out of the Chalk-surface contours under the Eocene in East Norfolk, relatively to those in East Suffolk, may be due to the fact that in the latter area, Lower London Tertiaries, and in the former area, London Clay, probably rests upon the Chalk. [For a discussion of the interpretation of the beds recorded in the East Norfolk Wells, see *Quart. Journ. Geol. Soc.*, Vol. LXXI., for 1915 (1916), p. 543.]

The approximate line at which the surface of the Chalk is at sea-level is indicated upon the map and is marked O.D. In this connection it is interesting to quote a note made by Messrs. Wood and Harmer as long ago as 1877 [*Quart. Journ. Geol. Soc.*, Vol. XXXIII. (1877), p. 90.]—"About midway in the course of the river [Bure] the Chalk disappears, and the base of the Contorted Drift sinks below the water-line of the country. This is in consequence of the eastwardly dip of the Preglacial floor, the Chalk disappearing below the water-level to the east of a line drawn from a point about four miles east of Norwich to the coast near Mundesley."

IV. THE DIP OF THE CHALK.

The Rev. John Gunn, who contributed so much to our knowledge of Norfolk geology, discussed the dip of the Chalk as long ago as 1872 ["On the Dip of the Chalk in Norfolk, and the Remains of Old Land Surfaces called the Stone Bed." *Proc. Geol. Assn.*, Vol. III. (1873), p. 117], with the scanty evidence then available. He gave a section of the Chalk and Eocene strata across Norfolk, in which he showed the Chalk thickening eastwards from Hunstanton to Norwich

and bevelled off by the Tertiary Beds on the East. He estimated the dip of the Chalk surface from Norwich to Yarmouth to be 526 ft. in 18 miles, or 29 ft. to the mile. As pointed out in Section III. of this paper, two different gradients, (*a*) the smaller one under the Crag, (*b*) the greater one under the Eocene, are included and confused in this estimate, which is therefore intermediate in amount between the two. Gunn estimated the dip of the Chalk Marl (at the base of the Chalk formation) to be 36 ft. in $1\frac{1}{4}$ miles in the neighbourhood of Hunstanton, and from that town to Norwich to be 1152 ft. in 40 miles; in each case a result of about 29 ft. to the mile. Thus, an apparent parallelism between the base and surface of the Chalk was indicated, but in the light of more recent information this is hardly correct.

The wells and borings in beds lower than Chalk occur at Castle Rising, Crimplasham Hall, Stow Bardolph, Sandringham, West Dereham, Middleton, Lynn, Gaywood, Downham Market, and Dersingham, and those piercing Lower Chalk and beds below are found at Stoke Ferry, Marham, Holkham Hall, Gayton, and Narborough. Deep borings passing through the overburden of Tertiary strata and through an almost complete thickness of Chalk into beds below, occur at Norwich (Carrow Works) and at Lowestoft (East Anglian Ice Co.'s Works) just across the county border, in Suffolk.

From these wells, etc., we obtain the following data for the dip of the *base* of the Chalk :—

Stoke Ferry (–25 ft.) [*i.e.* the base of the Chalk is 25 ft. below Ordnance datum.] to Lowestoft (–1518 ft.); 1493 ft. in 52 miles, or nearly 29 ft. per mile, direction slightly S. of E.

Stoke Ferry (–25 ft.) to Norwich (–1155 ft.); 1130 ft. in 32 miles, or over 35 ft. per mile, direction N. of E.

Gaywood (+13 ft.) to Lowestoft (–1518 ft.); 1531 ft. in 58 miles, or over 26 ft. per mile, direction E.S.E.

Gaywood (+13 ft.) to Norwich (–1155 ft.); 1168 ft. in 37 miles, or nearly 32 ft. per mile, direction S. of E.

Marham (+25 ft.) to Norwich (-1155 ft.); 1180 ft. in 32 miles, or nearly 37 ft. per mile, due E.

Narborough (-35 ft.) to Norwich (-1155 ft.); 1120 ft. in 30 miles, or 37 ft. per mile, direction S. of E.

Narborough (-35 ft.) to Lowestoft (-1518 ft.); 1483 ft. in 58 miles, or over 25 ft. per mile, direction E.S.E.

Hunstanton (+50 ft.) to Holkham Hall (-741 ft.); 791 ft. in $13\frac{1}{2}$ miles, or 59 ft. per mile, E.

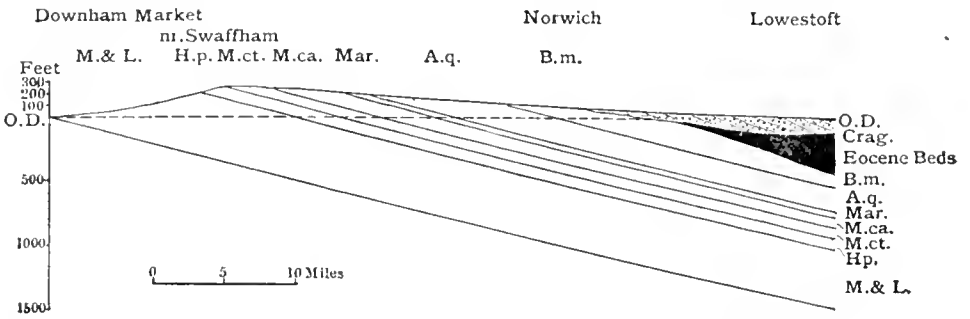
With these may be compared, just across the county boundary —

Culford (-422 ft.) to Lowestoft (-1518 ft.); 1096 ft. in 46 miles, or nearly 24 ft. per mile, E.N.E.

The strike of the Chalk zones in Norfolk serves to indicate that the direction of true dip is not that which gives the lower results obtained above; moreover, the apparent dip cannot be greater than the true dip, so that we may take something about 35 ft. per mile as the dip of the base of the Chalk. In Suffolk the south-easterly or east-south-easterly dip of the Chalk Marl at the base is only 16 ft. per mile, hence the dip not only changes in direction but in amount also, near the county boundary.

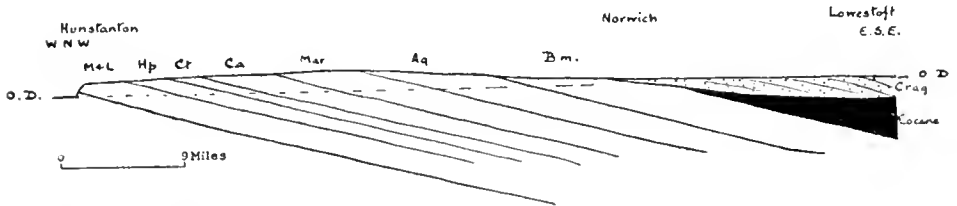
It may be assumed for the present (there being no evidence to the contrary) that the various zones of the Chalk dip at approximately the same rate as the Chalk Marl, for the parallel-sided outcrops of the zones do not indicate any thinning, neither is there transgression of one zone over others. As the slope of the Chalk surface, where it is bare or covered by Pliocene and later beds, is about 8 or 9 ft. to the mile, and that of the zones about 35 ft., the successively older zones crop out as we travel westwards (Figs. 3 and 4). They appear only slowly, however, having broad outcrops, but they crowd in towards the west and on the scarp face when lower zones are reached. This is partly due to the thinning of the latter in Norfolk. In Suffolk the zones are more evenly spaced across the county, that of *Micraster cor-anguinum* being reached at Bury St. Edmund's. Under the Eocene the Chalk-surface

gradient appears to be about 30 ft. to the mile (excluding the much greater slope of 52 ft. to the mile from Beccles to Lowestoft in the through-valley, an increased gradient which may indicate a filled-up pre-Eocene valley, or a subsequent local sagging of the Chalk and Eocene deposits).



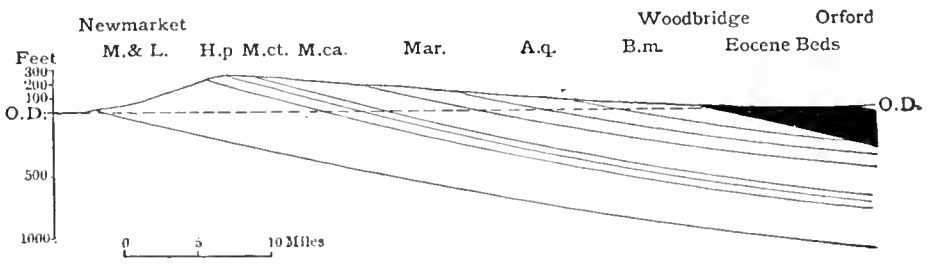
Scale.—Horizontal - About 17 miles to 1 inch. Vertical - 2000 feet to 1 inch.

Fig. 3.—Section across Central Norfolk from Downham Market to Lowestoft.



Scale.—Horizontal - About 18 miles to 1 inch. Vertical - 2000 feet to 1 inch.

Fig. 4.—Section across Norfolk from Hunstanton to Lowestoft.



Scale.—Horizontal - About 17 miles to 1 inch. Vertical - 2000 feet to 1 inch.

Fig. 5.—Section across Suffolk (to scale) showing the Chalk Zones and their bevelment by Eocene Deposits.

Thus the sub-Eocene floor and the base of the Chalk are almost parallel, and no higher zones would occur under the Eocene deposits and be transgressed by them. For bevelling of the zones to take place as in south-east Suffolk (Fig. 5), the sub-Eocene floor must have had a greater dip than the zones.

The sections in Figs. 3, 4, and 5 indicate the difference in this respect between Suffolk and Norfolk, due to the increased dip of the Chalk in the latter county. In Suffolk, the dip of the Chalk zones is about 16 ft. to the mile, of the ultra-Eocene

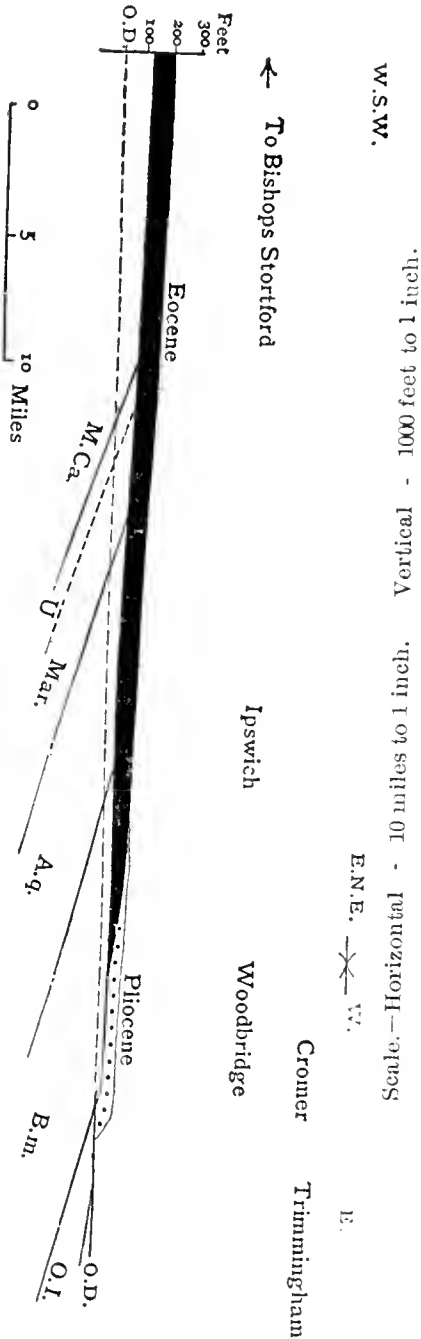


Fig. 3. Section across East Anglia showing the unconformity of the Tertiary Beds upon the Chalk (the dip of the zones is diagrammatic).
 In Figs. 3, 4, 5, and 6, M. & L. = Middle and Lower Chalk; H.p. = Zone of *Holaster planus*;
 M.ct. = *Micraster cor-testudinarius*; M.ca. = *Micraster cor-anguinum*; U. = *Uintacrinus*;
 M. = *Marsupites*; A.q. = *Actinocamax quadratus*; B.m. = *Belemnitella mucronata*; O.I. =
Ostrea tenuata.

Figs. 3, 5, and 6 are reproduced from the Q.J.G.S., Vol. lxxi., for 1915, by permission of the Council of the Geological Society.

Chalk-surface 7 ft. to the mile, and of the sub-Eocene Chalk-surface 30 ft. to the mile [Journ. Ipswich & Dist. Field Club, Vol. IV. (1913), pp. 19-21]. Reasoning upon the data given by

wells, etc., and observed outcrops and sections, the writer ventured to state that the zones in Suffolk were bevelled off by the Eocene deposits, which therefore transgressed the various zones vertically as well as horizontally across the county. If, therefore, a small thickness of the top zone, *Belemnitella mucronata*, had not cropped out in the Gipping Valley, this zone would not have reached the surface in Suffolk. As it is, its extent under the Eocene deposits was predicted to be small, because farther eastwards the zone of *Actinocamax quadratus* would again underlie the Tertiary rocks. This prediction was verified later by the sinking of a well through Pliocene and Eocene strata into Chalk at Rushmere, three miles east of Ipswich, where every indication pointed to the absence of the zone of *B. mucronata* and the presence of that of *A. quadratus*.

In Norfolk, however, occurs the best development of the *mucronata*-zone in England. It is of considerable thickness at Norwich, and is probably not bevelled off to any very great extent by the Eocene deposits. It continues eastwards under them, unless overlain by higher zones beneath the floor of the North Sea, reappearing on the other side of the basin in Denmark.

Knowing the dip of the Chalk zones in Norfolk and the breadths of their outcrops, we can obtain an approximate idea of their thicknesses. Mr. R. H. Rastall has discussed the thickness of the Middle and Lower Chalk in West Norfolk [Geology in the Field. Geol. Assoc. Part I. (1910), p. 164], but he deals only with the country north of Lynn, *i.e.* practically speaking, the Hunstanton area, where a notable thinning of the beds occurs. Figs. 3, 4, and 5 are sections plotted to scale across Norfolk and Suffolk. The thickness of the Chalk proved at Norwich, where it is known from the fauna that some of the top beds are missing, is about 1150 ft., and at Lowestoft 1055 ft. The base of the Chalk is therefore not quite a plane, for the dip lessens to about 18 ft. to the mile from Norwich to Lowestoft, as the basin of the North Sea is approached. It was expected, naturally perhaps, that the

Chalk would thicken to 1200-1300 ft., under Lowestoft, but the recent deepening of the boring there has shown that the Chalk is actually thinning, partly owing to a slight bevelling of the top-zones by the Eocene deposits, and partly owing to the flattening of its base eastwards. The strike of the zones of *B. mucronata* and *O. lunata*, together with this slight bevelling, renders improbable the occurrence of the latter zone under the Eocene deposits at Lowestoft. (See Map, Pl. 1.)

On examination of specimens of Chalk from the well at Mundesley, Clement Reid referred the uppermost 61 ft. out of 103 ft. of Chalk pierced, to the zone of *Ostrea lunata*, on account of the character of the chalk and flints. This agrees closely with the maximum thickness of 70 ft. to 80 ft. here estimated for the zone before it is overlain by Eocene deposits.

The zone of *B. mucronata* is probably about 150-170 ft. thick at Norwich, and before being overlain by the Eocene, may reach a maximum of about 240 ft. The zone is probably thicker in the Cley-Cromer area. The zone of *A. quadratus* is not easy to delimit in Norfolk on account of the scarcity of fossils and the glacial disturbance it has suffered, but it may be estimated at about 230 ft. The late H. B. Woodward estimated the thicknesses of the beds in the Norwich boring to be, zone of *Belemnites* 500 ft., *Marsupites* 200 ft., *Micraster* 100 ft. [Proc. Norwich Geol. Soc., Vol. I. (1882), p. 240]. The zone of *Marsupites* is likely, from the breadth of its outcrop, to be about 140 ft. thick, whilst that of *M. cor-anguinum* narrows from about 7 miles in south Norfolk to 3 miles in the north of the county, corresponding to a probable thinning from over 200 to 100 ft. The zone of *M. cor-testudinarium* is about 50 to 70 ft. thick and that of *H. planus* about the same, or rather more in south Norfolk. The zone appears to become thinner as the result of a roll when traced south-westwards into Suffolk [Journ. Ipswich & Dist. Field Club. Vol. IV. (1913), p. 26.], and also to become attenuated northwards towards Hunstanton, for in N.W. Norfolk it is estimated by Mr. R. H. Rastall to be about 30 ft. thick.

The Lower and Middle Chalk show the same thinning north-

wards. Exclusive of the *H. planus* zone, they appear to be over 300 ft. thick in central Norfolk, but from actual sections measured by the Geological Survey, they are known to amount to 160 or 170 ft. only in north Norfolk.

V. THE UNCONFORMITY OF THE TERTIARY STRATA UPON THE CHALK.

A. EOCENE DEPOSITS.

Borings in East Suffolk and Norfolk have revealed the fact that the Eocene deposits are present under the Crag [W. H. Dalton, *Geol. Mag.* (1880), Dec. 2., Vol. 7, p. 518.] and have a northerly trend, the London Basin having opened up to the north instead of being limited in a north-easterly direction. The green clayey-sands of the Thanet Beds are found lying upon the Chalk surface in south Suffolk, and appear, as far as the evidence of borings can be relied upon, to be present in eastern and north-eastern Suffolk. In eastern Norfolk, however, at Cantley and Southwood (pp. 46 & 55) the London Clay apparently rests directly on the Chalk, having overlapped the Reading Beds and Thanet Beds. London Clay appears to be present below the Crag at Wheatacre (p. 57). The surface of the Chalk at the last-named place is probably about 250 ft. below Ordnance datum; this depth, therefore, does not admit of any great thickness of Lower London Tertiaries, even if they are present at all. In south-western Suffolk and north-western Essex the Reading Beds are seen to transgress the outcrop of the Thanet Beds and rest directly upon the Chalk, but the London Clay thins off, as a result of erosion, southward of the other beds.

Since Eocene strata are present at Halesworth, in Suffolk, and at Cantley, Southwood, and Wheatacre, in Norfolk (besides being found in considerable thickness at Lowestoft and Yarmouth), their western boundary would rather be expected to cross the Waveney Valley a mile or two east of Bungay* Instead of this, we find that even at Beccles the Crag rests directly upon the Chalk; hence an eastward embay-

*J. H. Blake states in the *Mem. Geol. Surv.*, "Yarmouth and Lowestoft," p. 9, that from sections drawn, he would have anticipated that the Reading Beds, but not necessarily the London Clay, would appear in the Beccles well.

ment occurs in the boundary, as indicated upon the map. (Pl. 1.) Of the course northwards of this boundary we have at present little information, and more facts are not likely to accumulate quickly, for it is improbable that deep borings and wells will be put down in "Broadland," where large towns are absent. The wells at North Walsham, Cromer (see p. 48), and Mundesley [C. Reid, *Trans. Norfolk & Norwich Nat. Soc.*, Vol. VII. (1901), p. 291; *Summary Progress Geol. Survey*, 1898, p. 145], indicate that Crag rests upon the Chalk. Mr. F. W. Harmer has suggested that the difference in character of the North Sea Drift (Lower Glacial) as it is traced westwards in North Norfolk, may be due to the fact that, at Happisburgh Eocene deposits were ploughed up by the ice and incorporated in the moraine of the North Sea Ice-Sheet, whilst in the neighbourhood of Cromer, Pliocene deposits contributed their quota; farther west, around Weybourne and Holt, bare Chalk may have formed the bed of the ice-sheet [Trans. Norfolk and Norwich Nat. Soc., Vol. IX. (1910), p. 113].

Clement Reid offered similar suggestions (*Mem. Geol. Surv.*, "Cromer," Sheet 68E.) to account for the differences in the 1st and 2nd Tillis at Happisburgh. The Happisburgh Glacial Beds have been subjected to careful analysis by the writer with a view to obtaining evidence, particularly from the heavy mineral residues, as to the amount of Eocene material incorporated in them. Unfortunately, there has been such an admixture of new material of Glacial origin as to mask completely any Eocene detrital minerals which may be present. The boundary of the Eocene strata must therefore be left doubtful.

B. PLIOCENE DEPOSITS.

The western limit of the Pliocene may be traced with ease from the numerous field exposures and well-sections, etc. It is indicated upon the map, Pl. 1. The Crag is seen to rest directly upon the Chalk over a considerable area of eastern Norfolk and Suffolk (where the Sub-Crag Chalk surface-contours are similar in spacing and direction to those of the bare Chalk).

In southern Suffolk, however, the Crag rests upon Eocene deposits only, but gradually transgresses the successive outcrops of these, resting in turn upon London Clay, Reading Beds (Bramford, Ballingdon), Thanet Beds (Sudbury, Claydon), and finally upon Chalk again (Stoke by Clare), as the observer travels westwards.

These notes serve to emphasise the fact that in East Anglia three strong unconformities or breaks in the geological succession are found: (*a*) between the Chalk and the Eocene, (*b*) between the London Clay and the Crag, and (*c*) at the base of the Glacial deposits. All three are marked by considerable changes in the mineral constitution of the beds, and the first two by notable palæontological breaks and the presence of basal conglomerates.

These unconformities are further emphasised by the manner in which the later deposits rest on the denuded edges of the various Chalk zones. The highest Chalk in the British Isles occurs at Trimingham, where the well-known bluffs and masses belong in part to the zone of *O. lunata* (or zone of *Terebratulinas*) (R. M. Brydone, Quart. Journ. Geol. Soc., Vol. 64 (1908), p. 401, and others). The question as to whether this Chalk has been transported, or is only disturbed and still more or less *in situ*, cannot yet be regarded as settled. The fact remains, however, and on this point Mr. R. M. Brydone, Dr. A. W. Rowe, and Clement Reid were agreed, that judging from the position of the other zones, we should expect the highest zone of the Chalk to crop out very near to Trimingham. Clement Reid stated that the Chalk, apparently *in situ* beneath Pliocene deposits in the Mundesley Well, belongs to *O. lunata*-zone. [Trans. Norfolk and Norwich Nat., Vol. VII. (1901), p. 291, "East Norfolk Geology: Wells at Mundesley, North Walsham, and Metton"] Apart from this Trimingham Chalk, the highest Chalk in England is that seen in the Whitlingham Pit, east of Norwich, where the evidence of the very large shape-variations of *Echinocorys vulgaris* led Dr. A. W. Rowe to the conclusion that this Chalk is very high up in the zone of *Belemnitella mucronata*. The Eocene strata pass off from the

lunata zone, but probably rest on the former until we reach south-eastern Suffolk. Here only 20 ft. of *mucronata*-Chalk underlie the Thanet Beds (Claydon, Bramford), and a little farther west in the Brett Valley, the latter rest on the zone of *A. quadratus*. Farther west still, in the Stour Valley, near Sudbury, they pass over the sub-zones of *Marsupites* (Sudbury) and *Uintacrinus* (Ballingdon), until in north-western Essex and Hertfordshire the zone of *M. cor-anguinum* underlies the Eocene (Bishop's Stortford, etc.). This unconformity is indicated diagrammatically in Fig. 6. The map (Pl. 1.) indicates also that the Eocene deposits transgress the Chalk-surface contours also, in both Norfolk and Suffolk.

The Pliocene deposits similarly rest on *lunata*-zone at Mundesley, and on high *mucronata*-zone around Norwich. At Tharston, S.S.W. of Norwich, the Chalk is near the base of *mucronata*-zone (as determined by Dr. Rowe from the fauna), and is capped by Norwich Crag. Eastwards of Diss the Chalk is poorly exposed and almost unfossiliferous. Its marly character led Barrois to refer it to *Marsupites*-zone, but it more probably belongs to *quadratus*-zone. For a short distance, owing to a possible uplift of Charnian character, the Red Crag ceases to rest directly upon Chalk, and when it next does so in West Suffolk (near Clare) the *cor-anguinum*-zone supports it.

The great thickness of London Clay (310 ft.) and Lower London Tertiaries (46 ft.), and the rapid dip of their bases, which limits their landward extent to a breadth of 8 or 9 miles, suggest that they might have been deposited under conditions of gradual subsidence, and that warping and tilting of the land took place, resulting in a gradual upheaval of the Chalk. The denudation and lightening of the load of the latter went on *pari passu* with the accumulation of the Eocene deposits and gradual lowering of the sea-bottom. Similar movement, but in a different direction, may have taken place in later Pliocene times, when a thickness of 147 ft. or more of Norwich Crag was deposited at Southwold, 128 ft. at Beccles, 170 ft. at Lowestoft, 120 ft. at Yarmouth, and 208 ft. at Wheatacre. Mr. F. W. Harmer has stated at length his views on the latter question

["Pliocene Deposits of Holland," *Quart. Journ. Geol. Soc.*, Vol. 52 (1896), p. 766], depression to the north probably resulting from a tilting movement along an axis from Kent to the Dutch coast.

A result of considerable economic importance follows from the presence of these great thicknesses of Tertiary strata upon the Chalk-surface. The supply of water from the Chalk is usually as abundant in quantity as it is good in quality. Where, however, the formation is heavily loaded with a great overburden of Eocene, Pliocene, and Glacial deposits, as it is in eastern Norfolk and Suffolk, the water-supply is diminished very considerably. This diminution is no doubt largely due to the closing of fissures and confining of air in the Chalk,* whereby the circulation of water is prevented. Comparison of the supply from unloaded and loaded areas brings out this fact.

LOADED AREA.	Over-	Surface of	Yield in gals.
	burden.	Chlk. O.D.	per hour.
	ft.	ft.	
Yarmouth ...	476	-456	"Not successful."
Lowestoft ...	475	-463	1500 to 5400†
Southwold ...	323	-283	"Water small in quantity and poor in quality."
Leiston ...	298	-240	"No adequate supply."
Cromer			
(Roughton Heath)	215	- 5	540

NON-LOADED AREA.

As an example of a boring in a non-loaded area, the following recent result may be quoted :—

Ipswich (Akenham), 12 ft. of Tertiary Beds above Chalk. Yield, a million gals. a day from a 24-inch bore, and two millions a day from bore and headings.

*Sir J. Prestwich, "A Geological Inquiry respecting the Water-bearing Strata . . . around London," 1851, p. 60. W. Whitaker, "Geology of London, etc.," *Mem. Geol. Surv.* (1889), Vol. 1., p. 513. L. J. Wills and G. Barrow, "London Wells," *Mem. Geol. Surv.* (1913), p. 14.

† Increased from 1,500 to 5 400 gals. an hour by 5 lb. charges of gun-cotton. Quality of water medicinal.

Large towns and works situated in a loaded area would therefore be well-advised to go, if possible, farther afield, and make their wells in unloaded areas, conveying the water by a greater length of pipe, and creating a greater artificial head by pumping.

VI. BURIED CHANNELS OF DRIFT.

One other feature in the Chalk-surface calls for note. In each of the main Suffolk valleys a deep hollow occurs, 100 to over 400 ft. in depth, usually in the Chalk. These deep channels are filled with Glacial Drift, and their course and character have been worked out in some detail for Suffolk. [P. G. H. Boswell, *Quart. Journ. Geol. Soc.*, Vol. 69 (1913), pp. 581-620.] They appear to be similar to the *föhrden* of Schleswig-Holstein, North Germany, etc., being due to the action of sub-glacial streams of water during the Glacial Period, when the pre-Glacial valleys were occupied by tongues of ice.

These buried channels of drift are, as far as present knowledge goes, much rarer in Norfolk. One was met with recently at Saham Toney, near Watton [Summary Progress Geol. Surv. for 1910 (1911), Sir A. Strahan, p. 75], in the valley, but on the northern slope, of the Wissey. Other borings near by indicate that like its prototype at Ipswich [Water Supply of Suffolk, 1906, Mem. Geol. Surv., p. 74], this hollow has very steep sides, the details being as follows:—

1. Saham Hall, 150 ft. O.D. Drift 243 ft., Chalk not touched (1910).
2. Broomley Hall, 6½ fur. E of last, 140 ft. O.D. Drift 147 ft. to Chalk (1898).
3. Broomhill Farm, 15 fur. S.E. of Broomley Hall, 160 ft. O.D. Drift 151 ft. to Chalk (1905).
4. Well 500 yards N.E. of Saham Hall, depth of 42 ft. in Chalk.
5. An additional site was selected by a water-diviner 200 yds. further W.N.W. of 1, at 145 ft. O.D. Chalk was reached at 17 ft. down

The Chalk occurs around at 160 to 180 ft. above Ordnance

datum, *e.g.*, in a pit 3 fur. N.W. of Saham Hall, and half a mile west of this pit. Half a mile east of it also there is another old pit.

A buried channel of Drift also occurs in the Waveney Valley at Hoxne, Suffolk. (P. G. H. Boswell, *loc. cit.*, p. 609).

Other channels of Drift occur in the Wash area [Mem. Geol. Surv., Sheet 65, p. 56, etc.], but are of smaller and different type.

The supposed channel at Yarmouth was based upon the assumption that there was a great thickness (120 ft.) of recent deposits [Sir J. Prestwich, *Quart. Journ. Geol. Soc.*, Vol. XVI. (1860), p. 449], whereas these are now known to be mostly Crag. One of the greatest thicknesses of Drift outside the Cromer Ridge occurs at Marlingford, near Norwich, where 114 ft. of Glacial deposits are recorded.

VII., SUMMARY.

A hypsometrical map of the surface of the Norfolk Chalk shows it to be approximately a plain reaching to 250 ft. above sea-level, near Swaffham, in the west of the county, and sloping gently eastwards at about 9 ft. to the mile. The Chalk escarpment stands out upon the map, but the Cromer Ridge is seen to be purely a glacial surface feature. Eocene deposits and Crag cover the Chalk in the east of Norfolk, and the surface is seen to slope more rapidly (over 30 ft. to the mile) under the former, the contours being therefore crowded up. A strong "through-valley" occurs at the Waveney—Little Ouse Gap. It is hidden in part by later beds, but is well-marked in the Chalk-surface, being probably post-Eocene, but pre-Pliocene in age.

The dip of the Chalk lessens eastwards but maintains a general average of 35 ft. to the mile; the Eocene deposits therefore do not bevel off the uppermost Chalk zones to any great extent, as they do farther south in Suffolk. The unconformity of the Eocene is indicated by the transgression of the outcrops of the Chalk zones, and, similarly, the unconformity of the Crag Beds is proved by their resting upon *O. lunata*-zone at Trimmingham, *B. mucronata*-zone at Norwich, *A. quadratus*-zone in South

Norfolk, and *Marsupites*-zone and *M. cor-anguinum*-zone in Suffolk.

The general distribution of the Chalk zones is indicated upon the map (Fig. 1), and their approximate thicknesses in central Norfolk are estimated at, *O. lunata*, 70 ft., *B. mucronata*, 240 ft., *A. quadratus*, 230 ft., *Marsupites*, 140 ft., *M. cor-anguinum*, over 200 ft., *M. cor-testudinarium*, 50 to 70 ft., *H. planus*, 70 ft., *Lower and Middle Chalk*, over 300 ft. The lower zones are known to exhibit a marked decrease in thickness when traced into north-western Norfolk.

The water-supply from the Chalk is much diminished when the latter is loaded with a considerable thickness of Eocene and Crag deposits.

Deep channels in the Chalk, filled with Glacial Drift, are not so common in Norfolk as in Suffolk, but examples occur at Saham Toney (near Watton), and in the Waveney Valley (near Hexne, in Suffolk).

The study of the form of the Chalk-surface, the dip of the formation, and the character and thickness of the Tertiary strata overlying it, is one of considerable economic importance in relation to water-supply; it has the advantage of being equally interesting as a purely geological investigation.

APPENDIX.

Wells and borings put down since the last published accounts.

BLO' NORTON. Maps, 1", 175; 6", 109 N.W.; Geol. 50 N.W.

1. For Mrs. Houchem. Sunk 10 ft., the rest bored.

						Thickness.	Depth.
						ft.	ft.
Soil	...	...	...	...	...	1	1
Boulder Clay	{	Light clay	...	...	...	8	9
		Blue clay	...	...	...	20	29
Glacial Sand and Gravel	{	Sand	...	...	...	16	45
		Gravel	...	...	...	14½	59½
		Loamy sand	...	...	...	29	88½
		Gravel	...	...	...	½	89
Chalk with flints	...	...	...	...	...	18	107

2. For Rev. G. Norris. Sunk 20 ft., the rest bored by Messrs. Gedney, of Norwich.

					Thickness.	Depth.
					ft.	ft.
Made Soil	...	...	...	...	2	2
Glacial Beds	{	Sand	...	...	8	10
		Blue clay	...	...	132	142
Chalk with flints	...	...	...	...	20	162

CANTLEY. 1", 162; 6", 66 S.E.; Geol. 66 S.E.

Anglo-Netherland Sugar Factory, 4" artesian boring. Made and communicated by Messrs. W. & G. Fake, 1912. Between River Yare and railway close to the bend, $\frac{1}{4}$ mile S.E. of Station. An abundance of pure water.

					Thickness.	Depth.
					ft.	ft.
Superficial Deposits	{	Top soil and clay	...	...	12 $\frac{1}{2}$	12 $\frac{1}{2}$
		Peat	...	...	2 $\frac{1}{2}$	15
		Sand discoloured by peat	...	...	3	18
		Blue sand and stones	...	...	4	22
?London Clay	{	Dark sand and stones	...	...	1 $\frac{1}{2}$	23 $\frac{1}{2}$
		Dark clay	...	...	4	27 $\frac{1}{2}$
		Hard dark stone	...	...	1	28 $\frac{1}{2}$
		Dark clay	...	...	33 $\frac{1}{2}$	62
		Blue clay	...	...	38	100
		Cocoa-coloured clay	...	...	16	116
Chalk	...	Chalk stone, very hard	...	...	62	178
			...	...	10	188

(Here water arose from borehole 8' above the ground level. Tubes were driven down to stop the water).

Chalk, borehole unlined ... 7 195

CRIMPLESHAM, The Hall. 1", 159; 6", 69 N.E.; Geol. 65.

From B. W. Bryan, Esq., 1905.

Well to 27 ft. 6 ins., rest bored.

					Thickness.	Depth.
					ft.	ft.
Glacial Drift	{	Grey clay	...	...	16	16
		Loam	...	...	1	17
		Stiff white sand	...	...	5 $\frac{1}{2}$	22 $\frac{1}{2}$
		Very fine white sand	...	...	2 $\frac{1}{2}$	25
		Blowing sand	...	...	5 $\frac{1}{2}$	30 $\frac{1}{2}$

		Thickness.	Depth.	
		ft.	ft.	
?Gault	Blue clay	16½	47	
	Oolites	4	51	
	Dark blue sand	2½	53½	
	Green sand	10	63½	
	Nodules	¼	63¾	
	Blue sand	8¾	72½	
	Ditto	9	81½	
	Green clay	1½	83	
	Hard sandstone	3	86	
	Blue sand	2½	88½	
	Clay and sand	2	90½	
	Hard, porous stone (weight very light)	2½	93	
	Blue sand	½	93½	
	Green sand and loam	2	95½	
	Hard stone	2¾	98¼	
	Green sand	3	101¼	
	?Lower Greensand	Hard blue sand	2¼	103½
		Hard stone	4	107½
		Ditto	½	108
		Blue sand	2½	110½
		Hard stone	1	111½
		Green sand and slate-coloured clay	2	113½
		Thin layers of stone and blue sand	2	115½
Blue sand		1	116½	
Hard stone		½	117	
Blue sand		2½	119½	
Black clay		1	120½	
Green and slate-coloured clay		2½	123	
Hard stone		2	125	
Blue sand	3	128		
Thin stone and black clay	4	132		
Blue sand	2½	134½		
Fine blue sand	5	139½		
Black clay	4	143½		
Kimmeridge Clay	Dark blue clay to some depth.			

Mr. W. Whitaker says that the specimens and the description sent with them differ somewhat from the above, the details below 112 ft. being as follows:—

Black clay, blacker when fresh from bore,
but lighter since exposed to air (very

dark grey clay, with some bits of shell)	112ft. to 116ft.
Dark blue clay (dark grey with bits of shell)	116ft. to 241ft.
Light blue clay (grey clay, nearly as dark as above, with bits of shell) ...	241ft. to 242½ft.

From these specimens it seems clear that the Kimmeridge Clay is reached at 112 ft. The blue clay from 30½ to 47 ft. may be Gault.

CROMER, for the Gas Company, 1902. 1", 131; 6", 11 S.E.; Geol. 68 E.

From Messrs. F. Bennett & Co., Ipswich. Well previously sunk by Mr. Thos. Tilley about 3 years before, 114 ft. Continued in July, 1902.

				Thickness.	Depth.
				ft.	ft.
Crag	{	Well ... ..	...	114	114
		Hard pan*	...	1	115
		Rough ballast	...	5	120
		Running sand	...	5' 2"	125' 2"
		Bed of flints	...	2	127' 2"
Chalk	...	...	...	72' 10"	200

Flints met with at 125' 2", 139' 6", 143', 144', 146', 147', 149', 150', 153', 155' 6", 157', 159', 162', 165', 171', 174', and 179'.

*Messrs. Bennett say:—"It was this pan or rock that Tilley left off owing to the tools being smashed up; my men had to smash through the turned-up tool or driving shoe, some portion of the shore, and portions of the tube my men recovered during the boring. We drove the old 6" tube further down to a depth of 137" below ground level. The yield of water was between 1600 and 1700 gals. per hour, being of first class and free from salt. The water level stands at 99' from the surface, varying from 18" to 20", according to tide." [See also Northrepps and Roughton Heath.]

DERSINGHAM. 1", 145; 6", 69; Geol. 65.

For Norfolk County Council. Supt. Lewis. 1912. 4" artesian boring. No water obtained; boring abandoned. Made and communicated by Messrs. W. & G. Fake.

				Thickness.	Depth.
				ft.	ft.
	Top soil (mould)	...	...	5	5
	Carstone	...	...	1½	6½
Sandringham Sands	{	Blue sand	...	58	64½
		Fine white sand	...	1½	66
		Blue sand	...	20	86

GARBOLDISHAM. 1", 175; 6", 104 S.W.; Geol. 50 N.W.

Uphall Farm, 1912. 4" artesian well, good supply of pure water. Made and communicated by Messrs. W. & G. Fake. Rest level of water, 56' from surface.

				Thickness.	Depth.
				ft.	ft.
Top Soil	...	...	...	3	3
Glacial Beds	{	Grey clay with stones	...	40	43'
		Red sand and gravel	...	13	56
		Flints	...	4	60
Chalk	{	(boring lined)	...	12	72
		(boring unlined)	...	69¾	141¾

GREAT MASSINGHAM. 1", 146; 6", 35 N.W.; Geol. 65.

1912. Made by J. H. Cornish, North Norfolk Iron Works, Walsingham. Communicated by F. H. Wild, Manager. Sunk 150'.

				Thickness.	Depth.
				ft.	ft.
Alluvium	...	...	...	5	5
Boulder Clay	{	Brickearth	...	6	11
		White clay with few flints	...	30	41
		Blue clay with chalk-stones and flints	...	107	148
		Black hard clay	...	2	150

Water suddenly burst through in the night and rose 75 ft. The above well is described as "near the vicarage, and South of the vicarage well, but may be 1 or 2° West."

Mr. Wild reported that "within about 60 yards (of above well) is a well at the vicarage, about 100 ft. deep, sunk through hard chalk; the well is stone built only 30 ft. to 40 ft. down, the water-level being practically the same as in the above new well."

HARLESTON. 1", 175 ; 6", 106 S.E. ; Geol. 50 N.E.

?1902. For Dr. J. L. R. Robinson, at the late Dr. Candler's house. Made by C. Isler & Co. Lined with 50' of 6" tubes 18½' below surface, and 125' of 5" tubes 7' below surface. Water level 25' down. Supply, 250 gals. per hour.

					Thickness.	Depth.
					ft.	ft.
Dug Well	...	...	...	...	30	30
Drift	{ Yellow sand and shingle	{ Fine sand 10' Coarse gravel of flint and quartz pebbles etc. ... 19'	}	29		59
Crag	{	Green sand and shells (sand and pebbles)...	...	...	14	73
		Blue clay	...	...	4	77
		Grey sand and clay	...	...	5	82
		Grey loam and shells	...	...	5	87
		Grey sand and clay	...	...	41	128
Chalk with flints	...	...	...	...	122	250

Another account in brackets, referring to beds after the 14 ft., says :—

Grey to green sand with shell fragments, passing
through loam to clay with shells ... 55 ft.

Chalk.

This second account is signed " Chas. Candler, March, 1902, Harleston."

HONINGHAM HALL. 1", 161 ; 6", 62 N.E. ; Geol. 66 N.W.
Eight miles N.W. of Norwich.

1. Communicated by Messrs. Gedney, Norwich.

					Thickness.	Depth.
					ft.	ft.
Made soil	...	...	...	...	3	3
Boulder Clay	Blue clay	...	...	...	20	23
Glacial Sand and Gravel	{	Gravel	...	...	15	38
		Light sand	...	...	10	48
		Quick sand	...	...	9	57
Chalk with flints	...	...	...	...	11	68

2. Made and communicated by Messrs. W. & G. Fake.
 Bored, 176' 8" ; water rises to 5' 2" from the top.
 4" boring, lined 75' with tube and steel driving-
 shoe, 6" long. Bored 176' 8".

				Thickness. Depth.	
				ft.	ft.
Glacial Drift	{	Loamy sand	4	4	
		Grey clay	4	8	
		Rough sand and fine shingle	27	35	
		Marl and flint stone	7	42	
		Yellow marl	3	45	
		Soft madgean marl	10	55	
Chalk	...Close and hard	30	85		
	Good chalk and floors of flint	91' 8"	176' 8"		

Floors of flint stones at following depths from surface :—27, 38, 72, 84, 93, 98, 108, 117, 126, 130 to 134, 148, and 167 feet.

MELTON CONSTABLE. 1", 147 ; 6", 17 S.E. ; Geol. 68 S.W.

For Midland & G.N. Railway Station. 272' O.D. Made and communicated by Messrs. Le Grand & Sutcliffe. Water level, 23' from surface ; yield copious, but no prolonged test had been made.

				Thickness. Depth.	
				ft.	ft.
Top Soil	... ..	6	6	
Glacial Drift	{	Loam, clay, and stones ...	2½	8½	
		Loam	7	15½	
		Sandy ballast	6½	22	
		Ditto and chalk	8½	30½	
		Coarse ballast	12	42½	
		Brown loam	9½	52	
		Clay-sand and chalk	8	60	
		Clay and sand	4	64	
		Clay loam sand, flints, and chalk pebbles	13	77	
		Clay and sand	9	86	
		Chalk, marl, and flints ...	5	91	
		Hard sand	14	105	
		Sand, flints, and chalk ...	15	120	
		Clay, chalk, and stones ...	3	123	
Clay, stones, chalk, and sand	47	170			
Flints and sand	5	175			
Chalk with flints	... ..	301	476	

52. THE SURFACE AND DIP OF THE CHALK IN NORFOLK

NORTHPREPPS. 1", 131 ; 6", 11 S.E. ; Geol. 68 E.

Just South of main building at the Hall. 1899. Communicated by Messrs. Tilley. Rest level of water, 110'.

		Thickness.	Depth.	
		ft.	ft.	
?Glacial Drift, or in part, Crag	}	Sand with layers of gravel and boulders	16	16
		Sand and stone, with gravel and boulders	85	101
		Marl	4	105
		Live sand	16	121
		Brickearth	1	122
		Live sand	29	151
		Marl	4	155
		Live sand	51	206
		Clay	1	207
		Live sand	11	218
		Whitish clay	1½	219½
Chalk.		30½	250	

OLD BUCKENHAM, Hall. 1", 175 ; 6", 95 N.E. ; Geol. 66 S.W.

— Robinson, Esq. By Messrs. Isler & Co. Tubes : 20' of 8½" tubes and 60' of 6" tubes. Water level 24'. Supply, 1200 gals. per hour.

		Thickness.	Depth.	
		ft.	ft.	
Glacial Drift	}	Loam	2	2
		Loamy sand	2	4
		Clay and chalk mixed	7	11
		Ballast	10	21
		Clay and ballast	1	22
Chalk and flints		128	150	

ROUGHTON HEATH. 1", 131 ; 6", 19 N.E. ; Geol. 68 E.

1. For Cromer Isolation Hospital, 1900. Made and communicated by Messrs. Bennett, of Ipswich. Well 12' dry. Water level in tube, 74' from surface. Top of tube, 9' 5" from surface ; bottom, 8½' in chalk or 204' from surface. Test by hand-pumps showed a yield of 1000 gals. in 1½ hours.

		Thickness.	Depth.	
		ft.	ft.	
?Glacial Drift	{	Red sand, mixed with small stone	28½	28½
		Dark red sand and ditto	½	29
		Fine light-coloured sand	31	60
		Gravel and small stones	5	65
		Red sand free from stones	4	69
		Rough red gravel	3½	72½
		Bright red sand	3½	76
		White coloured sand	31	107
		Clay	1	108
		Dark sandy loam	22	130
		Light running sand	39	169
		Dark clay	4	173
Light running sand	7	180		
?Crag	{	Dark sandy loam	1	181
		Rough sand	11½	192½
		Light loam	½	193
		Dark loam and gravel	1½	194½
Chalk and flints	{	Flint bed	1½	196
		Chalk and flints	106½	302½

2. Well-boring, 1913. 1-6th mile due E. of Powhow Hill Tumulus on the Heath. Made and communicated by Messrs. Le Grand & Sutcliffe. 210' O.D. Rest level of water, 89'. Yield, 540 gals. per hour. Level not lowered 5'. Bored 318'.

		Thickness.	Depth.	
		ft.	ft.	
Glacial Drift	{	Fine gravel	9	9
		Light sand, large stones, and gravel	28	37
		Sea sand	15	52
		Gravel	7½	59½
		Brown clay	2½	62
		Chalk	11	73
		Light-coloured hard sand (water at 87 ft.)	26	99
		Light blowing sand	27	126
		Blue sandy clay and small stones	14	140
		Loamy sand	41	181
		Clay and chalk stones	13	194
		Sand and chalk pebbles	7	201

		Thickness.	Depth,
		ft.	ft.
?Crag	{ Light grey blowing sand ...	13	214
	{ Black flints and pebbles ...	1	215
Chalk	{ With flints, rubbly ...	23	238
	{ Soft chalk and flints ...	59	297
	{ Very hard chalk and flints ...	8	305
	{ Chalk and flints ...	13	318

Messrs. Le Grand and Sutcliffe said: "With the suction-pipe only 5' in the water, we can get 540 gals. an hour, and this produces no noticeable effect upon the standing water level, pumping all day long."

SHERINGHAM. 1", 131; 6", 10 N.E. and 11 N.W.; Geol. 68 E.

The Waterworks, 1899. 152' O.D. Communicated by R. M. Parkinson, of Peterborough. 10" boring. Pumping 7000 gals. an hour for 10 hours a day produces no effect.

		Thickness.	Depth.
		ft.	ft.
?North Sea Drift	{ Gravel	3	3
	{ Clay with small stones ...	20	23
	{ Loamy sand (grey sandy loam and small stones) ...	9	32
	{ Ferruginous running sand ...	35	67
	{ Boulder clay with chalk ...	2	69
	{ Running sand (ferruginous) ...	21	90
	{ Ditto, bluish colour ...	15	105
	{ Boulder clay with flints, chalk, sandstone, etc. ...	2	107
Forest Bed	{ Sand and little flints, rather earthy, with <i>Cyprina islandica</i> , <i>Tellina balthica</i> , <i>Mytilus edulis</i> , <i>Littorina littorea</i> ...	6	113
	{ Clay with chalk and flints, and marine shells ...	17	130
	{ Flint and chalk mixture (?derived from above) ...	7	137
Weybourn Crag	{ Blue clay, and grey earthy, very micaceous, sandy loam with small stones ...	2	139
Upper Chalk	{ Soft chalk ...	261	400

SHOTESHAM ALL SAINTS. 1", 161 ; 6", 87 N.E. ; Geol. 66 S.E.

Uppate Farm, Robert Fellowes, Esq. 1906. Communicated by Messrs. W. & G. Fake. Well sunk 70', bored 126'.

					Thickness.	Depth.
					ft.	ft.
?Glacial Drift	{	Loam and sand	...	...	3½	3½
		Yellow fine sand	...	...	8	11½
?Crag	{	Rough red sand	...	...	6	17½
		Slate-coloured sand and stone	...	...	10	27½
		Blue sand	...	...	13½	41
		Stones (? flints)	...	...	1	42
Chalk	{	Marl	...	...	4	46
		Chalk	...	...	21	67
		Sandgall	...	...	4	71
		Chalk	...	...	55	126
Well, 70' deep					70	196

SOUTHWOOD. 1", 162 ; 6", 77 N.W. ; Geol. 66 N.E.

The Oaks Farm, at corner of roads. 1¼ miles N.E. of Cantley Station and ¼ mile S.E. of church ruins. Made and communicated by Messrs. W. & G. Fake, Norwich. Sunk, 43'. Water rose to 50' from surface, and is said "to have passed analysis."

					Thickness.	Depth.
					ft.	ft.
Old Well	...	...	...	...	43	43
? Crag	{	Red sand	...	...	16	59
		Red brickearth	...	...	6	65
		Red sand	...	...	16	81
		Dark red clay	...	...	2	83
		Sand	...	...	5	88
London Clay	{	Blue clay	...	...	61	149
		Cocoa-coloured clay	...	...	38	187
		Blue clay with layers of hard, dark stone	...	...	46	233
		Hard, solid dark stone	...	...	7	240
Chalk	{	Clay with marl stone	...	...	10	250
		Marl	...	...	28	278
		Chalk with layers of stone	...	...	22	300

STALHAM. 1", 148; 6", 41 N.W.; Geol. 66 N.E.

Ingham New Hall, F. T. Rogers, Esq., 1907. Communicated by C. Isler & Co. Small supply. 10' by 6" tubes and 60' by 5" tubes.

				Thickness.	Depth.
				ft.	ft.
? Glacial Drift	{	Loamy clay	... ..	11	11
		Blowing sand	... ..	20	31
		Ballast	... ..	1	32
		Loamy clay	... ..	15	47
		Grey sand	... ..	8	55
		Loamy clay	... ..	6	61
? Crag	{	Grey sand	... ..	12	73
		Light blue clay	... ..	3	76
		Grey sand and shells	... ..	9	85
		Blue clay	... ..	2½	87½

STODY Lodge. 1", 131; 6", 17 S.E.; Geol. 68 S.W.

Five miles S.W. of Holt, for the Marchioness of Lothian.

Communicated by Messrs. Gedney, Norwich.

Sunk 68'.

				Thickness.	Depth.
				ft.	ft.
Sunk shaft	...	...	...	68	68
? Drift	{	Blue clay	... ..	30	98
		Dark sandy clay	... ..	9	107
? Crag	{	Dark sand and shells	... ..	19	126
		Red sand	... ..	6	132
		Grey sand	... ..	4	136
		Light sandy clay with small stones	... ..	2	138
Chalk with flints	...	...	...	18	156

SWANNINGTON. 1", 147; 6", 50 N.E.; Geol. 66 N.W.

About 1891. Communicated by W. & G. Fake to Mr.

W. Whitaker. Artesian well, 84' deep, sunk from

a well 13' deep. Tubed 80'. Water not fit for

domestic purposes, containing a large amount of

iron.

				Thickness.	Depth.
				ft.	ft.
Old well	...	...	...	—	13
? Glacial Drift	{	Soft grey clay	... ..	5	18
		Black bog	... ..	4	22
Chalk	{	Soft chalk	... ..	50	72
		Hard chalk	... ..	25	97

WHEATACRE. 1", 176; 6", 99 N.W.; Geol. 67 S.

1. Hall Farm. Communicated by Messrs. Gedney, of Norwich. Sunk 14', rest bored.

					Thickness.	Depth.
					ft.	ft.
Made soil	...	...	...	...	3	3
? Glacial	{	Gravel	...	...	14	17
		Blue clay	...	...	15	32
? Crag	{	Red sand	...	...	17½	49½
		Gravel	...	...	6½	56
		Light sand	...	...	13	69
		Fine gravel	...	...	4	73

2. 1911. Made and communicated by Messrs. W. & G. Fake. Boring abandoned. Tubes, 4" internal diameter.

					Thickness.	Depth.
					ft.	ft.
Top soil	...	...	...	...	3	3
[Glacial. Gravel]	{	Sand and gravel with land spring			5	8
		Light blue clay	...	...	15	23
[Crag 211 ft.]	{	Red sand	...	...	33	56
		Sea-sand and fine sharp stones	...	...	1	57
		Rough red sand	...	...	14	71
		Small stones. [Here at this depth in this 10 ft. of stone there was a small quantity of water, but when the water was taken out of boring it rose in the boring 6 in. in about an hour]			10	81
		Fine red blowing sand	...	...	36	117
		Fine shingle	...	...	4	121
		Coarse blue sand	...	...	8½	129½
		Fine blue sand with a few shells at intervals and occa- sional layers of thin loamy clay			89½	219
		[Crag shells at 219 ft.]				
		[Base of L.C. or Reading Beds]	{	Clay, chocolate-coloured [micaceous and sandy]			10	229

The specimens from depths of 219 and 229 ft. were examined by Mr. C. Reid, 4.4.1911, and the notes in square brackets

inserted by him in the above account. The writer would certainly refer the last 10 ft. to London Clay, and not to Reading Beds.

WOODBASTWICK Hall. 1", 148; 6", 52 S.E.; Geol. 66 N.E.

For C. A. Fellowes, Esq. Lined with tubes—30' by 10" tubes, 6' below surface; 60' by 8½" tubes, 3' below surface; 100' by 7¼" tubes, 1' below surface. Water level, 8' below surface; supply 6000 gals. an hour. Made and communicated by Messrs. Isler & Co.

					Thickness.	Depth.
					ft.	ft.
Dug well	...	...	...	...	6	6
? Crag	{	Sand	...	...	4	10
		Boiling sand	...	...	56	66
		Running sand	...	...	12	78
		Dark clay sand	...	...	6	84
		China clay	...	...	6	90
		Flints and pebbles	...	...	11	101
Chalk	{	Chalk and flints	...	...	50	151
		Soft chalk	...	...	139	290

WRETHAM Hall. 1", 174; 6", 94 N.W.; Geol. 66 S.W.

1891, for S. Morris, Esq. Sunk 12', rest bored. Communicated by Messrs. Gedney.

					Thickness.	Depth.
					ft.	ft.
Made soil	...	...	...	...	2	2
Glacial Drift	{	Loam	...	...	10	12
		Light clay	...	...	25	37
Chalk with flints	...	...	...	...	124	161

WYMONDHAM, Vicar Street, near the Church. 1", 161; 6", 74 S.W.; Geol. 66 S.W.

Communicated by Messrs. Gedney, of Norwich. Sunk 10' 6", rest bored.

					Thickness.	Depth.
					ft.	ft.
Soil	...	...	...	...	2	2
Glacial Drift	{	Loam	...	...	7½	9½
		Large stones	...	...	4	13½
		Blue clay	...	...	28	41½
		Gravel	...	...	4	45½
Chalk and flints	...	...	...	105½	151	

III.

THE BLACK-TAILED GODWIT

BY MATTHEW VAUGHAN

EVER since the days of the Tudors the Black-tailed Godwit (*Limosa limosa*) had the misfortune to be accounted one of the "daintiest dishes in England," and it is to this fact rather than to the raids of collectors or the encroachments of agriculture that the untimely extinction of this species in these islands must be attributed. Many passages might be quoted in support of this statement. William Turner, of Pembroke Hall, Cambridge, the intimate friend of Ridley and Latimer, draws attention to the esteem in which the Godwit was held as a bird for the table. In his Commentary on the birds mentioned by Pliny and Aristotle, published in 1544, he tells us:—"Furthermore, the bird which the English call the Godwit is so much like the Woodcock that the one of them could hardly be distinguished from the other. In captivity it feeds on wheat just as our pigeons do, and with us it sells for thrice as much again as any Woodcock, so much does its flesh tickle the palates of our Magnates." Christopher Merritt (1614-95), a fashionable physician of his day, and one of our earliest ornithologists, informs us that:—"A fat Godwit is so fine and light meat that noblemen, yea, and merchants too, by your leave, stick not to buy them at four nobles a dozen." There is an interesting passage referring to this bird in the Ephemerides of Casaubon, the great scholar, translated by Mr. J. E. Harting. In 1611 Casaubon was staying with Andrew, Bishop of Ely, and accompanied him on a visitation to Wisbech, "where," he says, "we saw certain choice birds which are fatted for sale. Amongst the rest one called Godwit, that is to say, 'Dei ingenium,' which is wonderfully commended so that at

Wisbech, where provisions are very cheap, the bird feeder said that he sold them for five or six English halfpennies, but when he took them to London he brought back twenty English pence for each. The flesh when cooked is dark as is that of Marsh-birds. I ate it at the Lord Bishop's table and did not think highly of it. I do not see the reason why it is so greatly preferred to the Otus." That the Otus of Casaubon is the Dotterel (*Eudromias morinellus*) and not the Bustard as some have thought, is proved beyond a doubt by the following extract from his journal:—"The Otus is a bird less than a partridge and a mimic, wont to be beguiled and caught by silly imitation. Great men and Kings are keen in the chase of this bird. It furnishes very delicate meat if my palate be sufficiently instructed. They say that if the fowler lifts up one of his feet, the bird does the same, and if he extends an arm, the bird extends a wing, and imitates all his actions."

It is unfortunate that all the older writers who allude to the Godwit dwell on the daintiness of its flesh, but about its habits and distribution there is not a word. We look in vain for a vivid picture of the Godwit, such as Lubbock has given us of the Ruff (*Machetes pugnax*), and what makes this omission more regrettable is that it is due not to lack of observers, but because the observers fail to realise their opportunities. Gilbert White, in the year 1746, lived for six months at Thorney, in the Isle of Ely, to settle an executorship and dispose of live stock, but in a letter to Marsham all the news that he has to tell is that he lost nine oxen by their eating yew. What would the ornithologists of to-day not have given if that accurate observer had studied the habits of the Godwit with the same care with which he has studied those of the Stone Curlew (*Ædicnemus ædicnemus*) and the Goatsucker (*Caprimulgus europæus*). Pennant visited Lincolnshire three times between the years 1756 and 1758, and though he has given us an excellent description of the East Fen, which was then "in a state of nature," and gives a specimen of the country before the introduction of drainage,

and though he admits that he had never found a finer field for the naturalists to range in, he merely includes the Godwit among the list of fen birds, and informs us that it bred near Washenbrough.

In the year of Waterloo Colonel Peter Hawker paid a visit to the Fens to inspect them, more from the sportsman's than from the naturalist's point of view; but, though the colonel took the keenest interest in the wildfowl of Southampton Water and Pool Harbour, and though he had a good working knowledge of birds, his report is not very satisfying:—"Walked nearly thirty miles surveying the Fens, and could soon perceive that they would not answer for wildfowl-shooting; if a frost, the birds are gone; if a thaw, the greater part of them remain in the decoys; so that the breeding season, when the ague is predominant, is the only time for this infernal country."

In the following year Hawker went to stay with Mr. Rising, of Horsey, which was then "a most extraordinary place for all sorts of wild birds. It was a desolate spot, and duty at Church was performed only once a month, and in winter the place was scarcely approachable." Hawker tells us he had wonderful sport with all marsh birds—no doubt including Godwits—, but what evidently impressed him most was not the variety of bird life, but the unhealthiness of the climate, about which he expresses himself in characteristic terms. "We killed," he says, "large numbers of every kind of marsh bird—but the circumstance that makes birds so plentiful here cancels all the pleasures of shooting, which is that the fear of death deters strangers from their constitutions in such a pestilential climate. I came home ill, but was happy to escape as well as I did."

Lubbock is almost equally disappointing. He does not seem to have bestowed on this bird the same amount of careful observation that he gave to the Ruff. He merely includes it among the five species that formerly used to swarm in our marshes, and dismisses it with the remark the truth of which will appeal to all who know the bird in its haunts abroad:—

“ While the Redshank in the breeding season flew around the head of any intruder on its territories, higher in the air and flying in wider circles, uttering a louder note, was the Black-tailed Godwit, called provincially the “shrieker” from its piercing cries.”

The Godwit's range in this country was more restricted than that of the Ruff. It was probably confined to the Fens, and possibly Holderness, and there is no reliable evidence that it has ever bred in the marshes of Essex and Kent. Mr. Hancock does not include it in his list of birds that once bred in Prestwick Carr, the Whittlesea Mere of the North, and now like Whittlesea Mere a thing of the past, though on one memorable day, in June, 1853, accompanied by the eldest son of Charles St. John, he found there the nest of the Ruff and that of the Wood-Sandpiper.

By the beginning of last century constant persecution had done its work, and this species was on the verge of extinction in these islands. It may be doubted whether this bird would not have stood a better chance of survival in the struggle for existence if, like the Ruff, it had been polygamous. In the fens of Somerset it had long been extinct ; and in Lincolnshire Montagu tells us that by the accounts of the oldest fen shooters no such bird had been known to breed within the recollection of the present generation, while Mr. Towns, the noted ruff-fatter at Spalding, assured him that he had not procured any for the last twenty years ; but perhaps this statement is a trifle too sweeping, as according to the late Mr. Cordeaux this bird used to visit the south Lincolnshire marshes in pairs in the spring, and in 1885 it is just possible that a pair remained to breed. The Rev. L. Jenyns, a friend of Darwin, and one of the most accurate of observers who was vicar of Swaffham Bulbeck, in the Isle of Ely, omits it from the list of birds which bred in his neighbourhood, and records it as an event of special interest that in the wet spring of 1824, when a considerable portion of the fen was completely flooded, a few Godwits were seen for a short time. The last authenticated instance of this bird's breeding in the British Isles was in 1847, when an egg was

bought of a countryman in the Cambridge market. Stevenson assumes that the egg was taken in Norfolk, without giving any authority for the statement, but is it not equally possible that it came from the neighbourhood of Whittlesea Mere?

It should never be forgotten that what led to this bird's untimely extinction was, as I have said before, constant persecution, for there are suitable breeding grounds in East Anglia adapted to its needs, and, given a fair chance, it readily adapts itself to the new order of things. In the Island of Texel, where drainage has changed much of what was once quaking bog into dry meadow land, the Godwit still holds its own, and has not taken these changes as notice to quit. In one part of the island, in the year 1913, I located quite fifty pairs, breeding happily; and as a striking proof of its powers of adaptation, two nests were found in the same day, one on the top of a dry sand dune, at a considerable distance from any water, the other in the centre of a heaving morass which could only be approached with difficulty; while in a large meadow, most of which was as dry as an ordinary cricket field, five pairs had comfortably settled down for the season, apparently quite satisfied with their surroundings, different though they were to those to which their ancestors were accustomed.

It must, however, be admitted that the Godwit is capricious in its choice of a breeding ground. In a celebrated mere, for the strict preservation of which generations to come will never cease to thank the practical wisdom of the Dutch Society for the Protection of Birds, I looked in vain for the Ruff, and only saw one pair of Godwits, which the keeper, who had known the mere for more than half a century, told me was an unusual occurrence.

It is extremely difficult, as has been pointed out elsewhere, to dogmatise on the habits of birds. Though not so ridiculously confiding as the Ruff, I found the Godwit reasonably tame; it did not seem to resent my intrusion on its breeding grounds, but allowed me to watch its movements at a comparatively short distance; whereas Mr. Abel Chapman, than whom there is no more competent authority, considers that in Denmark

few birds are wilder in their breeding stations, and the only sound I ever heard it utter was the loud cry "Grutto, grutto," whence comes the Dutch name for the bird, though Mr. Rising always used to say that its note resembled the mew of a cat.

Here is another illustration of the same principle. In Holland the Black Tern (*Hydrochelidon nigra*) is said always to build its nest on the "water-cabbage" which floats on the surface of the water. I remember one day the late Mr. F. C. Selous pointing out to me three nests on dry ground, though there was a mere apparently suited to their needs a few hundred yards off.

Though practically unknown in Heliogland, there is no better station than Texel for watching the migration of its cousin, the Bar-tailed Godwit (*Limosa lapponica*). They seem to use the island as a resting ground during their passage from the southern hemisphere to their breeding grounds on the distant Tundras which fringe the Arctic Ocean. One day I was watching a large flock of this species resting in a meadow, with their plumage in all stages of development, ranging from the dull grey of winter to the deep chestnut of their nuptial garb, when they were joined by two pairs of Black-tailed Godwits, who stalked among them, conspicuous like Saul among his warriors for their superior height and size.

For obvious reasons it is not wise to go into details, but on two occasions in recent years there is some reason for supposing that the Black-tailed Godwit has attempted to nest in the British Isles, and perhaps in one instance succeeded; and what makes the occurrence more noteworthy, the locality chosen was not in their old haunts in the Fens, whence they had been banished long ago, but "somewhere in Scotland," so we cannot consider them as descendants of the exiles, driven, like the Bittern (*Botaurus stellaris*), by some irresistible impulse to pay a visit to the home of their fathers, but as migrants resting on their passage to their breeding grounds in Iceland, and tempted by the attraction of their surroundings to stay behind and rear a family here.

Of another instance one may be allowed to speak in greater

detail. Some twenty years ago my friend the late T. M. Pike, while fishing one spring in the district of Moray, saw a pair of Black-tailed Godwits daily for a fortnight in a certain marsh, and he was convinced from what he saw that they intended to stay and breed. Unfortunately, he had to leave, and there was no one to carry on his observations, so a verdict of "not proven" must be returned. It could not have been a case of mistaken identity, as he knew the bird well in Holland, being the last Englishmen to whom the Dutch Government granted a licence to shoot wildfowl with a punt gun. In a conversation with Professor Newton he convinced him there was something in it; and all who knew the Professor will admit that he was nothing if not critical, and a man who subjected all evidence to closest scrutiny.

It is to be feared that it is too much to hope that this fine species will ever re-establish itself in Great Britain, but at any rate we can learn wisdom from the faults of those who have gone before. We can leave no stone unturned to preserve the rare birds that are left us for the benefit of generations yet to come.

IV.

METEOROLOGICAL NOTES, 1919.

(From Observations taken at Norwich).

BY ARTHUR W. PRESTON, F.R.MET.SOC.

JANUARY.

The first half of the month was mild for the season, with frequent rain. The second half was decidedly cold, particularly by day, with much cloud. The mean temperature of the first half of the month was 1.4 deg. above the average; that of the last half 3.5 deg. below. The rainfall (2.94 ins.) was 1.24 ins. above the normal, of which 2.40 ins. fell before the 16th. With the exception of a slight fall of snow on the 29th, and again on the 31st, there was a remarkable absence of snow, although other parts of England were visited by heavy falls. Sunshine was 11 hours below the average, and fogs prevailed on the 5th and 13th. A remarkable depression of the barometer occurred between the 3rd and the 7th, the mercury remaining below 29 ins. for 90 hours.

FEBRUARY.

The cold weather which set in in the third week of January continued with increasing intensity during the first half of February, the thermometer by day not once rising to 40 deg. between January 21st and February 12th. The frosts by night between February 7th and 14th were exceptionally severe. During this week the exposed thermometer fell below 20 deg. every night, and the days were very bright. The latter part of the month was milder, but the mean temperature of the month (35.2 deg.) was 3.5 deg. below the average, and, with the exception of February, 1917, which was colder, we

have to go back to 1902 for an equally cold February. There was not much snow, but the total rainfall of the month was 1.81 ins. above the average, the excess being chiefly accounted for by a downpour of rain, with some snow, on the night of the 17th, amounting to 1.18 ins.

MARCH.

In the earlier days of the month the weather was somewhat mild for the season, but it grew colder as the month proceeded. There was much cloud and frequent rain, with cold north-easterly and north-westerly wind on many days. Mean temperature was 2.2 deg. below the normal, the falling off having been 3.6 deg. by day, but only 0.9 deg. by night. Rainfall was an inch less than in February, but 63 in. above the average. Sunshine was 40 hours deficient, and vegetation at the close of the month was very backward. There was a remarkable absence of strong winds—a marked feature of the entire winter.

APRIL.

For the third year in succession April was a cold month, although the falling off in temperature was less marked than in the two previous years. Heavy showers and thunderstorms occurred on the 12th, 13th, and 15th, but on the 18th (Good Friday) a great outburst of warmth occurred, the thermometer rising to 67 deg. and to 65 deg. on the following day. On the 19th an ungenial reverse succeeded, caused by the inrush of north-east wind accompanying a large anticyclone which spread over the country. A heavy gale and snowstorm in the neighbourhood of London, accompanied by great floods, did not extend to Norfolk, beyond some strong wind and sharp showers of hail and rain. Sunshine was again greatly deficient, and vegetation remarkably backward, although not so late as in 1917.

MAY.

This was an exceedingly fine and warm month, with a great excess of sunshine, although the wind was rather cold on some

days. The mean temperature was 3.6 deg. above the average, and it was the fourth very warm May in succession. The thermometer rose to 70 deg. and upwards on twelve days, and there was an absence of sharp frosts, although some of the nights were cold. Rainfall was deficient, the total being only about 50 per cent. of the average quantity. There were no less than 283 hours of sunshine (77 hours above the normal), 18 days having given over 10 hours each, and 8 days 14 hours. With the exception July, 1911, it was the sunniest month in the last nine years. Vegetation was most rapid, and the luxuriance of the foliage remarkable. Fruit trees and flowering shrubs gave a wealth of blossom, and it was a memorable and beautiful season.

JUNE.

The fine, warm, dry weather which characterised the greater part of May continued until June 20th, when there was a great and abrupt change to chilly winds and cloudy skies with frequent showers. During the month the thermometer reached or exceeded 70 deg. on 12 days, and passed 80 deg. on 4 days. On several days in the last week it did not reach 60 deg. Thunder occurred on one day only (21st), when the storms were severe in places. The drought was much felt until broken by the rains of the last ten days of the month.

JULY.

Although an anti-cyclone produced very fine, warm weather over the western part of the country, depressions over the North Sea and the adjacent shores caused cool and ungenial weather to prevail in Norfolk almost throughout the month, which was an exceptionally cold one here. Mean temperature was 4.6 deg. below the average, the falling off having been greater by day than by night. Such cold weather in June is, happily, rare, and the only years when similar chilly conditions were recorded were 1802, 1816, 1888, 1907, and 1913. The rainfall was frequent, but not generally heavy, the month's total having

been slightly deficient. Sunshine was 86 hours below the average.

AUGUST.

The first half of this month was exceedingly hot and dry, the shade temperature reaching or exceeding 80 deg. on five days, and several other days were nearly as warm. In the second half of the month there was frequent rain and great fluctuations of temperature, unfortunate for the harvest, which was then in full swing. There were some very cold nights for so early in the season (41.2 deg. in screen and 36.7 deg. on grass on the 15th and 39.2 deg. in screen and 35 deg. on grass on the 31st). Thunderstorms occurred on the 16th and 26th, but, generally, the month was unusually free from thunder. There were 202 hours of sunshine, being an excess of 17 hours over the normal number.

SEPTEMBER.

The variations of weather during this month were remarkable and unusual. During the first fortnight it was fine and hot, the heat culminating with a shade reading of 86.5 deg. on the 11th, which was the hottest day of the year. The latter half of the month was as remarkable for its cold nights as the former half was for its hot days. On the nights of the 19th and 28th the screened thermometer fell to 31.8 and 31.7 deg. respectively (grass 28.4 deg. and 25.4 deg.), these being the two coldest nights recorded in September since these observations were commenced in 1883. Vegetable marrows and beans were cut, and, in some places, dahlias were blackened. The rainfall of the month was only .88 ins., as against 4.65 ins. in the previous September. Sunshine was 37 hours above the normal amount, and exceeded that of any of the previous four Septembers.

OCTOBER.

The opening days of this month were mild and generally fine, but were followed by a cold and showery spell. From the 18th to the 24th we enjoyed a veritable "St. Luke's Summer," the

days being bright, if not very warm. During the last week heavy squalls of hail and rain followed in frequent succession, bringing up the month's total rainfall to 3.53 ins. Mean temperature was 4.3 deg. deficient, was even lower than in the cold October of 1917, and but little higher than in 1905, when October held the unenviable reputation of being the coldest for 119 years. There were ground frosts on 19 nights, and on 12 days the temperature failed to reach 50 deg. Thunder occurred on the 2nd, 15th, and 27th, and sunshine was 34 hours in excess of the average.

NOVEMBER.

This was the most winterly November experienced for many years. Snow fell on the 3rd and again daily from the 10th to 15th, lying on the ground for seven successive days. Further snow fell on the 27th and 29th. The accompanying frosts were of no exceptional severity, but the mean temperature of the month (38.3) was 5.1 deg. below the average. It was about the same in 1910, but previous to that year we have to go back to 1879 for an equally cold November. Rainfall was .33 ins. above the average, and sunshine slightly deficient, the greatest falling off having been during the first ten days, the total for which period was only $4\frac{1}{2}$ hours.

DECEMBER.

This month was exceptionally wet, the total rainfall amounting to 5.05 ins. It is but rarely that so much rain falls in one calendar month, such an occurrence having previously happened here on four occasions only during the last 30 years, viz. :—

October, 1892 ...	7.62 ins.
July, 1903 ...	5.37 ins.
August, 1912 ...	11.27 ins
December, 1914	6.67 ins.

Not only was the rainfall excessive, but its frequency was so great that rain was measured on 30 days out of the 31, which is the largest number of "rain days" recorded by me in any one month since commencing observations in 1883. There was but

little snow. The month was generally very mild, and was $2\frac{1}{2}$ deg. warmer than November, whereas the normal mean temperature of December is $4\frac{1}{2}$ lower than that of November. There were no severe frosts, although ground frosts were registered on 19 nights. High winds occurred on several days; thunder was heard on the 21st, and lightning seen on the 18th and 21st. On the former day a "line squall" passed over about 8.30 p.m. with a very violent storm of wind. The barometer was unsteady throughout the month, storm centres coming in from the Atlantic in frequent succession.

THE SEASONS.

Tables of Mean Temperature and Rainfall of the four seasons of 1919, together with those of the five previous years, and compared with the average (including December, 1918, but excluding December, 1919):—

TEMPERATURE.								
Seasons.	1914.	1915.	1916.	1917.	1918.	1919.	Average	Departure of 1919 from average.
Winter -	degrees 40.3	degrees 39.7	degrees 41.7	degrees 35.4	degrees 38.7	degrees 38.7	degrees 38.4	degrees + 0.3
Spring -	48.5	46.4	47.6	44.9	47.5	46.9	46.3	+ 0.6
Summer -	61.8	60.2	58.8	62.2	60.0	58.9	60.2	- 1.3
Autumn -	51.0	48.6	50.6	50.0	48.6	46.8	50.1	- 3.3
Year 1919	50.5	48.8	49.3	48.0	49.4	47.6	48.8	- 1.2

RAINFALL.								
Seasons.	1914.	1915.	1916.	1917.	1918.	1919.	Average	Departure of 1919 from average.
Winter -	ins. 4.66	ins. 13.35	ins. 10.41	ins. 6.55	ins. 5.63	ins. 10.29	ins. 5.37	ins. + 4.92
Spring -	5.45	5.18	8.20	6.27	5.10	4.98	5.13	- 0.15
Summer -	5.25	7.47	7.63	8.61	6.03	6.15	6.87	- 0.72
Autumn -	6.38	6.58	7.39	8.03	9.62	7.49	8.38	- 0.89
Year 1919	27.62	29.97	32.68	27.82	28.88	29.99	25.75	+ 4.24

It will be seen that the winter was rather mild and abnormally wet. The spring temperature was slightly in excess of the average, with a normal rainfall. The summer was deficient both in temperature and rainfall, and the autumn exceptionally cold (the coldest since 1887) and rather dry.

THE YEAR.

The rainfall of the year 1919 amounted to 29.99 ins., falling on 209 days, and it was the sixth year in succession with excessive rain. Of the last eleven years, only one (1913) gave us less than the average amount of rain. December was the wettest month, with 5.05 ins., and May and September the driest months, with .86 ins. and .88 ins. respectively. The mean temperature of the year (47.6) was 1.3 deficient, and was lower than that of any year since 1892. The chief falling off took place in February, March, July, October, and November. May was the only month giving a large excess. For the ninth year in succession Mr. J. H. Willis, F.R.Met.Soc., has kindly supplied me with his sunshine returns, which show a total of 1536 hours during the year, or about 46 hours less than the normal. May was the brightest month with 283 hours. It was a fine fruit year, with a great crop of apples and pears in most places. Although the second half of August was unfavourable for the harvest, the period of dry weather, with tropical heat, during the first half of September, facilitated a rapid finish.

MR. PRESTON'S METEOROLOGICAL RECORDS FOR 1919.

MONTH. 1919.	BAROMETER.				THERMOMETER.				HYGRO-METER. Mean Relative Humidity 9 a.m. %	SUN-SHINE. Hours.	RAINFALL.		WIND.									
	Highest.	Date.	Lowest.	Date.	Mean.	Lowest.	Date.	Mean.			Inches.	No. of Days.	N.	E.	S.	W.	N.W.	W.S.	Mean esti- mate			
JAN.	30.65	24	28.74	5	29.751	52.8	15	27.0	19	37.1	41.0	2.94	22	0	3	3	7	6	7	3	2	2.7
FEB.	30.73	9	29.01	17	29.771	51.0	22	12.0	9	35.2	59.0	3.38	14	1	7	4	8	3	0	2	3	1.7
MARCH	30.49	16	29.21	27	29.770	56.0	12	24.0	24	39.3	83.5	2.30	20	5	2	6	2	1	6	4	5	3.3
APRIL	30.66	21	28.77	15	29.911	67.0	18	28.0	1	45.5	111.6	1.82	18	4	6	1	0	2	5	8	4	2.8
MAY	30.35	26	29.38	2	30.059	80.7	23	36.5	3	55.8	283.2	0.86	9	0	3	11	8	3	1	2	3	2.7
JUNE	30.48	10	29.60	30	30.071	82.4	7	38.0	4	58.3	211.5	1.27	11	4	0	1	0	5	3	3	14	3.7
JULY	30.19	9, 30	29.51	1	29.971	77.0	31	42.5	16	57.0	124.2	2.62	22	9	5	1	0	2	2	3	9	3.6
AUG.	30.25	12	29.22	26	29.963	84.0	10	39.2	31	61.5	201.9	2.26	11	4	1	0	1	5	6	7	7	3.0
SEPT.	30.43	16	29.33	23	29.977	86.5	11	31.7	29	56.5	186.4	0.88	9	2	5	0	4	3	5	5	6	3.1
OCT.	30.57	19	29.42	12	30.103	64.0	1	31.2	15	45.6	139.6	3.53	19	6	4	2	1	5	2	6	5	2.7
NOV.	30.34	1	29.28	25	29.722	56.0	23	25.0	14	38.3	59.9	3.08	24	2	5	8	1	2	4	4	4	2.7
DEC.	30.21	19	29.05	31	29.744	54.2	3	24.2	10	40.8	34.3	5.05	30	1	0	0	2	9	9	6	4	3.5
MEANS					29.901					47.6												2.9
EXTREMES & TOTALS	30.73	Feb. 9	28.74	Jan. 5		86.5	Sept. 11	12.0	Feb. 9		1536.1	29.99	209	38	41	37	34	46	50	53	66	

V.

SOME FISH NOTES FROM GREAT YARMOUTH
AND NEIGHBOURHOOD FOR 1919

BY ARTHUR H. PATTERSON

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

I began the year 1919, as I had ended that of 1918, catching Flounders, fine spawning examples of which were, for some weeks, to be had by "darting" on a sandy streak in the channel west of the Breydon swing bridge. On January 7th an 8½ inch albino example was taken in a trawl-net on Breydon.

A very strange example of Plaice came to hand on January 22nd. It weighed 1½ lbs. and had a curious sprinkling of black spots upon the upper surface, and the red spots characteristic of the fish shewed black centres. The under-side was splashed with dead white upon the pearly skin.

On February 7th I had the pleasure of adding the Black-mouthed Dog-fish (*Scyllium melanostomus*) to the Norfolk list of fishes. For some time a considerable quantity of Dog-fish had been landed at the North Norfolk fishing villages, and it occurred to me that there was just a possibility of this species commingling with the common herd. I accordingly sketched and coloured a drawing of this fish, which I gave to Mr. Robert Beazor, asking him to use his own vigilance and to interest that of others, in order that no example might escape, and on the date mentioned I received word from him that he had secured a specimen. The fish was 29½ inches in length, which is, I believe, a rather exceptionally large example. I have no evidence that it has been recorded before on our Eastern coasts. The points about the fish most striking to me were

the elongated tail-end, the brown ocellated markings on the skin, and the curious labial folds of the mouth corners, which give the fish a wide gape. On the upper edge of the tail fin was an arrangement of small over-lapping flat spines, from which some name it the *Pristiurus* or sawtail. The inside of the mouth had a smutty blue tint, as if it had been smeared with well-diluted ink. The fish is reputed to be unfit for food, but as there was difficulty in the way of preserving this specimen I handed the carcase over to my eldest son, who is somewhat partial to the whole family of "dogs" and who cooked it, feeling afterwards quite the reverse of being dissatisfied or of being badly affected by the eating of it.

Smelts were occasionally abundant during March, one smelter making a haul off Gorleston, on the 19th, of fifty score. On a later date a catch of 125 score was made in a single tide, and was sold at fifteen pence a score. It has been suggested to me that there should be some supervision over the local smelting, but the movements of this fish are so uncertain, as are the gains of the few hardy fellows who pursue the occupation in fair weather and foul, that any interference would not in any way benefit either the men or the public. A certain protection seems necessary beyond the reach of the salt water, but Breydon, which is to-day rarely so diluted by back waters as to make it even by courtesy a fresh-water basin, should not be handicapped by restrictions, otherwise than that the meshes of the net should be of the greatest size workable for the taking of adult fish only.

Haddocks and other round fishes of the family Gadidæ, would appear to have increased greatly in numbers since the beginning of the War, and were very abundant in the western waters of the North Sea in April.

The local trawlers landed good catches in May, seven boats bulking about a thousand trunks. One vessel, the *Adela*, landed a shot of fish that realised £600. Others made good averages of Plaice, Soles, Cod, Whiting, Brill, "Butts," Dabs, Gurnards, etc. The boats had gone out on the Thursday, fished within 100 miles, and returned on the following Tuesday.

On May 21st I secured some Flounders on Breydon whose stomachs were padded with *Tellina* shells.

A Surmullet of 1 lb. 14 ozs. was brought in with mackerel on May 27th, which is a large example for this coast.

Some good catches of Carp, by rod and line, on Saham Mere were reported in the *Eastern Daily Press* of September 1st. Four anglers, in a space of eight days in August, captured 200 of these fish, of a total weight of 250 lbs., the largest being 2½ lbs. The Carp is excellent eating, especially after a short incarceration in a fish-trunk placed in a running stream, which eliminates the muddy taste so common in pond specimens.

An eight-foot Porbeagle Shark (*Lamna cornubica*) was brought in on September 17th, and was sold for eight shillings as pig meat.

In October span-long Whittings were being taken in hundreds off the piers by sea anglers, whilst no sizeable fish came to the vicinity. The usual Whiting season was a complete failure.

A Salmon-trout (*S. trutta*) of 3 lbs. was landed on a lug-worm bait at Lowestoft on October 22nd—a by-no-means common occurrence off this coast.

When strolling by the tide-mark to Caister late in November I found a specimen of the Power Cod (*Gadus minutus*) just above high-water mark. Length 5 inches.

There is an age-old idea still obtaining that the Pike respects the personality of the Tench and leaves it to its own devices; added to this, it is suggested that the presence of a Tench acts beneficially upon that most rapacious of fish. Sentiment, however, does not prevent an occasional meal being made of the Tench, for in December an eight-pound Pike, from which a Tench of one pound was taken, was captured on the Broads.

In a box of Herrings sent from Oban to the fishwharf on December 30th a very fine and beautiful specimen of the Greenland Bull-head (*Cottus Grœnlandicus*) was discovered. Length 10 inches. I regard this as a well-defined and established species, and quite distinct from the Sea Bull-head (*Cottus scorpius*), which is common enough here.

VI.

SOME BIRD NOTES FOR 1919 FROM GREAT
YARMOUTH.

BY ARTHUR H. PATTERSON.

My first entry for the year refers to the daily appearance of long, noisy strings and wedge-shaped flights of Wild Geese, probably from the Holkham Colony, that passed usually twice a day over the town. On some marshes beyond the "Berney Arms," was growing a species of grass peculiarly attractive to them, and, with their usual precaution, sentinels kept a good watch over the majority feeding, so that although ambitious gunners were constantly trying to get a shot at them, not more than two or three were obtained during the whole winter. In one instance a wounded bird was pegged down as a decoy, but it had the opposite effect to what was intended: it remained immovable and silent and appeared to create a suspicion of danger amongst passing flocks. After feeding, and the tide permitted, the geese frequently resorted to the Scroby Sands to rest and preen themselves.

On March 3rd a bunch of twenty Sanderlings were observed on the beach, an exceptionally large flock for this district.

On May 13th certain Swifts returned to their previous year's nesting quarters, to find Starlings in possession; the latter promptly ejected the Swifts on their entering their old quarters and a fight ensued. Other Swifts came to the help of their evicted friends, and a hubbub of riot ensued all the day long until the Starlings owned themselves beaten, and the Swifts were then able to resume their old occupation.

May 13th and 14th were good days for Waders on Breydon ; besides a Spoonbill and several Sheld-ducks, I saw many Godwits, Redshanks, Curlews, Ringed-Plovers, Dunlins, and heard Greenshanks. On May 22nd I saw eleven Sheld-ducks, two Cormorants, many Grey Plovers, and some Knots in the reed.

On October 2nd a recently-killed Swift was picked up on the tide-mark of the beach.

On December 12th I noted that the surrounding marshes were swarming with Lapwings ; evidently a very large immigration had occurred.

VII.

THE HERRING FISHERY OF 1919.

BY ARTHUR H. PATTERSON.

THE herring fishery of 1919 was distinguished by a certain spirit of unrestfulness, due to a variety of causes, such as Governmental interference with the price of herrings, trouble with regard to coaling prices and supplies, and to a great increase in the shortage and prices of necessary materials. These, coupled with the unsettled state and exacting demands of the labour market, tended to cause a feeling of insecurity among those who speculate in all the interests vital to the pursuit and welfare of the herring business.

The Spring fishing was nothing to boast of, the early herrings being immature, underfed, thin, and dry. It was a pity to pursue them save that it just kept a certain number of vessels employed. I am strongly of opinion that the herring should be allowed to rest until its natural food becomes more abundant as the Summer advances ; it is then a highly nutritious, oily fish.

On May 6th, thirty-five boats arrived at Lowestoft, but the majority of them had only a basket or two of fish, which fetched the control price of £6 6s. 0d. per cran. Some "Longshores" taken by "driving" nets along the coast, by Winterton boats, on May 16th, made 4s. 7d. per hundred (of 132).

By June the control price had been reduced from £6 6s. 0d. to £4 18s. 0d. per cran, and this gave great umbrage to the boat owners, who complained about the enormous cost of

everything "that goes on to a drifter," nets, coal, oil, etc.

Considerable loss of nets and ropes was caused by sunken wreckage, and one fleet suffered to the extent of £1000 worth of nets, destroyed in one night.

The following figures will enable a comparison to be made between the 1919 fishing and that of the previous years :—

GREAT YARMOUTH.

Total number of Crans landed, 453,571; as against 202,447 Crans in 1918.

293	Motor Boats	(Scotch)
347	Steam Drifters	(„)
210	Steam Drifters	(English)

Total 850

as against :—

1918	...	...	...	340	Boats
1917	...	...	...	23	„
1916	...	...	...	59	„
1915	...	...	...	185	„
1914	...	...	...	370	„
1913	...	...	...	999	„

LOWESTOFT.

Mr. T. C. Rising, of Lowestoft, informs me that in 1919 the number of boats fishing from Lowestoft was 250, with a total of 279,662 crans, as against roughly 200 boats and 105,144 crans in 1918.

VIII.

REPORT OF BLAKENEY POINT COMMITTEE.

THE NATIONAL TRUST.

JOINT MANAGEMENT AND SCIENTIFIC REPORT.

THE present report covers generally the period 1917 to 1919. For reasons of economy its issue in the form of two separate reports has been temporarily discontinued.

THE TERN COLONY.

During the latter part of the war it became difficult to make arrangements for protecting the breeding ground. The colony was undoubtedly interfered with by the guard at the Lifeboat House—the Officers failing to exert effective restraint. However in 1919 the birds arrived in full numbers at the usual time and the breeding season was distinctly successful in spite of the fact that an unexpected high tide in June swamped part of the breeding ground and many nests were washed out. Under these circumstances the Terns set to work again; fresh clutches were laid and hatched out, the old birds remaining long enough for the second brood to be able to join the migration.

It is certainly remarkable how the Terns rise superior to the vicissitudes of the nesting ground. In one or more of the years of the war the main object of the Terns in visiting the Point, *i.e.*, the production of more Terns, was frustrated. In 1913 the colony suffered almost as severely from scarcity of “whitebait.” And yet, in both cases, the next season brought us an undiminished colony. What does it all mean? If on departure at the end of August the Blakeney Point contingent is short by 1,000 Terns, that means there are 1,000 fewer Terns in the world than there would have been had happier conditions prevailed. In explanation we seem reduced to these alternatives. Either the breeding grounds are stocked in succession at the northerly April migration and any deficiency in numbers will be felt only in the remoter grounds, last reached at higher latitudes, or (and perhaps this is the more probable explanation) the general population remains approximately constant, an unfavourable result in one locality being met by an excessive production somewhere else. Eight or ten years ago we used to ring the young Terns in the hope that some information

might accrue throwing light on the facts of migration, but the method gave the most meagre results. Moreover after two seasons the authorities who organised this scheme for marking birds told us there were no migration problems touching Terns needing solution, so we discontinued the work.

Our own view is that the method by ringing is at fault—at any rate for Terns. You don't want to shoot Terns or to find their dead bodies to determine where they were bred. If individual Terns are to be recognised some other scheme must be devised by ornithologists, and the work carried out simultaneously over large numbers of breeding grounds. That a certain number of Terns come back year after year to the same ground is well known to watchers of terneries—they recognise them by individual idiosyncrasies. But the watcher hasn't reached yet the standard of the shepherd who knows all his sheep.

In the case of the Oystercatchers that breed on the Point, three pairs have returned to us for several successive years and what is more have laid their eggs in the selfsame nests.

In 1917, when the submarine menace was at its height, enquiries were received from a government office for an estimate of the sea birds' eggs on Blakeney Point that would be available under certain contingencies for human food. The resulting calculations showed that the amount of such food was negligible in comparison with the yield that could be obtained by using in other ways the labour that would have to be employed in collecting the eggs.

BULLFER GROVE.

Friends of Blakeney Point will be much interested to hear that through the generosity of Sir Laurence Jones the National Trust have received to hold in perpetuity for the public enjoyment the above area situate at Bale, a village some $4\frac{1}{2}$ miles due south of Morston. It appears that Sir Laurence Jones, who was disposing of his estate at Gunthorpe, decided to present this very charming woodland area of about 9 acres as a thank-offering for peace. The ceremony of presentation was held in glorious weather on the afternoon of Saturday, June 7th, 1919, the eve of Whit Sunday. A large concourse of villagers, county residents, representatives of the National Trust, and others, assembled under a very fine old beech tree where the ceremony took place. After rambling through the woodland, which is very varied and well upkept, the company were entertained at tea under the shade of stately elm trees in a field near by.

In addition to Bullfer grove the presentations included an oblong area adjoining the churchyard in the village of Bale itself, planted with *Quercus Ilex* in close canopy.

It may be mentioned that the old beech tree in the Grove had a girth of 13 feet 6 inches at a height of 4 feet from the ground, as measured on the day of the ceremony.

Those who know Blakeney Point will enjoy visiting Bullfer Grove the more because it provides so striking a contrast in its shade, stillness and luxuriant vegetation to our bare and wind-swept dunes and beaches.

MARRAM GRASS FOR PAPER MAKING.

In a previous Report (1915/16) mention was made of experiments in progress to test the value of Marram grass (*Psamma arenaria*) as a source of paper. Well-grown samples of the current season's growth were cut and dried early in September in 1917 and 1918, and submitted to two firms of papermakers of high standing.

The firm which handled the 1917 sample reported favourably on the state of the sample as received, it being clean, of good colour and free from dead fibre.

The treatment followed was their standard treatment for Esparto grass, a recognised raw material in regular use. For boiling they find that Marram requires less soda than Esparto.

The actual fibre is short—about .6 mm. compared with 1.5 mm. for Esparto. In spite of this a fine tenacious paper results. The yield reckoned on the dry weight of grass boiled is low; 31.6% against 45/48% for Esparto. This is due partly to the actual amount of fibre being low and partly to its shortness, which is the cause of considerable losses in washing.

The greatest defect however relates to the bleaching. Whereas Esparto requires only 9% of bleaching powder to reach a certain standard colour, Marram with 15% fails to reach the same standard and also requires a longer time to bleach. In conclusion the firm express their willingness to handle a large sample of 3 or 4 tons.

We were not prepared to harvest a large cut like that on the Point, so arrangements were made for its supply from Anglesey. Ultimately that source failed us owing to the grass reserved for the purpose becoming buried in sand by an autumn gale so that it could not be harvested.

The firm receiving the 1918 sample proceeded on the same lines as above, and obtained quite comparable results. They comment on the fact that even employing 3 times as much bleach as with Esparto they failed to get nearly so white a colour. In view of this difficulty in bleaching they express the doubt whether it would be worth while carrying the experiment further.

The above trials make it perfectly plain that Marram grass is not a suitable material out of which to manufacture fine papers—that is until such a time as a technical expert may have been able to devise a process of treatment better suited to its peculiarities than is the Esparto-process.

HOW SEA-SNAILS BURROW.

The following note, based on observations made in August 1919, has been received from Mr. William Rowan. We are indebted to "*Country Life*" for the loan of the blocks which accompany it.

"While collecting Mollusca on Blakeney Point last summer a curious little episode was witnessed and photographed. I was digging for specimens of *Scrobicularia piperata* in the soft black ooze in which it is mostly found, at a depth of about 3 feet. As I secured specimens I threw them on to the surface and continued digging for more. One of my best happened to land in a small puddle and when I went to pick him up a minute or two later, he had disappeared. For a moment I was nonplussed, but on feeling in the sandy bottom found him nearly an inch below the surface. I replaced him and waited. In a moment his shell opened and his "foot" cautiously emerged, turned down and began to feel for the bottom (Fig. 1). No sooner did the foot touch the sand than it began to move to and fro till the slightly hooked end was well imbedded and had secured a hold on the ground. Promptly the muscles were contracted and since the foot was firm, the shell naturally moved forwards and downwards. Again the foot began to move from side to side till a fresh hold was secured still further down, when once again by the contraction of the muscles the shell was hauled a fraction of an inch further down. As the edges of the shell got into the sand a new motion was developed, consisting of a cutting swing from behind forwards (Fig. 2). This seemed to increase the rapidity of the descent markedly. A minute later little more than the umbo remained in view (Fig. 3). Another minute and the whole beast had disappeared.

The photographs were taken at minute intervals, No. 1 being taken about a minute after the animal had been put on to the ground. That the work of burying themselves is a considerable effort appeared from the fact that our *Scrobicularia* on being required to repeat the performance for a third time, took seven and-a-half minutes to disappear. It was incapable of doing it for a fourth time in succession. Since the photos were taken through water a time exposure was necessitated and hence in attempting to get the tilting of the shell as the beast lunged forward, movement is unfortunately shown in Fig. 2.

SCROBICULARIA BURYING ITSELF.



Fig. 1.

The foot protruding and
digging into the sand

Shell lying flat.



Fig. 2.

Little more than the umbo
remaining in view.

(One minute later).



Fig. 3.

All but vanished.

(Four minutes from the
start).

BRITISH
MUSEUM

18 MAR 22

NATURAL
HISTORY.

If put down on the dry sand, or even on the moist, the animal found it impossible to pull its shell after it, but in the puddle, being buoyed up by the water, it would naturally be easier to manipulate. Should the beast at any time find itself stranded high and dry, it would only have to wait for the rising of the tide before it could return to its natural home. It lives only in the blackish types of sand and on areas covered regularly by the tides.

The same experiment was tried on some other species, found also under ground. They all answered in the same way, though the time required varied considerably."

INSECT LIFE ON THE POINT.

Bit by bit the various groups of organisms that inhabit the area are being determined by experts. Dr. Winifred Brenchley and others are occupying themselves with the insects, which are astonishingly numerous and technically of great interest. It would appear that the species of insects far out-number the plants. Of flowering plants we have about 130 species, but the insects must run to quite five times this number. Blakeney Point awaits some Fabre to reveal the life-dramas of these inhabitants of our *Suædas*, *Marram* and *Silene*.

Dr. W. Watson of Taunton has recently studied our Mosses and Lichens, with the result that the existing lists have been doubled. It is hoped shortly to issue annotated lists of plants and insects.

RECENT CHANGES IN TOPOGRAPHY.

The instability of Blakeney Point is such that changes in its relief are continually going on. Serial photographs and charts merely confirm and give precision to observation. Shingle is cut away or piled up, marshes rise in level and creeks migrate, whilst sand dunes are destroyed and their elements transferred elsewhere.

A casual visitor to the Point when the tide is out hardly realizes how large a proportion of the terrain is submerged at high water. At the spring tides practically everything is under water except the dunes and the crests of the beaches. It is upon this continual contact with moving water, often in a state of violent agitation, together with the winds, that the mobility of the ground depends. Of all the changes here recorded the most striking and probably the most significant is the laying out of the foundations of a sort of new Blakeney Point outside the existing Headland. These new beaches have already been occupied by a section of the Tern colony, whilst hundreds of plants¹ are at work or rather at rest accumulating

¹ Including *Triticum*, *Psamma*, *Arenaria peploides*, *Cakile maritima* and *Salsola Kali*.

embryo sand dunes. These pioneer structures are best visited at high water when the contours of the new relief and the building action of the waves can be most readily appreciated.

It is proposed to record here, at no great length, some of the principal directions of change now in progress. For convenience these will be treated in the direction east to west.

The Shingle. At Cley Beech with high tides and stormy weather the seas carry shingle from the crest to the lee slope, thus shoaling the Cley Channel which here runs alongside. From the long continued operation of this process the channel has become unnavigable except by small boats at the spring tides. To all intents and purposes Cley is isolated from direct access to Blakeney Harbour. The most obvious remedy would be to cut a new channel through the saltings to the south of the existing channel, and at the same time to secure the beach, as by planting, so that it shall not travel up to the new channel and reproduce the existing situation.

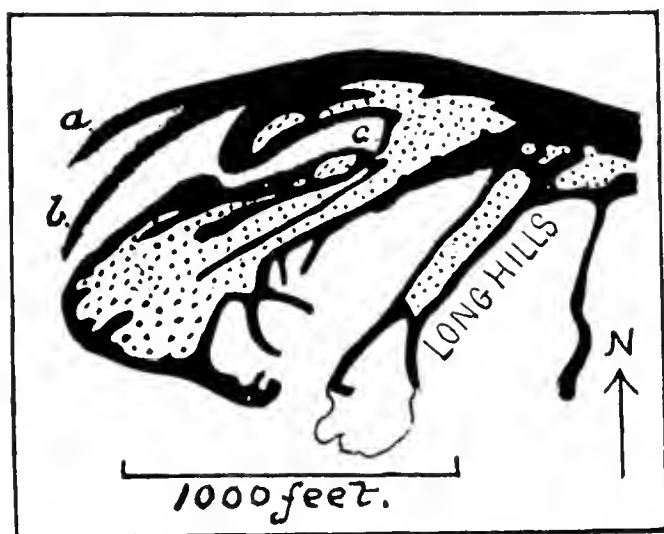
The local accumulation of shingle on a large scale is well illustrated just west of the Watch House on the Marams. Ten years ago the lee edge of the main beach ran straight from the Hood to the point at which the Watch House bank joins the main beach. Now, for a distance of 100 yards at the Watch House end of this straight run a prominent salient has developed containing thousands of tons of shingle. This accumulation, which represents wastage of the lee edge of the section referred to, is brought about by W. to E. drift occasioned by heavy weather from the S.W. In time this salient should form a bridge across to the Watch House bank.

On the Headland itself great changes have become manifest during the last 8 years. Prior to 1880 an outer causeway of shingle projected W. a full half-mile; gradually this beach was rolled landwards, its proximal parts merging in the dunes whilst its extremity was swung S. to form a sort of harbour outside the Lifeboat House. By 1907 the last traces of this beach had disappeared.

Since that date a new system of outer beaches has arisen and promises to repeat in essentials the history summarized above. In the winter of 1912/13 new inner and outer beaches (b and α , Fig. 1) made their appearance and were charted. The outer of these (beach α) has since undergone great extension—W. of the Headland (to the X in the margin, Fig. 1) and serves as an effective break-water. In 1919 these new beaches were again charted and further observations made on the distribution of the vegetation. During the autumn and following winter an unusual number of high spring tides was experienced so that the new beaches were often awash. The result is that beach α has developed a marked land-

ward sag. This part of the beach has drifted an appreciable distance towards the dunes, with which it will close up in fulness of time. The reason for this rapid landward travel is primarily its inadequate height. The highest tides overflow it, drifting the shingle from the weather to the lee side.¹ Were the beach 2 feet higher than it is, it would be awash only on the rare occasions of such spring tides as are raised materially above expectation by wind, and would form a bulwark of the same permanent nature as does the main beach throughout most of its course.

The *Britannia* beach which runs in an easterly direction from the Lifeboat House, closing in the southern edge of the Salicornia-Pelvetia Marsh has advanced some 100 yards N.E. in the last eight years owing to drift and accumulation of shingle.



TEXT-FIG. 1. Chart of Headland shewing ground exposed at ordinary high tides. Shingle beaches are black; sand dunes dotted. *a* and *b*, outer and inner new beaches (as in 1914); *c*, Great Sandy Low. X, point which tip of new beach *a* has now reached. The open sea is at the top of the chart. Scale 1/8725.

The houseboat *Britannia* which lies under its shelter has become in consequence entirely land-locked and could not be moved from her present position. A further consequence of the advance of the tip of this beach is active erosion of the marsh itself. The beach is becoming well clothed with *Suaeda* bushes and this should increase its stability.

The Sand Dunes. The older dune areas, viz. the Hood and the Long Hills continue to shrink from loss of sand. As these losses by windage are not replaced the dunes are wasting and must ultimately reach beach level.

¹ Thus our records show a landward movement of the crest of 16 feet during a single tidal cycle.

On the Headland itself the changes of the last 8 years are very marked indeed. The high dune ridges that run N.E. from the S.W. end of Glaux Low and on both sides of the Low for a quarter of a mile are being rapidly destroyed, and afford many excellent examples of eroded dunes. Seaward of Great Sandy Low and on both sides of the Boat House, on the contrary, much accretion is taking place. Extensive systems of sand hills have sprung up in the last 10 years so that the boat house is almost concealed from several points of view.

These dunes have extended a long way in the direction of the *Britannia* and being in active growth further changes are to be expected.

Turning to the *Marshes*. The established marshes of the Marams system present much the same appearance, physically and vegetationally as 10 years ago. Their vertical growth, as befits their maturity, has been slight—not more than $1\frac{1}{2}$ -2 inches. Alteration in detail is of course manifest.

The greatest change in any marsh is to be found on the Horn sands, to the S. of The Hood, sometimes known as the "New" or "Sapphire" Marsh. In 1910 this area bore a thin scattering of *Salicornia* and in 1913 it was charted in detail. At that time a few sea asters had appeared—perhaps 20 clumps. To-day this marsh of some 25 acres is one dense growth of aster (the rayless form predominating) with a fringe of *Salicornia*. Under the influence of its vegetation accretion has been so active that the average ground level of this marsh has risen at least a foot in the period under review. At many points other halophytes, such as *Obione*, *Salicornia radicans*, *Glyceria maritima* and *Statice Limonium*, are establishing. *Pari passu* with this great advance it is not surprising that the muds closer to the main beach should be rapidly colonising with *Salicornia europæa*, especially the soft mud just W. of the Watch House. These instances must suffice to illustrate what is everywhere taking place. These changes are not indiscriminate but follow regular and well defined sequences.

People sometimes ask, "Which is the best season to visit the Point?" The answer of course is, "Come at any time." From March when the dunes are gay with ephemerals till the winter when the marshes glow like copper with the dying *Salicornia*, there is never a dull moment. For those who would see mass production of flowers *in excelsis*, mid June is best for the *Silene* and Sea Pink, and late July for the procession of the *Statices*. Some day perhaps a Blakeney Calendar may be compiled, recording the times and seasons of the principle happenings in this world of plants, birds, insects, shellfish and other creatures.

EPISODES OF THE WAR.

The questions are often asked, "How did Blakeney Point fare in the war?" "Has its interest and value as a Nature Reserve received any set back, transient or permanent?" The second question may be answered at once. Only a trained eye would detect any changes whatsoever on the Point. As regards the natural life of the place it would be hard to imagine a breeding season more full of promise than that of 1919, whilst the display of flowers and tender herbage at Whitsuntide 1919 will hold its own with the best in living memory.

One source of "dilapidation" deserves mention. The soldiers in patrolling the Point always followed the same lines, wearing tracks across the dunes. At those points where these tracks traverse the crests the sand has become exposed to erosion by wind and in due course these spots will develop into "blow outs"—bare crater-like depressions, apt to be obstinate and difficult to eradicate. Already several have appeared.

From the outbreak of hostilities in August 1914 till the armistice, Blakeney Point fell under the charge of the military authorities. Guards were at once posted at Cley Beach and at the Watch House on the Marams, and in August 1915 at the Lifeboat House on the Headland itself. Essentially these were points of observation, and at no time was Blakeney Point organised for any serious defence. It is true Cley Beach was "wired", and rude sangars thrown up, and traverses of mud blocks improvised on the sea walls, whilst later a "pillbox" made its appearance at the end of the road from Cley, but these defences could at best only help to delay the advance of any landing in force till troops could be brought up from the interior.

At all times the access of residents and visitors to the Beach and Point was controlled by a system of permits, sometimes rather grudgingly issued; whilst from August 1915 to June 1916 the granting of permits was entirely suspended. These restrictions were borne with patience and fortitude by the neighbourhood, many of whose members were thus deprived of their accustomed opportunities of collecting driftwood, &c. from the shore.

It is easy to be wise after the event, but there is no harm in stating that the opinion was widely held and is corroborated by what follows that the outlook on Blakeney Point might with advantage have been entrusted to local men, boatmen and others familiar with the conditions in all possible circumstances. They would have known how to interpret the nocturnal phenomena of the Point, have recognised at a glance the business of any approaching craft, and in all probability have proved less costly to maintain than regular soldiers.

On the whole, service on the Point was far from popular, especially in winter time, or when the period was prolonged from week to week. There were some soldiers however who recognised its advantages, of which by no means the least was freedom from the irksomeness of parades, route marches and camp routine. I remember meeting one philosopher who had put in several successive periods at the Watch House. The spring was coming and he was considering whether to volunteer for further duty. Pointing with his thumb in the direction of the Watch House Creek, he asked, "That mud there, Governor, do it throw up in summer?" On my reassuring him, he told me, in that case, he might do worse than keep the billet.

Then there were men who showed an unquenchable enthusiasm for snaring rabbits. Not that they were particularly successful. As a rule the snares were attached to large sticks placed at the mouths of rabbit holes and rendered doubly conspicuous by pieces of paper tied to the grass near by! There was one Sergeant however who won the approval of the cognoscenti. He was a dead rifle shot and never failed to put a bullet through a rabbit's head.

On rare occasions the Adjutant would trudge out on a tour of inspection. His approach of course was heralded from the Watch House over the telephone, so that the men had ample time to make things ship-shape. I have even seen a soldier attempting to sweep up the loose sand on the dunes by the Lifeboat House with a broom, in preparation for one of these visitations.

The use of cameras on the Point was of course strictly forbidden, and the instruments if discovered were liable to confiscation. People who wanted to take photographs however soon found a way of circumventing this regulation. The Guard in their exile from civilisation were always in a chronic state of hunger for papers and magazines, and have been known to break into unoccupied huts in the search for fresh reading matter. It was found that by dumping an armful of John Bulls, Strands, &c., in the Guard Room several hours could be secured free from all risk of disturbance, during which plates and films could be exposed with perfect impunity.

Quite early in the war two entirely genuine bird men got into trouble through using field glasses and cameras without circumspection. Their movements on the beach had attracted general attention and on a certain Sunday afternoon word was passed from the sentry at Cley Beach that the "two spies" had passed east towards the Salthouse Rocket-House. A patrol sent out from Cley in the reverse direction intercepted them at a point on the old sea wall opposite Salthouse and took them in custody to Cley. The same afternoon happening to call at "The George" (where they were

staying) for tea I met these gentlemen after their release. One of them informed me that this was the third occasion on which he had been arrested in the past fortnight.

He was a big man and wore a beard; his face was sunburnt and he carried a rucksack. This explains why his appearance aroused suspicion. He told me that even the children ran after him in the villages crying, "There goes a German with bombs in his knapsack."

Blakeney Point and the adjacent coast line would appear to have served as a frequent rendezvous for Zeppelins on their way to the Midlands. The country about here is full of stories of their doings, stories which are not likely to lose anything with lapse of time. The destruction of a Zeppelin out to sea on the evening of Bank holiday (August 5) 1918 was well seen from high ground inland, as at Langham. A portion of one of its propellers subsequently drifted on to the beach and was recovered by young Mr. Bishop of Cley.

As a direct or indirect consequence of the war several ships were wrecked on the Point, whilst on numerous occasions the beach was littered with the cargoes of vessels submarined in the North Sea. Sometimes it would be planks that came ashore from a timber ship—hundreds of them. On other occasions the beach would be strewn with cases of margarine or baskets of fruit; whilst in the Spring of 1919 a paravane drifted ashore not far from the Lifeboat House. There is no reason for supposing that any of these gifts of Neptune were left to rot on the drift line.

Of the wrecks some of the details are of sufficient interest for inclusion here. The S.S. *Vera* was a considerable ship of perhaps 5,000 tons, bound with a cargo of coal for Italy. She was following in the wake of two mine sweepers, and, fouling their trawl, drew round on herself one of the sweepers and was badly holed amidships. In a sinking condition she beached herself on Cley Beach and became a total wreck. The salvage operations, which extended over several years, provided remunerative employment at a time when it was welcome and much coal was brought ashore. It seems almost incredible now to realize that this coal could be taken from the dump at one time for 7/6 a ton and later for 12/-. So far as the neighbouring villages are concerned the fame of this windfall became widely known all too soon, and large quantities of it were purchased by the gas companies of some of the inland towns.

During the winter of 1914/15 a Danish or Swedish steamer came ashore just to the west of the harbour outlet. Of the crew of ten or eleven only one man survives. He swam to the dunes of the Headland and under cover of night made his way to the Watch

House on the Marams, where he gave the Guard the surprise of their lives. It seems quite possible that all these men would have been got off safely in ordinary times, for it is commonly reported that the soldiers mistook the vessel for a mine sweeper coming to her moorings for the night in the ordinary way. No blame attaches to them for they knew no better; the battalion at the time in occupation was mainly recruited from a London district.

Although this steamer stranded to the W. of the outlet, the channel shortly afterwards changed its course and the wreck now lies deeply bedded in the sand some distance to the East. It can be reached dry shod from the dunes at low water at the spring tides, and has become a favourite resort of Zoologists who find it an excellent locality for marine animals such as the starfish, hermit crabs and the like.

At a much later date (Thursday, April 4th, 1918) two French schooners *Le Boer* and *Madeleine*, of some 300 tons each, were wrecked close by the last mentioned steamer under the following circumstances. After loading up with coal at a N.E. coast port they were being towed back to France, when off Sheringham *Le Boer* became too leaky to continue her voyage. With a view to caulking her between tides, the tug brought the two vessels to the mouth of Blakeney Harbour and beached them on the East point close by the aforementioned wreck. What precisely happened has not been ascertained, but the affair was so mishandled that the schooners had to be abandoned and their crews taken off. On Saturday, April 6th, the *Madeleine* was resting on an even keel whilst *Le Boer* showed a list of 45°. On Sunday the ships were visited by a party coming by boat from a distance—perhaps in search of souvenirs. An explosion followed in the forehold of the *Madeleine*, where carbide appears to have been stored. By dawn on Monday morning the *Madeleine* was well alight forward. Both vessels were visited by several boats from the harbour that day, and the fire was extinguished by the evening tide, the water entering the hold by a hole which had been burnt in her side. On Tuesday and Wednesday at low water a salvage gang was at work getting out coal from *Le Boer* (whose list facilitated operations), and carrying it over the sands to the old Blakeney lifeboats which lay on the edge of the channel, a third of a mile to the west.

The anti-submarine gun of the *Madeleine* (a 47 millimeter Hotchkiss) was also salvaged.

With the evening tide of Wednesday it came on to blow hard from the N.E. and *Le Boer* was seen to roll and bump violently. The final break up however came with Thursday morning's tide, when *Le Boer* was entirely demolished and the fragments were scattered

all along the outer beach of the Headland, or drifted into the harbour, forming a menace to the navigation of small boats. The *Madeleine* at the same time shifted 100 yards nearer the beach, whilst her forward parts broke up and drifted ashore, including several ammunition boxes which were handed over to the guard at the Lifeboat House.

Salvage operations were resumed at the ebb, but all *Le Boer's* coal had disappeared into the sand and the main part of that of the *Madeleine*. The evening tide gave the *coup de grace* to the *Madeleine*, so that both ships were entirely destroyed within a week of being so imprudently beached. Of the 500 or 600 tons of coal carried by the two ships probably not more than 20 tons were salvaged.

PUBLICATIONS.

Since the issue of the last Report in 1916 the only publication arising out of the work on Blakeney Point is No. 18, "On the Nest and Eggs of the Common Tern," which appeared in *Biometrika* at the end of 1919. It represents the outcome of observations on the Tern colony collected in July 1914, by Messrs. Wm. Rowan, E. Wolff, and the late P. L. Sulman. The paper is drafted by Professor Karl Pearson, F.R.S., whilst the laborious work of tabulating and computing has been done by E. Isaacs, E. M. Elderton and M. Tildesley. It is illustrated by four plates of photographs of the Tern and its nests, and one coloured plate of eggs. All the illustrations are by Mr. Rowan. Taken in connection with our publication No. 12 (which dealt with similar data collected in 1913), these two papers include the results of practically all the statistical work based on the eggs of the Tern that has appeared. In spite of the fact that the treatment is primarily mathematical, much to interest the general reader will be found in this last paper.

Though not a Blakeney publication, many observations drawn from the area, including a special chapter devoted to Blakeney Point, are contained in "Tidal Lands," a book for which the present writer is jointly responsible with Mr. A. E. Carey, the maritime engineer.

Since the issue of the last Report (in 1916) our losses by death have been heavy.

Captain Paul Sulman, a student of great promise who took an active part in the 1914 census of Terns' eggs, died of wounds received in France in 1917.

Captain Cyril M. Green, a member of the Botanical staff, at University College, and later Keeper elect of the Botanical

Department of the Welsh National Museum, who had been severely wounded at Loos, fell in battle at the capture of Gaza in November, 1917.

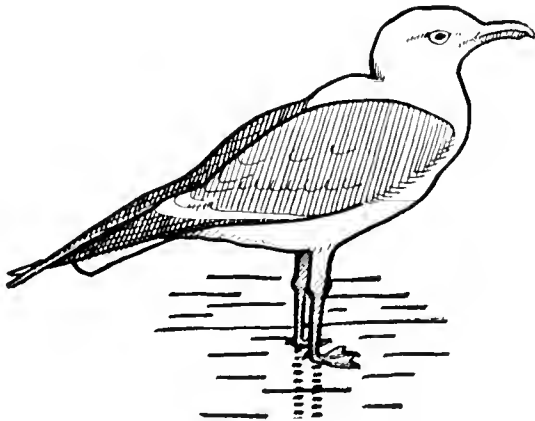
Dr. E. de Fraine, well known for her researches on the anatomy of recent and fossil plants, died after a long illness in 1916. Her last published work was a detailed investigation into the anatomy of two species of *Statice* (Sea Lavender) growing on Blakeney Point, No. 15 of our publications.

Dr. Sarah Baker died after a brief illness in June, 1917. An enthusiastic botanist, she never missed an opportunity of visiting the Point, where her special interest lay in the brown seaweed constituents of the salt marsh vegetation. In her memory a prize to promote research in botany has been founded in connection with the botanical department of University College, to which she belonged.

I have gratefully to acknowledge the following subscriptions to the upkeep of the laboratory :—Prof. W. P. Ker, £1 1s. 0d.; Mr. H. B. Watt, £1 10s. 0d.; Miss Gwen Jones £5 0s. 0d.; and gifts of books and pamphlets from Mr. J. H. Gurney, Mr. Robert Gurney, Mr. E. E. Green and Dr. Sydney H. Long.

The personnel of the Committee of Management for 1920 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, Dr. Sydney H. Long, Professor F. W. Oliver, Cannon Gordon Roe, The Hon. N. Charles Rothschild, Miss M. A. Sewell, and Mr. C. J. Temple-Lynes.

F. W. OLIVER, *Secretary.*



BLAKENEY POINT PUBLICATIONS.

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- No. 1. Polymorphism in the Flower of *Silene maritima*, by
E. J. Salisbury Out of Print.
- „ 2. The Shingle Beach as a Plant Habitat, by F. W.
Oliver Out of Print.
- „ 3. The Brown Seaweeds of the Salt Marsh, by S. M.
Baker Out of Print.
- „ 4. Blakeney Point, Norfolk; the new Nature Reserve, by
F. W. Oliver Price 4d.
- „ 5. Some Notes on the Animal Life of Blakeney Point, by
Wm. Rowan Price 6d.
- „ 6. Some Remarks on Blakeney Point, Norfolk, by F. W.
Oliver Price 6d.
- „ 7. Topography and Vegetation of Blakeney Point, Norfolk,
by F. W. Oliver and E. J. Salisbury ... Price 3/-
- „ 8. Vegetation and Mobile Ground as illustrated by *Suaeda*
fruticosa on Shingle, by F. W. Oliver and E. J.
Salisbury Price 1/6
- „ 9. Note on the Food Plants of Rabbits on Blakeney Point,
Norfolk, by Wm. Rowan... .. Price 6d.
- „ 10. Some Observations on a Tern Colony, by Wm. Rowan,
Price 6d.
- „ 11. The Structure and Water Content of Shingle Beaches, by
T. G. Hill and J. A. Hanley Price 1/-
- „ 12. On Homotyposis and Allied Characters in the Eggs of the
Common Tern, by Wm. Rowan, K. M. Parker and
Julia Bell Price 1/6

BLAKENEY POINT PUBLICATIONS, continued.

- No. 13. The Blakeney Point Ternery, by Wm. Rowan, Price 6d.
- „ 14. The Ecology of the Maritime Lichens at Blakeney Point, Norfolk, by R. C. McLean Price 2/-
- „ 15. The Morphology and Anatomy of the Genus *Statice* as represented at Blakeney Point. Part I. *Statice binervosa* and *S. bellidifolia*, by E. de Fraine. With Systematic and Ecological Notes, by E. J. Salisbury, Price 2/6
- „ 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, Price 2/6
- „ 17. The Little Tern, by Wm. Rowan Price 9d.
- „ 18. On the Nest and Eggs of the Common Tern, A Co-Operative Study, by W. Rowan, E. Wolff and the late P. L. Sulman (Field Workers), Karl Pearson (Reporter), E. Isaacs, E. M. Elderton and M. Tildesley (Tabulators and Computers) Price 3/6
- Blakeney Point Reports for 1913 Price 3d.
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HAND LISTS OF A FLORA AND FAUNA OF
BLAKENEY POINT.

- No. 1. The Birds of Blakeney Point, by Wm. Rowan, Price 1/6
-

Any of the above to be had post free from F. T. Smith, at the Botanical Department, University College, W.C.1.

IX.

MISCELLANEOUS NOTES AND OBSERVATIONS.

NESTING OF THE LITTLE TERN AT HORSEY.—Although it has been well known for some years to Norfolk ornithologists that there are small breeding colonies of the Little Tern (*Sterna minuta*) at several places on the coast, e.g. Blakeney Point, Wells, and Wolferton, and that the birds return regularly to these spots for nesting purposes, we can gain no information of this species having occupied the Horsey site for at least twenty years. It is therefore satisfactory to record that in 1919 between thirty and forty pairs unexpectedly appeared on this part of the coast, and on June 15th thirty-one nests containing eggs were found (James Vincent). The colony was visited by several members of the Society. Most of the nests were found on a spit of shingle on the North side of the dunes, near Horsey Gap. There were also three or four pairs of Ringed Plover (*Ægialitis hiaticula*) nesting on the adjacent beach, above high-water mark. In 1920 the birds returned to the same site, when the size of the colony was estimated to have increased to between fifty and sixty pairs. During this Summer some valuable observations were made upon the colony by Dr. T. Lewis, F.R.S., as to the breeding habits of the birds, and recorded by him in *British Birds* (Vol. XIV., p. 74). Unfortunately our Society has no funds that could be spent upon the services of a watcher for the colony, and we regret to have to record the fact that a considerable number of the nests were robbed by boys and others. We are indebted to Dr. Lewis for giving us this information, which was immediately acted upon in the only possible way, namely, by erecting a Warning Notice Board near to the site of the colony. We visited the birds again on July 17th and found several young ones squatting in the dunes, so that the depredations were perhaps not quite so wholesale as was at first anticipated.

—EDITOR.

BIRD NOTES FROM KESWICK OLD HALL.—There are two shallow ponds in the grounds here, both of them admirably suitable for wild ducks of almost any description, and during the twenty years preceding the war I kept a variety of ducks on these ponds and found their habits very interesting to watch, especially those of the diving species. Some of them nested and reared young, but not many of the latter reached maturity, owing, I fancy, to rats, large eels, and other enemies, though a few Tufted ducks and one or two Pintails managed to survive these dangers. I have also bred several Pintail x Mallard hybrids, which are easily reared and grow very fast. Nestlings of the Tufted duck will start diving when only a few days old, but I cannot say from personal observation that this habit is developed so early in the young of others of the diving ducks. For some years I had a pair of Black Swans, which nested on several occasions and brought up a few young ones, but the female usually spoilt the first eggs laid by too much attention, and only those laid last used to hatch. Both male and female took their share in incubation, which lasted thirty-five days. They were rather truculent birds, and it became necessary to pen them in a separate enclosure, or they would have killed the other inhabitants of the pond. The male bird would attack anyone who approached him, not excepting the person who regularly fed him. I always fed my ducks on mixed oats and barley, which was thrown into shallow water, thus leaving nothing to attract rats.

There were always Waterhens on the pond, and I found these birds quite interesting to watch. One habit I have noticed which I have not seen previously recorded, namely, that of building fresh nests, "day nurseries," for their young, after the latter are hatched. Sometimes these are built on the bank, when they are small and slight in structure; at other times they are made as floating "nurseries," and are then more bulky in construction. On one of the ponds there are floating, anchored boards, which the ducks use as resting places, and on one occasion I saw a pair of Waterhens, with their chicks, swim up to one of these boards, when one of the old

birds climbed on to it with her young ones. The other parent immediately began collecting floating leaves and other débris and brought them to the bird on the board, who commenced building a nest with this material. After a while the birds changed places and jobs, and before very long they had run up a large, rough-looking nest, into which the nestlings retired.

At times Kingfishers visit my ponds, and I have seen as many as five fishing at one time. This bird does not always dive from a bough or other resting place, but will sometimes hover over the water before dropping upon its prey.

A few years ago a pair of Green Woodpeckers began nesting operations in a large ash tree in the garden, and I used to see showers of chips coming out of the hole, at intervals, whilst the boring was going on. This seemed to be done chiefly by the female, the male resting on the tree about a foot below the hole. After a while a pair of Starlings appeared on the scene and proceeded to take possession without any opposition on the part of the Woodpeckers. I at once determined that they should not steal the nest, and for the greater part of the next three days I stationed myself with my gun near to the tree, but after having shot thirteen Starlings I gave it up in despair. During the whole of this time the male Woodpecker remained in his usual place, about a foot below the hole, and I never once saw him make a peck at or otherwise try to dislodge the usurpers. Whenever I shot a Starling, whether male or female, the survivor returned with a mate in about a quarter of an hour. Why did not these unpaired Starlings find mates amongst themselves?—EDWARD KNIGHT.

BIRD NOTES FROM ELLINGHAM.--1919.—April 26th. Lesser Spotted Woodpeckers very active here; also Green Woodpecker and Greater Spotted Woodpecker, and many Nuthatches.

April 28th. Found a Snipe on four pale blue eggs without

markings, on the marsh. This is the second clutch of the kind on these marshes in the past two years.

May 9th. Cuckoo's egg in Pied Wagtail's nest on house. Note, they brought up this young Cuckoo, built and laid again and were *again* victimised by the Cuckoo. They successfully reared the second young Cuckoo.

May 28th to 31st. Spent at Brandon, where several pairs of Redstarts were found nesting in boxes.

June 4th. Found four Nightjars' nests and eggs in various places; also Treecreeper on three fresh eggs. The bark became detached and the nest collapsed, so I roped it on and she brought up her family.

July 1st. Hawfinches nesting in an apple tree in the "Wilderness." The young were reared.

1920.—January. The Little Owl has spread to this district, and I have several times seen one lately, sometimes mobbed by small birds.

January 20th. Saw a flock of twenty-five Jays in the park, and saw another of fifteen a few weeks ago.

January. Saw a desperate fight between two male Kestrels and found a third dead.—E. CLARIBEL SMITH.

WHITE-BEAKED DOLPHIN IN NORFOLK.—A female example of the White-beaked Dolphin (*Delphinus albirostris*) was found on the beach at Yarmouth on May 1st, 1919, from which I made the following measurements:—Length, nine feet three inches; pectorals, twenty inches long; dorsal fin, twenty-four inches; tail spread, twenty-seven inches. The upper jaw contained forty-eight teeth, the lower fifty. Millais (*Mammals of Great Britain and Ireland*, Vol. III., p. 340) gives the measurements of this animal as varying in length between seven feet and nine feet eight inches, "the males being somewhat larger than the females," so that the present specimen was of unusual size. The record was sent to Sir Sidney Harmer, F.R.S., at the South Kensington Museum.
—ARTHUR H. PATTERSON.

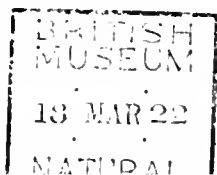
TWO RARE BEETLES.—At the Meeting of the Society held on October 26th, 1920, Mr. H. J. Thouless exhibited specimens of two species of Beetle which had been recently captured by him in the County.

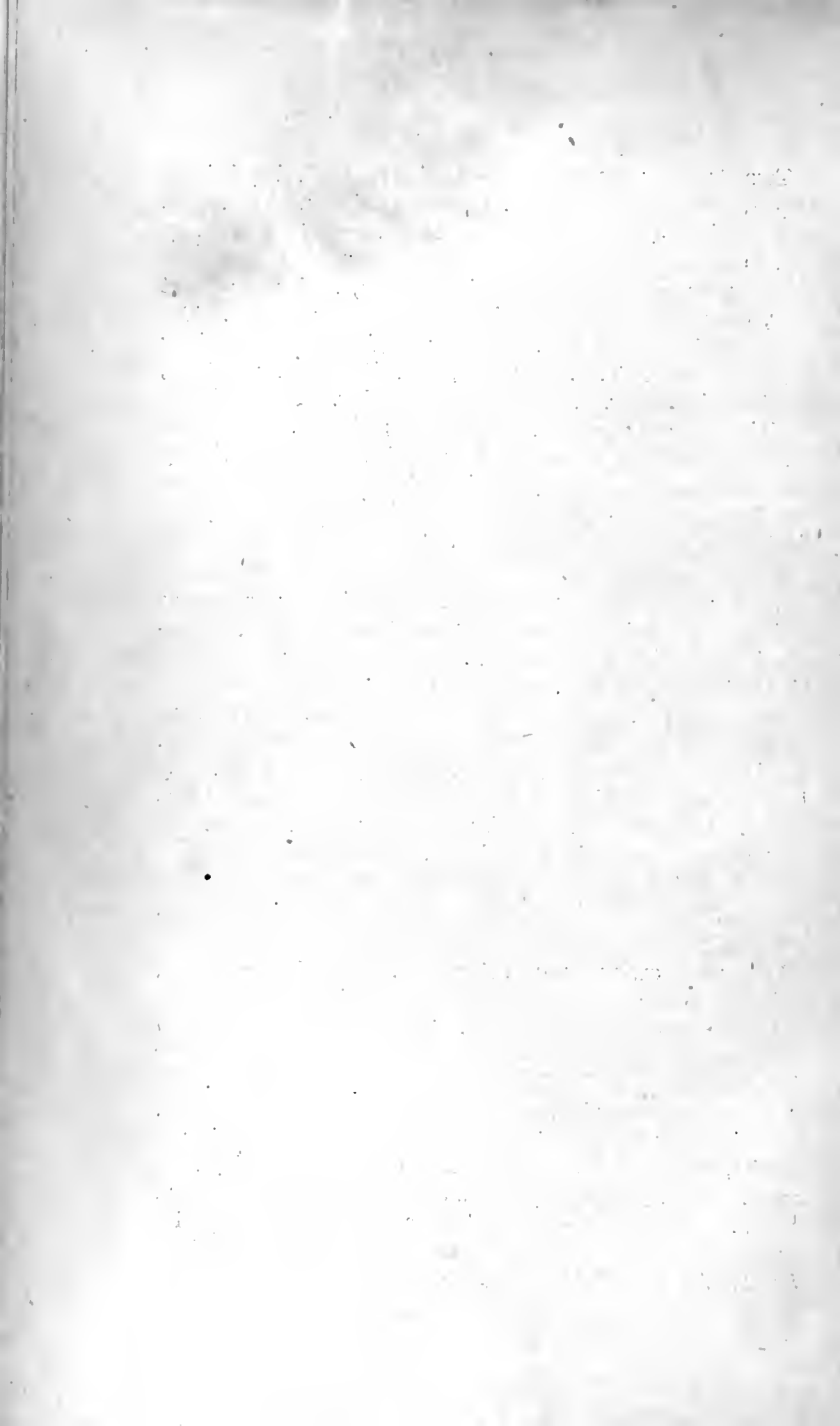
Tapinotus sellatus F., a weevil of which, until the present year, only three British specimens had been recorded. The first was taken by the Rev. Landy Brown, in 1838, at Horning; the second by Mr. T. V. Wollaston, at Whittlesea Mere in 1846, and the third by Mr. O. E. Janson, at Horning. The specimens exhibited also came from the Horning district.

Leptura rubra L., a fine Longicorn which had not previously been recorded as British, but which has occurred in small numbers during the last three seasons in rotten stumps of Scots Pine at Horsford.—EDITOR.

WIGEON BREEDING IN NORFOLK.—There is every reason to believe that a pair of Wigeon (*Mareca penlope*) nested in Norfolk in 1919. On June 14th, Mr. Christopher Davies was on his Broad at Burnt Fen, and drifted down to within ten yards of a male and female Wigeon (the former in full nuptial plumage) that were accompanied by four recently-hatched ducklings. The identification is beyond doubt, and on the following Sunday I saw the duck with her ducklings on the same part of the Broad. Enquiries have failed to discover any Wigeon being kept in confinement in the neighbourhood. The Wigeon has been suspected of breeding in the County on more than one occasion, but I cannot find any record of a nest.—S. H. LONG.

HOODED CROW NESTING IN NORFOLK.—On July 22nd, 1920, I saw two young Hooded Crows (*Corvus cornix*) in the company of ten Rooks on Horsey Warren. The birds were all perched on a wooden railing, so that it was easy to compare the smaller size of these young Crows with that of the Larger Rooks. As I approached nearer it was seen that they could fly quite well. It is highly probable that these birds were hatched off in the district, though I have no evidence of the nest having been found. On May 11th, 1919, I saw a Hooded Crow on this same warren. There does not appear to be any record of this species having nested in the County since 1857 (Stevenson's *Birds of Norfolk*, Vol. I., p. 261).—S. H. LONG.





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TRANSACTIONS
OF THE
Norfolk and Norwich
NATURALISTS' SOCIETY

PRESENTED TO MEMBERS FOR
1920—21

VOL. XI.—PART II

EDITED BY THE HONORARY SECRETARY



NORWICH

PRINTED BY A. E. SOMAN & Co.

SEPTEMBER, 1921

PRICE 10/-

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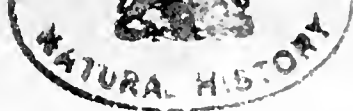
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3. The discouragement of the practice of destroying the rarer species of birds that occasionally visit the County, and of exterminating rare plants in their native localities.
4. The record of facts and traditions connected with the habits, distribution, 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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 1889 Patterson Arthur H., *Hon. Mem.*, 32, Lichfield Road, Great
 Yarmouth
 1920 Patteson Mrs. F. E., Great Hautbois House, Norfolk
 1901 *Paul J. J. Dawson, Eaton Grove, Norwich
 1911 *Payler Donald, Castle Museum, Norwich
 1916 Peabody Institute, The, Baltimore, Md., U.S.A.
 1920 Pelham Mrs. Sidney, 85, Newmarket Road, Norwich
 1903 Petre Col., Westwick Hall, Norfolk
 1872 Pigott Sir T. Digby, C.B., F.R.G.S., Sheringham, Norfolk
 1909 Platten Rev. T., The Close, Norwich
 1880 Preston A. W., F.R.Met.Soc., Christ Church Lodge, Norwich
 1919 Preston Sir E., Bart., Beeston Hall, Norwich
 1900 Preston F., Thorpe Mansions, Norwich
 1913 Purdy T. W., Aylsham
 1887 Pycraft W. P., A.L.S., F.Z.S., British Museum (Natural History),
 London, S.W.

R

- 1912 Riley W. A., 100, King Street, Norwich
 1911 Rising A. P., The Manor House, Ormesby, Great Yarmouth
 1908 Riviere B. B., F.R.C.S., M.B.O.U., *President*, St. Giles' Plain,
 Norwich
 1893 Roberts E. T., 34, Carlisle Road, Norwich
 1919 Robinson F., Watton, Norfolk
 1869 o.m. Robinson H. S., Eaton, Norwich
 1908 Rogers Commander F. S., R.N., Ingham New Hall, Norfolk
 1909 Rogers Rev. Henry, Clarendon, Lowestoft
 1884 *Rosebery The Right Hon. the Earl of, K.G., 38, Berkeley
 Square, W. I.

Elected.

- 1908 *Rothermere Rt. Hon. Lord, Hemsted Park, Cranbrook, Kent
 1897 *Rothschild Rt. Hon. Lord, F.Z.S., Tring, Herts.
 1879 Royal Microscopical Society, President of the, *Hon. Mem.*,
 20, Hanover Square, W.
 1918 Rudd A. J., London Street, Norwich
 1906 Rumbelow P. E., 27, Rodney Road, Great Yarmouth
 1919 Russwurm Mrs., Scarning Grange, E. Dereham
 1901 Rye Walter, 66, Clarendon Road, Norwich

S

- 1909 Seymour Col. C. D., J.P., Barwick House, King's Lynn
 1921 Sherlock A. F., 45, York Road, Great Yarmouth
 1919 Sier N. W., 2, Willow Lane, Norwich
 1921 Silcock Chas., "Orgoodness," Claremont Road, Claygate, Surrey
 1919 Simpson F., Sheringham, Norfolk
 1917 Smalley F. W., "Windermere," 4, Blackheath Park, S.E., 3.
 1919 Smith H. F., Diddlington Hall, Norfolk
 1915 Smith Mrs., Ellingham Hall, Bungay
 1891 Smith W. R., Harleston, Norfolk
 1909 Snow T., The Craig, Windermere
 1921 Soman A. E., 37, St. Andrew's Street, Norwich
 1917 Sowels Miss, Thetford
 1911 Spurrell J. T., St. Faith's, Norfolk
 1921 Stimpson Edward, Sall Moor Hall, Reepham, Norfolk
 1919 Suffield Rt. Hon. Lord, Gunton Park, Norfolk
 1896 Sutton W. Lincoln, F.I.C., Eaton, Norwich

T

- 1921 Taylor Dr. Mark R., 49, Mount Pleasant, Norwich
 1878 Taylor Shepherd T., M.B., The Mount, Edgefield, Melton
 Constable
 1906 Thomson D. G., M.D., C.B.E., Thorpe End, Norwich
 1886 Thouless H. J., "Corfe," College Road, Norwich
 1910 Ticehurst C. B., M.B.O.U., 46, London Road, N. Lowestoft
 1896 Tillett Wilfrid S., 2, Claremont Road, Norwich
 1920 Todd Lt.-Col. Eardley, Mundham House, Brooke
 1902 Todd R. A., B.Sc., Plymouth
 1913 Tomes Sir Chas., LL.D., F.R.S., Mannington Hall, Norfolk
 1910 Tracy N., 3, King Street, King's Lynn
 1921 Troubridge Sir Thos. H., Bart., 48, Gt. Cumberland Place,
 London, W.
 1896 True F. W., *Hon. Mem.*, U.S. National Museum, Washington,
 U.S.A.
 1883 Tuck W. H., 5, Southgate Green, Bury St. Edmunds
 1906 Turner Miss E. L., F.Z.S., H.M.B.O.U., Langton Close, Girton,
 Cambridge

U

- 1921 Upcher H. E. S., The Gables, Upper Sheringham
 1869 o.m. Utting S. W., Stanley Avenue, Thorpe, Norwich

V

- 1880 Vaughan Matthew, The Limes, Marlborough
 1917 Vincent James, Hickling, Norfolk

W

Elected.

1910	Wade Dr. E. W., Harleston
1875	Walter J. H., F.Z.S., Drayton Hall, Norwich
1921	Walton Miss, 17, Camberley Road, Norwich
1906	Watson Innes, Swanington Court, Norfolk
1872	Wheeler F. D., M.A., LL.D., Hellesdon, Norwich
1883	*Whitaker Joseph, F.Z.S., Rainworth Lodge, Mansfield
1901	Wild Edward, The Hawthorns, Eaton, Norwich
1913	Williams Miss Margaret, 7, Queen Street, Norwich
1909	Witherby H. F., F.Z.S., 326, High Holborn, W.C.
1919	Woods Miss Amy, "Camiers," Mundesley-on-Sea
1899	Woodward Dr. Henry, F.R.S., V.P.Z.S., F.G.S., <i>Hon. Mem.</i> , Tudor Cottage, Clay Hill, Bushey, Herts.
1907	Wormald Hugh, M.B.O.U., Heathfield, East Dereham
1911	Worthington R., Lowestoft
1903	Wright Miss Helen, 25, Surrey Street, Norwich
1920	Wyllys Hugh, "Shrublands," Southtown, Great Yarmouth

Y

1915	Yarmouth Free Library, The, Great Yarmouth
------	--------------------------------------------

TOTAL.

Honorary Members	...	...	11
Life	"	...	36
Ordinary	"	...	236
			—
			283
			—

The Treasurer in Account with the Norfolk and Norwich Naturalists' Society, Year Ending April 24th, 1921.

I. GENERAL ACCOUNT.

	Dr.	£	s.	d.	Cr.	£	s.	d.
1920-21.								
To Balance on Deposit,	65	10	6	...			
" Excursion a/c	13	0		...			
" Subscriptions	66	3	6	...			
" Sale of "Transactions"	86	19	6	...			
" Sale of "Flora of Norfolk"	5	4	0	...			
" Transferred from Publication Fund	1	4	0	...			
" Interest on Deposit a/c	35	10	6	...			
	...	3	2	0	...			
	...	70	11	3	...			
	...	1	14	6	...			
	...	3	0	6	...			
	...	6	13	0	...			
By Balance, April, 1920			
" Fire Insurance			
" Year Book of Societies			
" Printing notices, etc.			
" Cost of "Transactions," vol. xi., part I.			
" A. E. Soman & Co.,—Printing, etc.			
" Illustrations, Binding, etc.			
" Wrappers and Cardboard			
" Vitty and Seaborne—Illustrations			
" Soman & Co.—Reprints			
" Haydon—Bookbinding			
" Norfolk and Norwich Library—Rent of Room			
" Assistant Secretary			
" Postages, etc.			
" Balance—Current a/c			
" " on deposit			
		81	19	3				
		1	15	0				
		7	4	0				
		3	3	0				
		5	0	0				
		5	7	6				
		30	19	0				
		56	2	0				
		87	1	0				
		£198	3	6				

Examined and found correct,
W. A. NICHOLSON, Hon. Auditor,
17th May, 1921.

II. SPECIAL PUBLICATION FUND.

1920-21.								
To Balance on Deposit	...	...	...	...	...	...	...	£ s. d. 35 10 6
Donations—							Transferred to General Account	...
Prof. P. G. H. Boswell	...	...	...	...	...	...		...
J. H. Gurney	...	...	...	...	...	...		...
Dr. S. H. Long	...	...	...	...	...	...		...
R. Gurney ...	...	...	...	...	...	...		...
Sir E. Gurney	...	...	...	...	...	...		...
J. H. Walter ...	...	...	...	...	...	...		...
Dr. B. B. Riviere	...	...	...	...	...	...		...
K. J. Howard	...	...	...	...	...	...		...
H. H. Halls ...	...	...	...	...	...	...		...
F. C. Hinde ...	...	...	...	...	...	...		...
Sums under 10s.	...	...	...	...	...	...		...
								£35 10 6

III. LIFE MEMBERSHIP FUND.

1920-21.								
To £64 War Savings Certificates at cost	...	...	...	...	...	...	...	£ s. d. 49 12 0
" Balance April, 1920, at Norfolk and Norwich Savings Bank	...	...	...	...	...	...	...	21 2 4
" Two Life Membership payments	...	...	...	...	...	...	...	12 0 0
" Interest on Bank a/c ...	...	...	...	...	...	...	...	0 10 6
								£83 4 10

By Balance—
War Savings Certificates dated 4/4/18 ...
At Norfolk and Norwich Savings Bank ...

Examined and found correct,

W. A. NICHOLSON, Hon. Auditor,
17th May, 1921.





ADDRESS

*Read by the President, B. B. RIVIERE, F.R.C.S., M.B.O.U.,
to the Members of the Norfolk and Norwich Naturalists'
Society, at their Fifty-second Annual Meeting, held at the
Norwich Castle Museum, April 26th, 1921.*

LADIES AND GENTLEMEN,

MY year of office as your President comes to a close this afternoon, and before proceeding to the subject matter of my Address, I must say a few words about the doings of our Society during the past session.

During the winter we have held our usual monthly meetings, which, I think I may say, have been well attended; and we have had the pleasure of listening to some interesting discussions. We had, in addition, a combined meeting with the Norwich Museum Association in January, when Prof. Garstang came down from Leeds, and gave us a most interesting and original lecture on Bird Song. A large number of people had to be turned away from this lecture, owing to lack of accommodation.

So far as I can ascertain, our Society would seem to be in a prosperous condition at the present time, and we have a nett increase in our membership during the year of 10—12 members. Why we have not become bankrupt on a seven-and-sixpenny annual subscription, only our Honorary Treasurer can say, and perhaps it were best not to cross-question him on the subject; but of this we are certain, that he has financed us through the War in a most skilful manner; and we have shown our appreciation of his efforts to-day, by voting him an extra half-crown per head for the future.

We have, unfortunately, lost four members by death during the past year, and for this and other reasons (resignations, etc.), our membership has been reduced by seven. On the other hand we have elected several new members, so that we have a nett gain of about ten.

In the person of Mr. James Reeve we have lost another of our original members, of whom only six now remain ; and by the death of Mr. Henry Upcher one who had been a member for 50 years, for he joined the Society two years after its foundation. Both of these members were in the list of our Vice-Presidents, and we hope to publish obituary notices of them in the next number of our Transactions.

Two other members have died, viz., Mr. George Hotblack, who had been a member since 1884, and Bishop Fisher, who joined the Society in 1912.

An effort was made last summer to get up an excursion to the West Norfolk Meres, but so small was the response that it had to be abandoned. If Mr. Leney can be induced to repeat the effort this year, I hope more members will support him, for I think such an excursion would be full of interest.

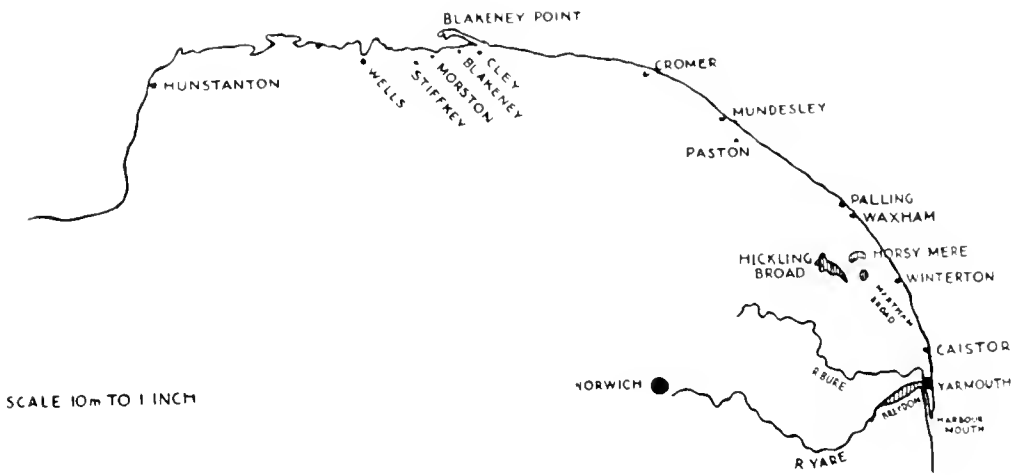
I will now pass on to the subject proper of my address, which I have entitled

THE AUTUMN MOVEMENTS OF GULLS ON THE NORFOLK COAST

For many years the attention of ornithologists, and of others not especially interested in birds, has been attracted by a regular passage of gulls, which takes place, mostly in the afternoons, in a North-Westerly direction along the coast of Norfolk, during the months of late Summer and Autumn.

Much has been written, and many have been the surmises, as to the origin and destination of these gulls, but without, so far as I am aware, our knowledge of the subject having been advanced much beyond the realms of speculation.

Henry Stevenson, in a note quoted by Mr. Southwell in Vol. III. of "The Birds of Norfolk," p. 339, referring to this movement as seen at Cromer, writes :—"The marked regularity of their habits in this respect has often led me to enquire, 'Whence do they come, and whither do they go?'" Having noted, with the accuracy of observation which was characteristic of him, that there is a return movement to the East during the early morning, which usually consists of smaller and more detached parties of birds than those passing to the West later



OUTLINE MAP OF NORFOLK



in the day, he concludes that it is probably a daily movement between the Yarmouth Roads and some favourite roosting place, and suggests as the latter the shores of the Wash, or even the Lincolnshire and Yorkshire coasts.

Mr. J. H. Gurney, in addition to several references to this movement in the course of his annual "Ornithological Reports for Norfolk," published in *The Zoologist*, has gone more fully into the subject in two interesting and original papers, one of which was read before this Society on November 30th, 1886, and is published in Vol. IV. of the Transactions, p. 326, the other appearing in *The Ornithologist* for April, 1896, his observations having also been made from the neighbourhood of Cromer.

In these two papers Mr. Gurney speculates at some length as to the source and goal of these North-Westerly flying gulls, without however being able to arrive at any definite conclusion, and advances the theory, supported by a certain amount of evidence, that it is purely a movement against the wind, the prevailing wind upon the East coast of England in the Autumn being from the West.

In order to maintain this theory, it is necessary to disregard the very definite and regular, though less noticeable, early morning movement to the South-East, and also to disallow any connection between these movements and the very important factor of food supply, as represented by the herring fishing grounds.

With the object of throwing, if possible, some further light upon this problem, and of making a general study of the movements of the vast army of gulls which frequent the coast of Norfolk during the Autumn, I have, during the last twelve years, stayed, I believe, at every habitable spot upon the coast between Yarmouth and Hunstanton at some period of the Autumn, besides making a trip in a Yarmouth drifter, and it is the results of the observations thus made, incomplete though I fear they are, which, within the limits of the time and space at my disposal, form the subject matter of the address which I have the honour of reading to you to-night.

Although I am afraid I shall have nothing very new, nor perhaps very interesting, to tell you, yet I am encouraged by believing that through the systematic study of the regular movements of any one bird in any one particular area, the science of ornithology may be advanced, if only by a little, and that possibly by the accumulated observations of a large number of observers upon such lines, even some of the present problems of bird-migration may eventually be solved. This, then, must be my justification for my choice of subject.

One difficulty with which one is confronted in endeavouring to make an investigation of this kind, is the very obvious one of being unable to be in two places at once, with the consequent difficulty of correlating movements seen at different points of the coast at different times, and my very best thanks are therefore due to several friends who have been kind enough to make observations for me from various parts of the coast simultaneously with my own, more especially to Mr. A. F. Sherlock, Mr. J. Vincent, and Mr. R. Pinchen for the valuable notes they have sent me from Breydon, Horsey, and Blakeney Point respectively, and to Capt. Hamond, R.N., for the observations he has very kindly made for me on the North Sea fishing grounds.

Then, again, in the case of gulls it is quite impossible to distinguish between those arriving upon the Coast for the first time from across the North Sea, that is to say, migrants in the true sense of the word, and those which are merely returning from the fishing grounds.

A third difficulty is to separate what one may call regular movements from those of an irregular and casual kind which cannot be classified ; and although even the most regular movements are subject to a certain amount of variation, I shall in this paper only deal with those which one can, with a fair amount of certainty, expect to see taking place every day during the appropriate season.

As regards the species of gulls which take part in these regular movements, including the well-known North-Westerly afternoon

flight which is so noticeable at Cromer, my observations have led me to consider that a fair proportional estimate would be :— Great Black-backed Gulls (*Larus marinus*), between 70 and 80%, of which the great majority are adults ; and Herring Gulls (*Larus argentatus*), between 20 and 30%, immature birds in this case being in excess of adults. This does not, I know, agree with the observations of Mr. J. H. Gurney, who in the two papers to which I have already referred has mentioned both the Common Gull (*Larus canus*) and the Lesser Black-backed Gull (*Larus fuscus*) as taking a large part in the North-Westerly passages he so well described. Although a few Common Gulls may sometimes be seen amongst the flocks which coast S.E. in the early mornings I have very seldom seen this species amongst those flying N.W. in the afternoons, and my own experience has been that the Common Gull takes a wholly negligible part in any of these movements. A shore-loafer, and a frequenter of Yarmouth harbour mouth, the only movement I have found it taking any regular part in is that of joining the Black-headed Gulls (*Larus ridibundus*), which daily throughout the autumn and winter journey inland at sunrise to feed upon the ploughs and marshes, returning about sunset to the coast, where they roost upon Breydon, and in calm weather upon the sea, and in rough weather upon the sea-shore all along the coast.

As regards the Lesser Black-backed Gull, I have never been able to detect it taking part in any of these regular movements, nor am I in agreement with those who regard it as a common bird upon our coast. Personally I admit that I am unable to distinguish immature birds of this species from immature Herring Gulls when upon the wing, and am indeed very doubtful as to the possibility of doing so ; but, so far as adults go, I consider the Lesser Black-backed Gull to be a scarce bird in Norfolk, except during the Spring and Autumn migrations, when a few can usually be seen on Breydon, where also Mr. Sherlock tells me he has very occasionally met with it in mid-winter. Capt. Hamond, R.N., informs me that he has never seen it at sea after the first week of October.

It is, therefore, the great Black-backed Gull and the Herring Gull with which we are concerned in considering the Autumn gull movements which I am dealing with in this paper.

These two species, which, with the Black-headed Gull and the Common Gull, represent the four commonest Norfolk gulls, may be seen upon our coast during every month in the year. Although during the early summer they are mostly represented by immature birds, yet a fair number of adult Great Black-backed Gulls, as pointed out by Mr. A. H. Patterson, frequent Breydon, even during the height of the breeding season.

An increase in the gull population begins to be noticeable during the month of July, and its ranks continue to be augmented by fresh arrivals with increasing rapidity throughout August, September, and October, during which latter month their numbers are at their height. How great these numbers are I shall later on, at the risk I am afraid of being accused of exaggeration, attempt to estimate; but certainly in the case of the Great Black-backed Gull, 80% of which appear to be adults, they are very great, and can only be accounted for by large immigrations from the Continent. And in this connection it is significant to find that Mr. Bonhote in 1908 observed what he described as "incredible" numbers of Great Black-backed Gulls, all adults, on Texel Island, which lies a little North of East of the Norfolk Coast, on the other side of the North Sea, between September 15th and 21st, on which date a considerable decrease took place, a slight increase in numbers again taking place on September 29th and October 7th. (*Ornis.*, Vol. XIII., p. 173).

It is difficult to detect any definite evidence of a migration across the North Sea from the few records of gull movements from Norfolk light vessels, which are to be found in the Migration Reports, for the reason which I have already stated, viz., the impossibility of distinguishing migrating gulls at sea from those going to and from the fishing grounds. I believe, however, that the occasional enormous North-Westerly flights along our coast, far in excess of the usual daily movement, which occur most frequently early in October, and to which

I shall again refer, probably consist to a large extent of newly-arrived birds, and are therefore true migrations.

The number of Great Black-backed Gulls and Herring Gulls upon the coast is usually maintained throughout November, but they begin to leave in December, and by the end of the year a large majority of the Great Black-backs have disappeared, and there has also been a great reduction in the number of Herring Gulls. The remainder of these (Herring Gulls) about this time begin to go on the land in the early mornings with the Black-headed Gulls, returning to the coast and also to some of the big broads to roost at night.

Although, owing to the attractions of the sands lying to the West of Blakeney Point as a roosting place, a few gulls may often be seen flying N.W. along the coastline in the afternoons at any time in the year, this oft-recorded movement does not, in my experience, begin to be really noticeable until the end of August or beginning of September. It is at its maximum during the months of October and November, becomes rapidly less marked throughout December, and by the end of the year has practically ceased. It might therefore, with perfect accuracy, be described as exactly coinciding with the Yarmouth herring fishing season, the first catches of the year being usually made about the last week in August, the great bulk of herrings being landed in October and November, and the season ending as a rule about the middle of December.

In the year 1914 I happened to be at Mundesley during the whole of November, and was interested to observe that the North-Westerly afternoon flights of gulls ceased altogether about the middle of the month, the last catch of herrings having, owing to the War, been landed at Yarmouth on November 3rd.

That it is the herring which attracts such incredible numbers of gulls to our coast in Autumn is, I think, beyond dispute, and that it forms the staple diet of the Great Black-backed Gull and the Herring Gull at this period of the year is too well known to need any additional testimony from me, except to say that every bird of these two species shot upon the coast in

Autumn, which I have examined, has contained the remains of herring.

Leaving out of consideration for the moment the question of fresh immigrations of gulls arriving upon the coast for the first time, it soon became evident to me, therefore, in the course of my observations, that it is between the North Sea herring fishing grounds and three main bases or resting places upon the coast that these regular Autumn movements take place, the three resting places being (1) the well-known tidal estuary of Breydon, (2) a somewhat variable site in the neighbourhood of Horsey, and (3) the five mile stretch of sands lying between the two harbours of Blakeney and Wells.

Before dealing in further detail with these four localities and the lines of flight which connect them, I should like here to say a few words upon the much-debated subject of wind, and the effect of its direction, if any, upon these movements.

Owing to the conclusions arrived at by Mr. J. H. Gurney, I began this investigation with a certain amount of mental bias in favour of the direction of the wind being an important determining factor, but my own observations have led me to believe that its influence is no more than secondary, affecting possibly the number of gulls which take part in these movements, and certainly the manner in which they are carried out, but not the fact of whether they take place or not.

I agree with Mr. Gurney in believing that gulls prefer if possible to fly against the wind, and in nine cases out of ten, when flying with no definite goal in view, this is their custom. But certainly, as regards the regular movements that I am about to describe, I have satisfied myself that they take place daily throughout the herring fishing season, whatever the direction of the wind. I will admit, however, that it would seem that rather more gulls take part in any particular one of these movements, when this happens to be against the wind, these gulls, possibly, having waited for a contrary wind in order to make this particular journey. On the other hand, this impression may be to some extent deceptive, owing to the

influence which the direction of the wind has upon the manner in which these gull flights are made.

With a head wind gulls usually fly low, and in small parties, and are therefore easily observed. With a tail wind, on the other hand, they fly high, and the flocks are usually much larger, and therefore fewer, and are thus more likely to pass by unnoticed.

By far the largest North-westerly passage of gulls along the coast which I have ever seen, at Palling on October 13th, 1913, and to which I shall again refer, took place with a light Southerly wind, *i.e.*, practically a tail wind; and I had a very good opportunity of observing the effect of a persistent East wind upon the daily North-Westerly coasting movement, when staying at Mundesley during the last fortnight of October, 1920. The wind was from the East upon every day of these two weeks, and though I came to the conclusion that rather more gulls than usual took part in the early morning coasting movement to the S.E., that is against the wind, yet the return journey to the N.W. took place every afternoon and evening, with the greatest regularity, but in a less noticeable manner, the birds passing high in the air, and in very large flocks at long intervals.

The almost daily prevalence of a West wind, which, according to Mr. Gurney's theory, would be necessary to account for the regularity of this North-Westerly and Westerly flight along the coast-line, is not borne out by facts. Mr. A. W. Preston has very kindly supplied me with information as to the direction of the wind throughout the month of October, when this movement is most in evidence, for the last ten years, and out of these 310 days the wind was from the West, including N.W. and S.W., upon 118 days only, that is to say it was considerably more often East, North, or South. than West.

Though I believe, therefore, that gulls prefer to fly head to wind, and that they will do so more often than not, when not travelling to any definite destination, I do not think that the direction of the wind is the cause of, or has any other than a secondary influence upon, the regular Autumn gull movements

with which this paper is concerned, which, as I have already stated, take place between the North Sea fishing grounds and the three great coastal resting places, at Breydon, at Horsey, and between Blakeney Point and Wells.

I will now endeavour to describe these movements in more detail, and I think perhaps the most convenient way to do so will be to begin with the sea, and work round the coast from S.E. to N.W.

Unfortunately, life on board a Yarmouth drifter in rough weather cannot, by the greatest stretch of imagination, be described as comfortable, as those who have experienced it will, I think, readily agree; and the would-be observer of birds who is tempted to go to sea in one of these vessels is liable to find himself rapidly reduced to a condition in which he is physically incapable of observing anything more interesting than the bottom of a tin basin! This, I regret to say, was to some extent my experience upon the occasion of the only trip I have made; a further opportunity, which presented itself last autumn, of making a longer voyage under more comfortable conditions, having unfortunately fallen through, upon the very day of sailing, owing to the coal strike.

As a result, however, of many conversations with the skippers and crews of drifters, and more especially with Capt. Hamond, R.N., who, as commander of the Fisheries Protection boat, H.M.S. Ettrick, has had most exceptional opportunities of observing bird-life at sea, and who is, in addition, a first-rate ornithologist, I have been able to obtain a good deal of information, besides what little I was able to gain at first hand, as to the doings of the gulls upon the fishing grounds.

Excepting, perhaps, that wonderful navigator the Kittiwake (*Rissa tridactyla*), the gull of the open seas, which the wildest weather and the fiercest storms will scarcely drive ashore, the commonest gull on the herring grounds is the Great Black-backed Gull, with the Herring Gull numerically next. If one asks any one of the crew of a drifter how many "Old Saddle-backs" he sees every day at sea, the answer is invariably the same: "Thousands;" and certainly their numbers appear

to be very large. In fine weather a great many seem to spend the night on the fishing grounds, but by far the largest numbers are there about dawn and during the early hours of the morning. In the afternoon, from all accounts, there are very few at sea.

As most of you are probably aware, the usual procedure on board the drifters is to haul the first two or three nets, known as the "look on" nets, some time during the night. If the herring are found to have struck, all the nets are hauled, but if not, the first nets are let go and are hauled again about dawn. Hauling, in fair weather, may take anything from four to eight hours, according to the size of the catch, and in rough weather longer, and one may say that practically all the nets are hauled between the hours of 2 a.m. and midday, the majority of the boats beginning to haul about dawn. After hauling, the whole length of nets are shaken over the side and cleaned, as the boats steam back to Yarmouth harbour.

During the whole of the time the nets are being hauled, even at night, but in far larger numbers after daylight, the gulls are flying round the boats, picking up the herrings which fall out of the nets, and the broken fish which are thrown overboard, and even actually seizing the fish out of the nets themselves, and each boat as she steams homewards is followed by a cloud of gulls, constantly dropping down on to the water to pick up the herrings which are shaken overboard in the process of "cleaning nets."

Nobody, so far as I am aware, has ever seen these gulls even attempt to catch fish for themselves, but considering that during the season of 1920, 1,000 boats were fishing from Yarmouth, and 500 from Lowestoft, and that 70,000 crans, representing about seventy million fish, were landed at these two ports in a single day, viz., October 28th, one can imagine what a rich harvest of dead herrings is to be gleaned by the gulls on these North Sea fishing grounds; and rich indeed it must be to supply the needs of the incredible numbers which visit our coast at this season of the year.

The Great Black-backed Gulls and Herring Gulls usually leave the home-coming drifters a mile or two from Yarmouth

harbour mouth, and either wheel about to pick up a fresh boat, or come ashore. During September, when the herring shoals are to the North and the boats are fishing off the Lincolnshire coast, Capt. Hamond tells me that he has seen large numbers of gulls going ashore to the sands between Blakeney and Wells. From early October onwards, however, practically all gulls, on leaving the fishing grounds, make the land somewhere between Yarmouth Harbour and Horsey Gap, the large majority coming ashore during the morning. Those which arrive to the North of Caister go to Horsey Mere, and Hickling and Martham Broads, or join the resting flocks upon the beach or marshes between Horsey and Winterton, where, in due course, we shall meet with them again. Of those which come ashore at Caister some turn N.W. across the marshes to Horsey, Hickling, or Martham, and some South to Breydon; whilst those which come in over Yarmouth, with few exceptions, all go to Breydon. A few, however, and these appear to be mostly immature gulls, settle upon the sea just off shore, and by the afternoon there is usually a long straggling flock resting upon the water between the Wellington pier and the harbour mouth. Towards evening these birds usually fly away North up the coast line.

At the harbour mouth any morning when the drifters are arriving one may watch the gulls coming in from the sea, singly and in small parties, in an almost unending stream, mostly from the East; but later in the season, when the herring are South-East of Yarmouth, also from the S.E. A few turn North on reaching the shore, and pass out of sight straight up the coast line, but the vast majority are bound for Breydon, and pass straight over the town, or up the harbour, usually lifting in the air and circling round once or twice, before finally dropping down upon the mud flats.

Breydon is the most South-Easterly of the three great gull resting-places I have named, the nearest for gulls which have followed the drifters back to Yarmouth, and from the first week of October onwards, the nearest to the fishing grounds.

Mr. A. H. Patterson, writing in 1912 (*Zoologist*, Vol. XVI., p. 422), says :—" Gulls, I think, are becoming more numerous. Three years ago I estimated the numbers resting on Breydon after an early morning's feeding at the Herring grounds, at about 7,000 ; on certain days lately I have estimated the number at nearly half as much again. Great Black-backed Gulls of all ages appear to predominate."

This is, I think, a fair estimate, and certainly not above the mark for the latter half of October and November, more gulls using Breydon, I think, during the latter half of the season, when the herring are to the East and South-east of Yarmouth, than when the boats are fishing further North. At this season of the year I have never been able to detect these gulls feeding on Breydon, as they may be seen to do at other times, but rather do they always appear to be resting, sitting, as a rule, close packed in huge flocks, and very often asleep. Their favourite resting-places are, perhaps, round about the mouths of the " Five-Stake Drain," and the " Ship Drain," at the lower end, and beside " Horn Drain " and " Duffle Drain " higher up ; and between these two localities there are usually a few gulls passing to and fro most of the day.

In spite of the regular comings and goings which take place at Breydon, the gulls are there at all hours of the day and night. So many are there, indeed, that the arrival or departure of very large flocks seems to make but little appreciable difference to their numbers, though these are, I think, perceptibly less in the early morning than in the early afternoon.

I have heard it said that an East wind brings more gulls to Breydon, and were this so two possible explanations might be offered. Firstly, an East wind usually means a poor tide on Breydon, with more mud uncovered, thus offering a greater attraction to gulls ; and, secondly, according to Mr. Gurney's theory, with an East wind more gulls would have come from the West along the coast-line in order to fly against the wind. Personally, I have not been able to convince myself that either the direction of the wind or the flow of the tides has any effect upon the numbers or movements of the Breydon gulls, and in

this Mr. A. F. Sherlock, who is constantly on Breydon at all hours of the day and night in a gun-punt, agrees with me. At high tide the gulls are usually found concentrated about the mouth of the "Ship Drain," or on the so-called "Lumps," the last parts of Breydon to be covered, and those which cannot get a foot-hold rest upon the water. With a big tide and a strong West wind, when it is too rough for comfort, they occasionally go away to the Bure marshes, whereon they sit until the tide ebbs.

Although gulls may be seen arriving on Breydon from the sea at all hours of the day, the great majority, as I have already stated, come in during the morning. The return journey to the fishing grounds takes place at two very regular times, namely, about sunset, and an hour before sunrise. This sunset seagoing flight from Breydon has been so well described by Mr. A. H. Patterson that I cannot do better than quote his words:—"It is a fine and interesting sight on a fine afternoon, just before sunset, to see the ruddy light falling upon acres of birds; to hear them cackling their plans for the night's procedure; and to observe them mounting, battalion after battalion, in regular succession, and making for the open sea, whereon in fine nights they roost, to be in readiness for the morning's chance—to annoy the fisher folk hauling their nets by snatching at the herrings as they come up filled." (*Zoologist*, Vol. XVI., p. 422.)

That an exactly similar movement takes place about an hour before sunrise was first pointed out to me by Mr. Sherlock, and it appears to take place daily with the greatest regularity, the passage commencing with the first faint glimmer of dawn, and lasting for between ten minutes and half-an-hour, the majority of birds crossing the coast-line between the Britannia and Wellington piers. These gulls probably make straight for the fishing fleet, where they would arrive about the time when most of the boats are hauling their nets.

Besides these regularly timed journeys to sea, there is another regular movement from Breydon to the North, which I think is more in evidence during the earlier than the later part of the

fishing season. This movement goes on all day up till sunset, and consists in the departure at intervals of large and small flocks of gulls, which fly away across the railway and the Bure Marshes, and disappear to the N. and N.W. Their destination is Horsey Mere and Hickling Broad, where, later on, we shall meet with them again. A few of these flocks may also occasionally be seen to bear away to the East of North, towards the coast-line.

Between Yarmouth and Horsey, besides the gulls which we have noted coming in from the sea during the morning and proceeding to Breydon, Horsey Mere, and Hickling and Martham Broads, a few gulls may also be seen during the morning, and to a lesser extent in the afternoon, coasting N.W. along the shore line. These are mostly birds which have come in from sea at Yarmouth and turned North up the coast-line instead of going to Breydon. A few, however, appear to have come from Breydon, flying N.E., and to have hit the coast-line somewhere North of Caistor. Those which pass late in the afternoon are, I think, the gulls which earlier in the day we saw resting upon the sea between Yarmouth Harbour mouth and the Wellington pier. A few gulls may also be seen coasting S.E. along this stretch of coast-line in the early mornings. These I have been able to follow as far down the coast as Winterton, but no further, at about which point they appear to turn out to sea.

We next come to Horsey, in the neighbourhood of which is the second of the three gull resting-places. Here the gull movements during the height of the herring season are very interesting, and rather complicated, and many an October day have I spent beside Horsey Mere, or on the sandhills near Horsey Gap, watching the thousands which come and go during the day, and trying to discover the purpose and methods of their movements.

The fresh water of Horsey Mere, and Hickling and Martham Broads, is the attraction at this part of the coast, and to and from these three sheets of water the Great Black-backed and Herring Gulls are passing in thousands all day, during these

autumn months. It will, perhaps, suffice if I endeavour to describe their movements at Horsey Mere, those to and from Hickling, and on a smaller scale, at Martham Broad, being very similar.

On Horsey Mere the gulls arrive all day in an almost continuous stream, though the great majority come in during the morning. They come from the East from the sea, and overland from the South from Breydon, and these latter flocks may be watched coming up from the distance usually between the two church towers of Martham and Winterton. On settling on the Mere, most of the gulls drink, but one and all immediately bathe, and by stealing unobserved to the edge of the Mere one may perhaps see nearly a thousand Great Black-backed Gulls, all ducking and splashing together in the water—a remarkable and very beautiful sight on a fine October morning. Having bathed and performed their toilet, they at once depart, and just as new comers are constantly arriving on the Mere, so are small parties as constantly leaving, the direction of their departure being to the East, North, and North-West. More birds leave for the North and North-West, and less for the East as the day goes on, and, as often as not, late in the afternoon, a few big flocks, coming from the direction of Breydon and flying from South to North, will pass over Horsey without tarrying, lined up in great V's, and flying high and fast. By nightfall they have all departed; darkness and peace fall again upon the Mere, and its rightful tenants, the ducks, the coots, and the grebes, once more take possession, thankful, no doubt, to see the last of their noisy, and by no means trustworthy, visitors.

Those gulls which set out for the North and North-West hit the coast-line somewhere between Waxham and Cromer, and I know of a regular line of flight which passes over the parish of Paston to join the coast-line at Mundesley. Having reached the coast-line, they follow it to the West as far as the stretch of sands beyond Blakeney Point, which is their destination.

We will now follow the gulls which leave Horsey Mere in an Easterly direction, and in order to observe their next movements

it is best to take up a position on some high sand hill somewhere between Horsey Gap and the flood gates. From this observation post at sunrise there will probably be no resting gulls anywhere to be seen, but during the next few hours the first flocks begin to arrive from Horsey Mere and Hickling Broad. These at once settle, either upon the beach, usually to the South of Horsey Gap, or upon one of the grazing marshes between Horsey and Winterton, and are joined by each successive party of new arrivals, the flock thus rapidly growing in size. They are also joined by birds which come in from the sea and do not pass inland to Horsey Mere, by gulls coming up overland from the South from Breydon, and from the South-West from Martham Broad, and by a few which follow the coast-line from Yarmouth.

Sometimes a flock of birds will settle down in a new situation, thus forming the nucleus of a second, or even of a third flock, and these being rapidly added to by fresh arrivals, there may be, by the afternoon, two or three enormous flocks, each containing several thousands of birds, sitting upon the shore or upon the marshes.

From about mid-day onwards, parties of gulls begin to leave these flocks for the North-west, and their usual method of departure is a very interesting and peculiar one. Suddenly, with a great clamour and babel of gull voices, the whole huge flock will rise in the air, and parties of birds up to a hundred or two will detach themselves and fly away N.W. up the coast-line, splitting up into smaller detachments as they go, the main flock, meanwhile, again settling down in its old position. This curious procedure is repeated at intervals of from ten minutes to a quarter-of-an-hour throughout the afternoon, until usually by dark all the birds have in this manner disappeared up the coast-line to the North-West. Sometimes, however, a few large flocks will remain at Horsey for the night, in which case they go to sea again very early in the morning, usually about dawn. With a very rough sea, when few gulls are on the fishing grounds, the numbers resting during the day upon the beach and the marshes between Horsey

and Winterton are very large, and certainly exceed those of Breydon. This is also the case during a Northerly gale of sufficient force to prevent the gulls from continuing their North-Westerly flight up the coast, and on such an occasion I have seen enormous flocks held up on the marshes to the South of Horsey, parties of varying sizes getting upon the wing at frequent intervals, and attempting to fly away N.W., but as constantly being forced to return to the main flock, unable to make any headway in the teeth of the gale.

Between Horsey Gap and Blakeney Point no Great Black-backed Gulls and Herring Gulls are to be seen either going out to or coming in from the sea, but it is between these two points that there takes place the well-known North-westerly flight along the coast-line, which has been so well described by Mr. Henry Stevenson and Mr. J. H. Gurney, and which has attracted the attention of so many observers, it being, indeed, one of the most striking ornithological features of this part of the coast during the autumn months.

The gulls which take part in this movement we have already met with starting upon their journey further down the coast. They have come in from the sea during the morning at various points between Yarmouth harbour mouth and Horsey. A few have passed straight up the coast-line from Yarmouth. Some have reached the coast-line direct from Breydon, and some from Horsey Mere. But the vast majority are those gulls which have rested during the early part of the day in huge flocks upon the beach and marshes to the South of Horsey Gap, these flocks being formed by gulls coming in from the sea, from Breydon, from Horsey Mere, and from Hickling and Martham Broads, and from which at intervals throughout the afternoon parties of birds have departed to fly up the coast-line to the N.W. in the manner which I have described.

This North-Westerly coasting movement, seen at any point of the coast-line between Horsey Gap and Blakeney Point, sometimes begins quite early in the morning. Much more usually, however, it commences in the afternoon, the flocks passing with increasing frequency as the day draws to a close,

and continuing to do so long after sunset, until, in fact, it is too dark to distinguish them. The flocks vary in size from two or three birds up to a hundred, or even more, but on most days I should say that the majority pass by in parties of less than twenty. These North-Westerly flying gulls are invariably lined up in V formation, and are always flying steadily and fast, as though on a set journey, with a definite goal before them. With a head wind they fly low, either just above the cliff line, or over the sea close to the water. With a tail wind, on the other hand, they fly high, and usually pass by in larger flocks, sometimes of 100 birds or more, and at longer intervals. With a very strong wind from the East or South-East behind them they usually employ a different method of flight altogether. Soaring very high in the air, and usually in very large flocks, they constantly turn into the teeth of the gale, and as constantly veer away, allowing themselves to drift in a wide half-circle to leeward, and thus, with hardly a wing flap, they go circling and drifting up the coast before the wind, at little less than the rate of their ordinary flight.

During October and November, when the herring fishing is at its height, the number of gulls which pass this stretch of coast-line to the N.W. every afternoon is very large. Mr. J. H. Gurney writes :—" Ten thousand have been seen to pass Cromer in the day " (*Ornithological Report for Norfolk, 1905*), and I consider this to be a moderate estimate. I have myself spent many hours counting the passing flocks, and trying to arrive at a fair estimate of the numbers which go by in the course of the day ; and by counting the numbers passing per minute for fairly long periods of time, thus obtaining an average per hour, and then calculating the number of hours during which the passage has lasted, I have frequently obtained totals of over 10,000, and upon several occasions of between 15,000 and 20,000.

Besides the gulls which we have followed from the fishing grounds, I think it highly probable that gulls arriving upon the Norfolk coast for the first time from across the North Sea, upon reaching the coast-line, also follow it round from East to

West, and alight upon the sands to the West of Blakeney Point. This line of flight around the coast of Norfolk is that adopted by many passerine autumn migrants which have crossed the North Sea in an East to West flight, and which, on reaching the bend of the coast at Hunstanton, turn down the shore of the Wash, and pass inland, probably along the course of the river Nene.

How many, if any, of the gulls taking part in this North-westerly coasting movement are fresh arrivals, is, I think, upon ordinary days impossible to say; but that the occasional enormous passages of gulls in this direction to which I have already referred, and which usually take place early in October, are true immigrations to this coast, I have no doubt. One such passage upon a gigantic scale was witnessed by Mr. A. F. Sherlock and myself at Palling on October 13th, 1913, and coincided, curiously enough, with the season's record catches of herring which were made by Yarmouth boats on that day and the day before.

This extraordinary flight began with daylight, and lasted without intermission throughout the entire day, and probably long after dark, as gulls were passing in undiminished numbers up to the time when it was no longer possible to see them. Eighty per cent. of these birds were adult Great Black-backed Gulls, and in such enormous numbers were they passing, all following the coast-line to the N.W., that we found it practically impossible to count them by the minute, the flocks being never out of sight, and many of them containing over a hundred birds.

We came to the conclusion that they were passing at considerably over the rate of 100 per minute, but calling it 100, and reckoning the passage to have lasted 12 hours, which it certainly did, one obtains the astounding total of 72,000 having passed during the day. I am fully aware that this sounds incredible, but none the less believe that it is by no means an over-estimate of this very extraordinary immigration.

Besides this North-Westerly coasting flight, there also takes place along this stretch of coast-line between Blakeney Point

and Horsey, at the same season of the year, a daily movement in the opposite direction to the S.E., which is, as a rule, confined to the first two or three hours of daylight. That these birds are on their way to the fishing grounds I have little doubt. They appear to turn out to sea at various points along the coast, many more passing Mundesley than reach Horsey, while none, as I have already stated, appear to follow the coast-line further South than Winterton. Moreover, during September, when the drifters are fishing to the North, this movement is almost negligible, but, as the herring shoals pass further and further round the coast to the S.E., so this coasting flight to the S.E. becomes more and more a feature of the early mornings. None the less, even during November, when practically all the herring fleet are fishing to the S.S.E. of Yarmouth, the gulls which pass to the S.E. in the early mornings never, in my experience, equal in numbers those which return in the opposite direction later in the day.

These South-Easterly coasting gulls are never lined up in V formation, nor do they appear to be flying in the steady and purposeful manner of the North-Westerly moving birds. Rather do they pass along the coast-line in a long, straggling line, and with no formation. Sometimes a few Common Gulls and Black-headed Gulls accompany them, and I believe that there is always a larger number of immature gulls and Herring Gulls amongst these flocks in proportion to adult Great Black-backs than there is amongst those which pass to the N.W.

The last and most Westerly of the three main bases or resting places for gulls upon the coast is the stretch of sands which lies between Blakeney Point and Wells. This is the destination to which the countless flocks which we have seen passing along the coast-line to the N.W. are hurrying, as it is the starting point of those which journey in the opposite direction to the S.E. To the West of Wells no gull movements take place, and during the herring season very few Great Black-backed Gulls and Herring Gulls are to be met with, though at other times of the year a considerable number of the latter frequent the

mussel beds of Hunstanton and the shore of the Wash. The sands which lie between the two harbours of Blakeney and Wells are some five miles in length, and are bounded on the South by the marshes of Morston, Stiffkey, and Wells. With an average tide at high water they are mostly covered, whilst at low tide they are perhaps a mile and a half to two miles in width, and they make an ideal resting place for gulls, as they do a feeding ground for Waders.

Considerably more gulls are to be seen resting here than at either Breydon or Horsey, and in fact during the height of the herring season the numbers sometimes seem almost incredible. I have watched them coming in from the East, both following the coast-line along Cley beach and coming up Blakeney channel, for six hours on end at an average rate, so far as I could estimate it, of forty to the minute, which would give a total of some 14,000 Gulls. And when, from the vantage point of a high sand-hill on Blakeney Point, and armed with a pair of strong field-glasses, one looks across the sands to the West towards Wells, it is truly a wonderful sight to see the great flocks sitting mile after mile as far as the sight can reach, covering the sands like a series of vast white sheets.

As at Breydon, these gulls never appear to be feeding, but always to be resting, and they are there at all times of the day and night, though I think that their numbers are usually appreciably less in the morning than in the late afternoon and evening.

The time of the daily arrival upon these sands from the East coincides with that of the North-Westerly flight along the coast-line. Sometimes they begin to come in quite early in the morning, and continue to do so all day, but more usually the movement begins in the afternoon, the largest numbers arriving after sunset, between which and darkness there is usually a very large influx. The arriving gulls come along the coast-line from the East, flying over the sea, the sand-hills, or Cley beach, a good many also coming up Blakeney channel. At low tide they settle on the sands joining the flocks already there, mostly to the West of Blakeney harbour, though a few

sometimes rest upon the Blakeney side. With the aid of glasses most of the flocks can be seen to settle, though a certain number pass out of sight to the West. When the sands are covered, most of the arriving gulls turn to the South and appear to go down upon the Stiffkey marshes, and at every high tide, as the water flows, flocks can be seen leaving the sands for these marshes. At the earliest streak of dawn flocks of gulls are to be seen leaving the sands and flying away East along the shore-line and down Blakeney channel, this movement usually lasting for the first two or three hours of daylight, and many more gulls taking part in it during the latter than during the earlier part of the fishing season. These are the gulls which we have already met with, following the coast-line to the S.E. in the early hours of the morning, on their way, I believe, to the fishing grounds.

We have now followed these gulls through all the various stages of their journey from the fishing grounds to their most Westerly resting-place upon the sands beyond Blakeney Point. We have also seen that the return passage to the sea takes place from Breydon, from Horsey, and to a certain extent from Blakeney.

There remains, however, one stage in the daily circular journey, which, though I feel confident of its existence, I am unable, so far as my own observations go, to describe, and which remains a gap which I am so far unable to fill.

I have several times referred to the discrepancy in numbers between those gulls which leave Blakeney sands for the S.E. along the coast-line in the early mornings, and those which, coasting N.W., return to them from the same direction later in the day. Up till, perhaps, the middle of October, the latter usually exceed the former by many thousands, whilst even during the last half of the herring season the South-Easterly coasting birds seldom if ever equal in numbers those which pass to the N.W.; nor, in my experience, is there ever so large a proportion of adult Great Black-backed Gulls amongst the former as the latter.

When, and by what route, then, do the rest of these gulls reach the fishing grounds from the sands between Blakeney and

Wells? That they do reach them is, I think, certain, seeing that they regularly return every afternoon and evening. I think it is fairly obvious that, during the month of September, when the herring shoals are off the Lincolnshire coast, the gulls which rest between Blakeney and Wells would, in order to reach the fishing grounds, fly straight out to sea, heading due North, and this movement would therefore not come under observation from the coast. The fact, which I have already mentioned, that Capt. Hamond has observed gulls arriving upon these sands from the sea during September, tends to confirm this. The further South the herrings pass, as the season advances, the further to the East and S.E. of Blakeney sands do the fishing grounds lie, and thus the further round the coast in this direction would these gulls have to fly to reach them, until during the month of November, when most of the fleet are fishing S.S.E. of Yarmouth, the nearest route would be to follow the coast-line the whole way, or at all events as far to the South as Winterton.

All this coincides with what one may actually observe, but the fact remains that, even at this time, the number of gulls which follow the coast-line to the S.E. in the early mornings is never so large as those which return to the N.W. in the afternoon and evening. Considering that the majority of gulls appear upon the fishing grounds during the first few hours after dawn, and that the drifter fleet, even by the time they reach Smith's Knoll (usually early in October), are more than fifty miles from Blakeney Point, one would expect the gulls coming from these sands to leave some hours before daylight, and that is what I believe they do. I have, however, no proof of this to offer, and it would be a very difficult movement to detect.

I have upon several occasions, some hours before dawn, walked across the sands to the edge of the sea beside Blakeney harbour mouth, and have heard a great clamour and "talking" going on amongst the gulls upon the other side, as though flocks might have been leaving, but could, of course, see nothing until daylight, when the usual parties of birds were getting up and flying away East. My belief, however, is that the

Easterly flight during the first few hours of daylight is but the tail end of a larger exodus which takes place during the hours of darkness.

In conclusion, there is one point to which I might here call attention, as it has, I think, a bearing upon the feeding habits of the larger gulls.

It may have been noticed that, in dealing with Breydon and with Blakeney Sands, I laid stress upon the fact that in spite of the regular comings and goings of large numbers of gulls, there were, none the less, at all hours of the day and night, many thousands always to be found at these two resting places. Now, if every gull visited the fishing grounds every day, it would naturally follow that both Breydon and Blakeney sands would, each morning, be practically deserted. As a matter of fact we know that the only passages to sea of any considerable number of gulls from Breydon take place at two very regular times in the twenty-four hours, many more birds being left behind than depart. It may therefore, I think, be concluded that the Great Black-backed Gull and the Herring Gull only feed at intervals of several days—probably three or four. Mr. Patterson (*Nature in Eastern Norfolk*, p. 254) records the fact of a gull shot early one morning on Breydon as it arrived from sea, having disgorged no less than eleven herrings; and if this at all represents an average meal, one can easily imagine that a period of several days is required for its digestion.

II.

NOTES ON THE GENUS UTRICULARIA AND ITS
DISTRIBUTION IN NORFOLK

BY W. G. CLARKE, F.G.S.,

AND

ROBERT GURNEY, M.A., F.Z.S.

Read February 22nd, 1921

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I. INTRODUCTION

Though the Genus *Utricularia* is one of exceptional interest among water plants, about which much has been written, there is no comprehensive account of its biology or anatomy in English literature. Quite recently an excellent summary of present knowledge has been given by Mrs. Arber (1920), but the only other English work dealing at length with the genus is Darwin's "Insectivorous Plants." Much of the extensive literature of the subject in German periodicals has been inaccessible to us, so that the following account of observations made is offered, not as an original contribution to the knowledge of the genus, since most if not all the facts ascertained with regard to the structure and biology of the plants is probably already known, but rather with the object of directing attention to these plants, for the study of which Norfolk botanists are most favourably situated.

* The authors of this paper are separately responsible for the Sections to which their initials are appended.

Mr. Clarke's account of the distribution and flowering of the species is founded upon many years' observations in all parts of the county, but the notes upon the structure of the plants are the outcome of work done at odd times during 1920 and 1921, the material for which has been mainly derived from one source—East Ruston. Specimens for comparison have been seen from Roydon, Hevingham, Flordon, and Ugate Common (Swannington), but the abundance of the plants at East Ruston and the accessibility of the place have made it the main source for all species.

The Genus *Utricularia* comprises about 200 species (Kamienski), distributed all over the world, and divided into sections, the one including land forms with undivided leaves, and the other submerged plants with leaves more or less divided. The land forms are confined to the tropics, and the genus as a whole may be said to be mainly tropical, the few species which occur in Europe being either stragglers into a temperate climate or more probably relics of a warmer Pliocene or Pre-pliocene period.

In spite of the apparent diversity of form in this enormous and wide-spread genus, there is a remarkably constant ground plan. Many of the land species, as *U. affinis*, for instance, have underground bladder-bearing shoots, which are directly comparable to the leaf and bladder-bearing shoots of the submerged species. It is generally maintained that the submerged type has been derived from the land form, and there can be little doubt that water-plants are as a rule the descendants of terrestrial ancestors; but the entire absence of roots, even in the seedlings of *Utricularia*, seems to be a strong argument in favour of an assumption that the *Utricularias* are plants anciently adapted to aquatic life, some of which have become modified for a terrestrial existence.

In Europe seven species, all of which are submerged water-plants, are found, but one of them, *U. exoleta*, is an Asiatic and Australian species which has only been found in Portugal. Of the remaining six, five species occur in Britain.¹ These six

¹ Bennett. Journ. Bot. Jan., 1904, p. 10.

species are separable into three pairs, the two members of each pair being with difficulty distinguished from each other, but quite distinct from each of the other pairs. These pairs are *U. vulgaris* and *U. neglecta*, *U. intermedia* and *U. ochroleuca*, and *U. minor* and *U. Bremii*. One member of each pair, *U. vulgaris*, *U. intermedia*, and *U. minor*, occur commonly in Norfolk, and *U. ochroleuca* and *U. neglecta* have also been recorded from Foulden Common and from Martham Dyke and Stow Bedon respectively, by Mr. Bennett²; but, having regard to the extreme difficulty in separating these species when not in flower, it seems to us that these records require confirmation. It appears to be the general rule that the two members of a pair are not found in association³, and it seems probable that their ecological requirements are entirely different, and not unlikely that they may prove to be local forms of one and the same species. *U. neglecta*, in fact, has been regarded as only a variety of *U. vulgaris* by some botanists (Meister, 1900), and *U. ochroleuca* and *U. Bremii* have given rise to some discussion.

II. DISTRIBUTION IN NORFOLK

Many authors endeavour to indicate different types of habitat for the three commoner species of *Utricularia*, but experience in Norfolk does not support this. A free-floating species, like *U. vulgaris*, requires a sufficient depth of water, and an open association, but is otherwise found indiscriminately in ditches, fen dykes, turf-pits, broads, ponds, and swamps. *U. minor* is usually intertwined with subaqueous plants, particularly *Chara* (as on Flordon and Southrepps Commons), *Sphagnum* (as on Holt Lowes and Roydon Common), and *Hypnum* (as on Uagate Common, Swannington, and Great Witchingham Common), while in the fen ditches and on Foulden Common it is often rooted in the mud. *U. intermedia*

² Trans. N. & N. Nat. Soc., Vol. X., p. 485.

³ *U. neglecta* and *U. vulgaris* have been recorded (Linton, 1894) as occurring in ditches in the same meadow at Wool in Dorset, but even there apparently not actually growing together.

is anchored in the mud at the sides of pools or ditches, among roots of *Juncus*, in *Chara*, *Sphagnum*, and *Hypnum*, so that the presence of subaqueous vegetation is desirable, but not absolutely necessary.

I have records of 79 Norfolk stations for bladderworts. In these, the proportion of acid water, judged by the associated flora, is 19 per cent. Such plants as *Drosera rotundifolia*, *D. longifolia*, *Erica tetralix*, *Gentiana pneumonanthe*, *Juncus squarrosus*, *Nardus stricta*, *Lycopodium inundatum*, and *Sphagnum sp.*, when in close association with pools in which *Utricularia* occurs, have been taken as proof of the acidity of the water. The proportion of acid-water for 60 localities in which *U. vulgaris* was present was 13 per cent. ; for 46 localities of *U. minor*, 26 per cent. ; and for 16 localities of *U. intermedia*, 37 per cent. Tabulated, the figures are :—

	Localities	<i>U. vulgaris</i>	<i>U. minor</i>	<i>U. intermedia</i> .
Acid Water ...	15	8	12	6
Non-acid Water ...	64	52	34	10

These figures seem to indicate that *U. vulgaris* has a slight preference for non-acid (usually calcareous) water, and *U. minor* a similar preference for acid, but that *U. intermedia* has a decided preference for acid.

The Norfolk stations for *Utricularia* may be classified as follows :—

Vulgaris only.	Minor only.	Intermedia only.	Vulgaris and Minor.	Vulgaris and Intermedia.	Minor and Intermedia.	Vulgaris Minor and Intermedia.
30	16	2	18	2	2	10

The two localities where *U. intermedia* only has been noted are Leziate Fen and Dyball's Common, East Ruston (not hitherto recorded). The ten stations where the three species are found growing in actual association are Roydon Common, Foulden Common, Honing "Slough," East Ruston Common, Barton Turf Fen, Derby Fen, Grimston, Du Beck, Thurne, Marham Fen, Sutton Broad, and Titchwell salt-marshes. In only three cases is the water acid, so that despite apparent specific

preferences, there is nothing inimical to any of the species either in calcareous or acid water. The same applies to water with a certain amount of salinity, for although records near the coast are not numerous, the presence of all three species in the ditches of the Titchwell salt-marshes indicates that an occasional influx of salt-water is endurable. *U. vulgaris* also grows freely in Hickling Broad, where the salinity is sometimes as high as 46.20 grains of chlorine per gallon (Nat. Trans., Vol. IX., p. 250), but is there found on the bottom in about 4 feet of water, and not floating.

The peculiar conditions following the flood of August, 1912, caused a development of *forma platyloba* in *U. minor*, on Uppgate Common, Swannington. In July the growth of *U. minor* at this station was quite normal, but the sudden influx of a considerable quantity of water caused the plants to grow vertically and develop broader leaves. This is contrary to Glück's experience, for he considered that the form was only developed in shallow water.

Utricularia ochroleuca has only once been recorded for Norfolk, and this was from specimens gathered on Foulden Common by Mr. C. W. F. Newton, in September, 1914. Mr. Arthur Bennett compared these with specimens from Inverness and the Black Forest, named by Dr. Glück, and came to the conclusion that they were *U. ochroleuca*, Hartm. (Nat. Trans., Vol. X., p. 393). On October 19th, 1912, I gathered specimens on Foulden Common which had so much superficial resemblance to *U. ochroleuca* that they were submitted by Mr. W. H. Burrell, F.L.S., to Dr. Glück, who referred them to *U. intermedia*, pointing out that on the Continent he had not found so great a number of transitional leaves with acute and serrate lobes, and emphasising the risk of confusing autumnal forms with *U. ochroleuca*. (Nat. Trans., Vol. IX., p. 625). When the pools on Foulden Common yield only *U. intermedia* in the summer, and what is apparently *U. ochroleuca* in the autumn, it is difficult to believe that more than one species is represented.

Apart from differences between corolla and spur, rarely comparable in this country, as the flowering of either *U.*

intermedia or *U. ochroleuca* is of such extremely rare occurrence, the chief distinctions between the two species are (according to Dr. Glück) :—

U. intermedia :—Green assimilating leaves, quite without bladders ; leaf-tip obtuse, with prickle set on apical margin.

U. ochroleuca :—Always bearing sporadic bladders ; leaf-tip gradually attenuated into long point, which ends with fine bristle.

It is, however, easy to prove that these specific differences are not constant. Through the kindness of Mr. Bennett I have seen specimens of *U. ochroleuca* in his herbarium. One from the Konigsveen, near Nymwegen, has no sporadic bladders ; one from Sweden has eight, and another from the same country less, and a deep-water form from Coniston Lake has three. Mr. Newton's Foulden Common specimen in Mr. Bennett's collection had two sporadic bladders, and mine (referred by Dr. Glück to *U. intermedia*) had from two to as many as four. But sporadic bladders are not infrequent on undoubted *intermedia*. They occurred in gatherings made by Mr. Gurney and myself on East Ruston Common on April 10th, 1921, and of 37 specimens from $\frac{1}{2}$ to 2 ins. in length gathered by me on Uppgate Common, Swannington, on April 16th, two had two sporadic bladders, and six had one, so that the percentage was therefore 16. Examination of a small handful of bladderworts from the same common on May 14th, 1921, showed that it contained 135 specimens of *U. minor* and 36 of *U. intermedia*. Five of the latter each had one sporadic bladder.

On June 8th, 1913, an examination of some hundreds of specimens on Uppgate Common revealed the fact that about 5 per cent. had sporadic bladders. As *U. ochroleuca* may possess no sporadic bladders, and *U. intermedia* may have two or three, this specific distinction is obviously not to be relied upon.

A much more reliable specific characteristic is furnished by the attenuated leaf-tip of *U. ochroleuca* ending in a fine spine. Yet abnormal specimens of *U. ochroleuca* differ but little from abnormal specimens of *U. intermedia* in this respect. Specimens

gathered by Mr. Burrell and me on Barton Turf Fen (Plate V., Fig 9), September 25th, 1912 (one is figured by Dr. Glück, 1913), closely approach *U. ochroleuca* in the attenuated leaf-segments and the number of lateral bundles of hairs seated on finger-like projections, while my Foulden Common specimens (with obtuse leaf-segments) approach *U. ochroleuca* in having spines rather than bristles. With (as Dr. Glück points out) stem, leaf, bladder (this is doubtful) and floral axis morphologically equivalent, and subject to metamorphoses under special conditions, specific distinctions cannot be constant, and forms on the border-line between *U. intermedia* and *U. ochroleuca* must inevitably occur.

III. OBSERVATIONS ON FLOWERING

The scapes of *U. vulgaris* are round, erect, and bear from 2 to 8 bright yellow flowers. Both scapes and calyx are purplish. Normally the scapes are from 4 to 8 inches in length, but plants in deep pools on Foulden Common in 1910 had scapes $13\frac{1}{2}$ in. and 8 in. (on one plant), 12 in., 13 in., and 15 in., and in the same year on East Ruston Common some of the scapes were 10 ins. in length. The palate of the corolla is marked with a few separate orange lines, and the conical spur, rounded, deflexed at the tip, and adpressed to the under lip, has three vertical orange stripes and a curved orange line on each side at the base. There are purple veins at the base of the upper lip and palate.

In *U. minor* the scapes are from two to six inches in height, two to six flowered, the corolla being very pale yellow, with transparent veins. The short, obtuse, keeled, deflexed spur has no markings.

The only known British specimen of the flower of *U. intermedia* was found by me on Roydon Common on July 18th, 1910. The slender scape is $3\frac{1}{4}$ ins. in length, the palate $\frac{1}{4}$ in. in length, broad and prominent, the flat upper lip $\frac{1}{2}$ in. in length. The corolla is pale yellow, though not so pale as *U. minor*; the lip is boldly striped with deep orange, and the palate slightly

striped. The conical spur is $\frac{3}{8}$ in. in length, adpressed to the palate, and bordering it is a purple V-shaped mark. The flower-scape rises from the junction of the water-shoot and the earth-shoot. A flower found on East Ruston Common in July, 1911, by Mr. H. J. Thouless (in company with Mr. W. H. Burrell and myself) was considered by Mr. Burrell to belong to *U. ochroleuca*, but the specimen was unfortunately lost.

Some years seem much more favourable than others to the growth and flowering of the bladderworts. All the necessary conditions seem to have been present in 1910. *U. vulgaris* is normally from 6 to 18 inches in length, but that year on Caldecote Fen one specimen was $2\frac{1}{2}$ ft. in length, with one strand branching from the middle, while on East Ruston Common one plant, excluding a branch, was 6 ft. in length. Blossoms of *U. vulgaris* and *U. minor* were also abundant all over the county. The following year was also favourable, and at Horning and Woodbastwick on June 17th a number of plants of *U. vulgaris* were 4 ft. in length. Both 1912 and 1913 were extremely good years for plants and flowers, but 1914 was the beginning of a series of unfavourable years. On May 31st, 1914, there was no *U. intermedia* discoverable on Barton Fen; on June 14th there was very little at East Ruston; on July 4th none was to be found at Swannington, the swamp being almost dry; and on July 11th *U. intermedia* could only be discovered with the utmost difficulty at Foulden, the drought having had an adverse effect. 1915 was a slightly better year, but 1916 was unfavourable. For 1917 and 1918 I have no data, but both in 1919 and 1920 there was very little flowering, and plants were scarce in localities which from 1910 to 1913 inclusive had yielded them in abundance.

The periodicity of the bladderworts may be due to a variety of causes, favourable ones being low temperatures which retard the development of the winter-buds, a sufficiency of water to provide food and to allow full maturity to be attained, and a sufficiently high mean temperature to induce flowering. Yet efforts to discriminate between favourable and unfavourable

years regarding rainfall and temperature (either annual or seasonal) have yielded little result. A comparison between the mean daily temperature of the earth at 1 ft. in the East of England and the mean temperature at surface of the water on the Greifensee (Switzerland, see Guyer, 1911, p. 261) shows an excess of temperature for the East of England of 18.9 degrees for the months of January—April inclusive, and a total deficit of 39 degrees for the months May—December inclusive. Cold winters and hot summers are therefore favourable to the flowering of *U. intermedia*, since it appears to flower freely in Switzerland. In Norfolk the mean temperature was 0.4° above the average in 1910, 1.8° in 1911, 0.9° in 1912, and 1.0° in 1913, all favourable years for *Utricularia*; in 1914 it was 1.7°, in 1915 it was 0.0°, in 1916 it was 0.5°, and in 1919, 1.2°; all unfavourable years. On the average this gives an excess of 0.75 degree mean temperature in the favourable years. Whether this is sufficient to account for the periodicity of the bladderworts must be considered unproven. It is possible that the deciding factors are the availability of mineral salts, or the presence of suitable food for entrapping in the bladders.

IV. TURIOS OR WINTER BUDS

UTRICULARIA MINOR

The winter buds are formed at the ends of the water-shoots, or rarely of the earth-shoots, from the end of August onwards. The leaves at the apex of the shoot are closely packed into a tiny green ball, which finally breaks loose from the decaying parent plant, and floats on the surface of the water throughout the winter. The leaves of which the turio is composed are rather thick and stiff, and consist of three broad segments, which themselves are deeply divided at their ends (Plate IV., Fig. 10). These three lobes represent the two primary branches and the accessory branch of the normal leaf. (See below, p. 141).

Germination of the bud takes place about the beginning of April, but may easily be induced earlier by exposure to the

warmth of an ordinary room. Turios kept in an unheated laboratory were found to germinate in January.

In germination the axis of the turio elongates, and the leaves themselves increase somewhat in size and become separated, while new leaves are formed at the apex which have much the same form as that of the turio leaves. In specimens from East Ruston examined in April a distinction was generally traceable between the first ten leaves, which were turio leaves, and the eleventh or first new leaf (Plate III., Fig. 6). The new leaves were intermediate in form, and the slender, mature form of leaf was not attained till about the tenth new leaf. The distinction is not always very clear, since the turio leaves may have a single rudimentary bladder, but commonly the turio leaves may be distinguished by absence of bladders. Shoots may develop from the axils of turio leaves, and the first leaves of such shoots are of intermediate form; but generally shoots arise from the new stem. The turio often does not separate from the old stem, part of which, in a decayed condition, may be found attached to the base of the young plant in the spring.

The young plant generally grows with great vigour at first, and develops leaves of great complexity and with more numerous bladders than is usual later in the year.

UTRICULARIA INTERMEDIA

The turios are formed about the end of August at the ends of both the water- and earth-shoots. They are oval in shape, and consist of numerous closely-packed leaves, the marginal hairs of which form a hairy felt over the surface of the bud. The leaves themselves differ from normal leaves in having a number of lateral bundles of long hairs seated on finger-like projections, and the first leaves produced in the spring resemble the turio leaves in this respect. The same is the case with the apical leaves in the autumn, which immediately precede the turio, and plants are occasionally found in which a large number of these modified leaves are produced. Such plants are not easy to distinguish from *U. ochroleuca*, which is characterised by the retention of these finger-like processes at all seasons.

The turios break loose from the parent plant when the latter begins to decay, and float on the surface of the water during winter, starting into growth about the end of April. They respond to heat even more readily than those of *U. minor*, and a number of buds kept in an aquarium were found in full growth in December. When exposed, in an incubator, to a temperature of between 70° and 80° F., turios brought from East Ruston germinated in about 24 hours, and growth was extraordinarily rapid, as the following table shows. The plants produced were normal, with the exception that the internodes were very long, and earth-shoots were produced also.

TABLE I.

U. intermedia. Measurements (in inches) of young plant grown in incubator at temperature of 70°—85° F.

Date.	Time.	Length.		Actual Growth.	
		Lateral Branch.	Main Stem.	Lateral Branch.	Main Stem.
Feb. 14, 1921	10 a.m.	1.44	3.5	—	—
	5.30 p.m.	1.56	3.94	.12	.44
„ 15	9.30 a.m.	1.94	4.7	.38	.76
	5.45 p.m.	2	5.3	.06	.6
„ 16	10 a.m.	2.44	6.0	.44	.7
	7.45 p.m.	2.56	6.37	.12	.37
„ 17	9.30 a.m.	2.87	6.75	.31	.38
	5.30 p.m.	3.12	7.0	.25	.25
„ 18	9.10 a.m.	3.5	7.37	.38	.37
„ 19	7 p.m.	3.87	8	.37	.63
„ 20	8.30 a.m.	4.25	8.25	.38	.25
			growing point damaged.		
„ 21	9.30 a.m.	4.25		—	—
„ 22	10 a.m.	5.37		1.12	—
„ 23	10 a.m.	5.75		.38	—

On the whole, growth was more rapid at night than during the day, though the plants were only exposed to a rather dim light at any time. The sudden growth of the side branch in the specimen measured on February 22nd, after the main growing point had been damaged, is rather remarkable, and I am inclined to suspect an error in measurement on February



UTRICULARIA



21st. Measurements were made by stretching the plant as straight as possible upon a rule, and absolute accuracy was not altogether easy to ensure.

The germinating turio of *U. intermedia*, unlike that of *U. minor* and *U. vulgaris*, remains practically unchanged in form, and only elongates sufficiently for the first few leaves to become separated. The new stem springs from its apex, and earth-shoots are produced almost immediately from the stem close to the turio, or even from within the turio itself. The unexpanded turio may be found still attached to the base of the plant well on into the summer. The turio of *U. ochroleuca* is said to differ from that of *U. intermedia* in shape and also in that its axis elongates in germination (Glück, 1906, Taf. V., Fig. 59).

UTRICULARIA VULGARIS

Winter buds were not found in this species in 1920 till about the end of September. They are rather large, dark green balls at the ends of the branches, enclosed within a terminal whorl of leaves. These balls are sometimes irregular in shape, owing to a division of the axis, and are somewhat slimy on the surface. It is not easy to ascertain the number of leaves in the bud, but there appear to be normally about 15, and these leaves, when expanding in the spring, are found to differ very little from the normal form. Usually they do not produce bladders, but rudimentary bladders may sometimes be found upon them.

As a rule the turio sinks to the bottom attached to the decaying parent plant, but this is by no means always the case, for turios formed by plants kept in aquaria were, in December, partly floating and partly resting on the bottom. Those that rested on the bottom did not do so solely by reason of being attached to the thread-like remains of the old plant, for the floating turios were attached in the same way. Prof. Glück's experiments have shown (Glück, 1906, p. 175) that turios of *U. vulgaris* can retain their vitality even after being enclosed in ice for 10 days or more, and no doubt the other species must have great powers of resistance, since their floating turios are fully exposed to frost.

Germination takes place in *U. vulgaris* very early, and plants several inches long may be found at East Ruston in the first week of April. Turios placed in a slightly heated greenhouse at the end of December started at once into growth, and others kept in an incubator together with *U. intermedia* (see above) grew with remarkable rapidity, as shown in accompanying table.

TABLE II.

U. vulgaris. Growth of young plant in Incubator.

Date.	Time.	Length.	Amount of Growth.
Feb. 16	7.45 p.m.	1.12 in.	—
" 17	9.30 a.m.	1.56 "	.44
" 17	5.30 p.m.	1.87 "	.31
" 18	9.10 a.m.	2.37 "	.5
" 19	7.0 p.m.	3.37 "	1.0
" 20	8.30 a.m.	3.62 "	.25
" 21	9.30 a.m.	4.25 "	.63
" 22	10 a.m.	4.62 "	.37
" 23	10 a.m.	4.87 "	.25

In germination the axis of the turio elongates rapidly, the leaves become widely separated and increase in size, while new leaves are produced approaching the adult form. There is no obvious contrast between the turio leaves and the new leaves, as there is in *U. minor*, and the basal leaves turn backwards so that both ends of the young plant are rounded and all distinction between turio and new growth is lost. I have seen specimens in which a new shoot has been produced at the base of the turio in such a way that the young plant was making growth at both ends of an apparently single stem.

The turios vary greatly in size. At East Ruston there seems to be a dwarf race of *U. vulgaris*, the mature plants of which do not commonly exceed about 8 inches in length, and these plants produce turios some of which may be no more than 1 mm. in diameter. From these minute buds tiny plants arise with reduced leaves of a very simple type. Whether these dwarf plants really constitute a fixed race, or are merely derived from exceptionally small turios of normal large plants, is a question which seems to be worth further investigation and some experiment.

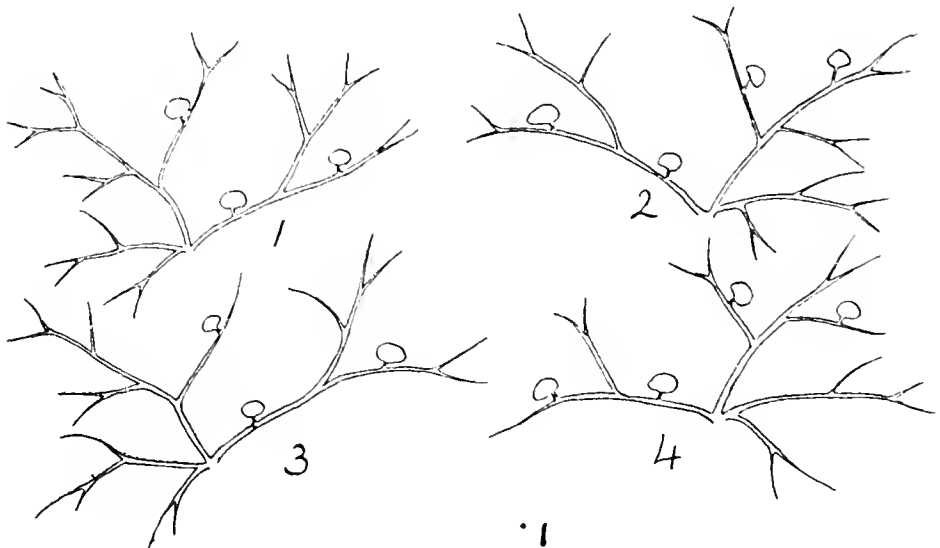
V. STRUCTURE

(1) LEAF FORM

UTRICULARIA MINOR

The shape and mode of branching of the leaf differs greatly, not only in plants from different situations, but also at different seasons, and in different plants growing under apparently similar conditions in the same place, and even in different parts of the same plant ; but I believe that all modifications are reducible to a simple plan which is retained and traceable in all cases.

All types of leaf are derivable from a simple two-branched type (Plate IV., Fig. 4), but the leaf usually consists of two main branches (Plate IV., Fig 1, A. and B.), and an accessory branch C., which springs from the base of branch B., so that the whole leaf appears to be three-branched. The leaves are alternately right- and left-handed, so that the accessory branches of successive leaves are always on the same side of the main stem (Text-Fig. 1). The main branches divide into secondary



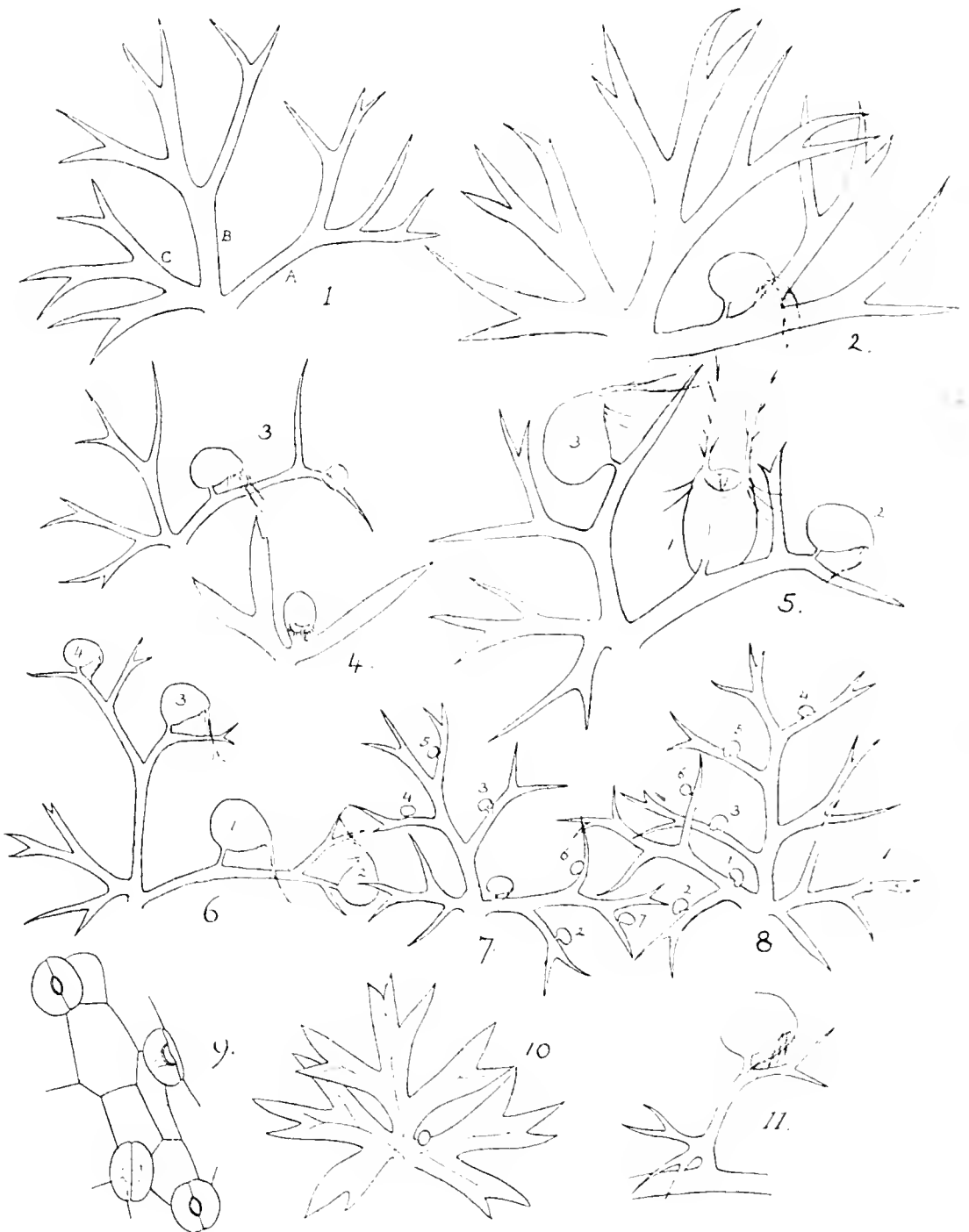
Text Figure No. 1.

Diagram of four successive leaves of *U. minor* from East Ruston, 10.4.21, showing arrangement of bladders and position of accessory branch alternately on right and left side.

branches or segments, and these segments are entirely without lateral hairs, differing in this respect from both *U. vulgaris* and *U. intermedia*. The segments are normally very narrow and pointed, but specimens are not infrequently found in which they are comparatively short and broad ("*platyloba*" form), and in these cases the bladders are usually few or absent. The production of the broad-lobed form of leaf is perhaps caused by a fall of water and approach of the plant to the surface, but this is by no means certain, since I have found this type growing at Flordon in apparently exactly similar conditions as normal plants with thread-like leaves, and Mr. Clarke has found it, after the flood of August, 1912, in water of exceptional depth. On the other hand I have kept plants of *U. minor*, developed from resting buds in the spring, throughout the summer in a glass jar exposed to light from all directions, and found that, whereas the plants started vigorously with normal, bladder-bearing leaves, the leaves became almost entirely devoid of bladders as time went on¹, and those developed at the surface of the water were of the typical "*platyloba*" form. In fact, as the water evaporated, the growing apex of the plants adhered to the sides of the jar and took on the form described by Prof. Glück as the "land form," while the submerged part remained with thread-like leaves.

The bladders vary in number from one to seven, but rarely exceed five. In spring the young plants grow with great vigour and at this time bladders are numerous and may reach seven on a leaf, but in older plants the number diminishes and usually does not exceed two or three. The position of these bladders is remarkably constant, if not invariable. In the accompanying Plate I have given drawings of leaves bearing from one to seven bladders, and have numbered the bladders according to the order in which they are added. When only one is present it is always found in position 1; when there are two the second occupies position 2, and so on. The position of the first three

¹ Goebel, 1891, suggests that light exercises an inhibitory effect on production of bladders. Luetzelburg explains experimental reduction of bladders as due to starvation.



UTRICULARIA MINOR



bladders is, I believe, almost invariable, but it is less easy to be positive in the case of larger numbers, owing to the smaller amount of material available for comparison. Nevertheless, I believe the positions assigned to be correct, at least in the majority of cases. *In no case have I seen a bladder borne by the accessory branch.* It is generally considered (see Göppert, 1847) that the bladders are modified leaves or parts of leaves, but this view does not appear to be supported by a study of our Norfolk Utricularias. If it were so each bladder should occupy the place of a branch or of a leaf segment, but comparison of the figures here given shows that this is not the case, the bladders rather springing from definite positions on the segments themselves. For instance, in Plate IV., Fig. 2, the bladder is obviously an additional member, and does not arise by suppression or transformation of any part of the leaf. Leaves Nos. 7 and 8, although possessing an unusual number of bladders, show no corresponding suppression of segments. These two leaves show to what great complexity some spring plants may attain, and a tendency to resemble *U. vulgaris*, but the bladders themselves afford a minor distinction, since those of *U. vulgaris* are primarily axial in position, whereas in *U. minor* they are seated rather upon the leaf segments than at their junction with the main axis.

Earth-shoots, similar to those of *U. intermedia*, are always present in normal plants, these shoots bearing etiolated leaves of a reduced and altered type (Plate IV., Fig. 11). The reduced leaf is, however, of the same form as the normal leaf, in that it consists of two main branches and an accessory branch. The branch A is produced into a long stalk bearing one branch and a large bladder, while the other branches are reduced to small flattened forked lobes.

The leaves of the earth-shoot may bear two bladders, but they are both borne on branch A, while branches B. and C. may be so much reduced as to be scarcely visible. In such cases all likeness to the normal type of leaf is lost, but the derivation of this modified form can be traced in all its stages in intermediate leaves which may be found on earth-shoots which are

not completely buried in moss or mud. It is not unusual to find earth shoots which have grown out into the light and become transformed into normal water-shoots with normal green leaves. Plants grown in aquaria exposed to light do not, in my experience, produce earth shoots, and may even be without bladders.

The bladders of the earth-shoots are very efficient anchoring organs. If a number of plants are spread out in a pan it is extraordinarily difficult to separate them without breaking the shoots, since the bladders lock them together most provokingly.

UTRICULARIA VULGARIS

U. vulgaris is extraordinarily variable in size and form of leaf; so much so that it is not always easy to distinguish small plants from those of *U. minor*. In large, luxuriant specimens the leaf consists of four main branches, two outwardly directed, and two smaller ones pointing towards the stem, and these send off alternate branches which again divide, producing in this way a great number of fine terminal branchlets or segments which are densely crowded together. The terminal segments, unlike those of *U. minor*, have hairs along their margins.

The number of bladders is very variable, but in such large leaves there is generally a row of large bladders springing, close to the main axis, from the base of each secondary branch, and also a number of smaller bladders arranged upon the secondary branches near their apices. The bladders develop from the base of the leaf outwards, and the peripheral bladders are never found unless the full complement of axial bladders is already present. There is, in my experience, always one large bladder at the base of the leaf between the two main branches, and often a small rudimentary bladder in addition. Prof. Glück states that this basal bladder is always present in *U. neglecta*, and rarely so in *U. vulgaris*, so that it may be regarded as a minor diagnostic character; but it is so commonly present in Norfolk specimens of *U. vulgaris* that it cannot be regarded as of any specific importance.

Every stage in the reduction of the normal complex leaf to the simple two-branched form may be met with, and some examples are shown in Plate VI., Figs. 1—7. In Fig. 7 the leaf approaches, but does not attain, full complexity, and axial bladders are present at the origin of each secondary branch, but no peripheral bladders are developed. This figure shows that the basal lateral branch which, in fully developed leaves, projects backwards and gives a quadriradiate form to the leaf, is really only a secondary branch of the main axis, and that the leaf is, as in *U. minor*, primarily two-branched. The remaining figures show further stages in reduction to the simplest possible form in Figs. 2 and 3. The resemblance of some of these leaves to those of *U. minor* is very striking. These leaves of reduced type have all been taken from plants found at East Ruston, where a dwarf race occurs (see p. 140).

UTRICULARIA INTERMEDIA

The leaf of *U. intermedia* is simpler and less variable than that of the preceding species, but the general appearance of the plant varies greatly according to whether the internodes are long or short. There seem to be three possible conditions, all of which are commonly met with. These are :—

(1) All the internodes long, so that the leaves are all widely spaced (Plate III., Fig. 5). (2) Each pair of leaves springing close together and separated by a long internode from the next pair (Plate III., Fig. 3). In the plant shown the first pair of leaves following the turio are widely separated, while the remainder are almost opposite. (3) All internodes short, with the result that the leaves all overlap, lying horizontally. This is the condition in which all plants were found at Roydon in August, 1920 ; but the same plants kept in a pan exposed to a south light in a few days lengthened their internodes and became entirely different in appearance, while the leaves themselves increased in size. Plants of this type resemble the "land form" of Prof. Glück, but were found at Roydon beneath 3 or 4 inches of water.

Generally the plant grows amongst moss, with the leaves spread out horizontally, but when grown in aquaria with diffused light the horizontal form is not assumed, and the leaves are more thread-like.

The normal leaf of *U. intermedia* consists of three branches which themselves divide into secondary branches (Plate V., Fig. 1). These secondary branches are not numerous, but are variable in number, though following a fairly uniform plan of arrangement. Each secondary branch may again divide or may remain simple, and the terminal segments are flattened and provided with sparse hairs along their margins. The tips of the segments are narrow and tapering in spring, but become blunter and even rounded later in the season. In *U. ochroleuca* they are said to be tapering at all seasons. In the leaves of the turio, and in leaves first formed in spring or immediately preceding the turio in autumn, the edge of the leaf is produced into a number of slender, finger-like processes bearing bundles of 3-6 hairs. Such leaves bear a strong resemblance to those of *U. ochroleuca*, and when, as is sometimes the case in autumn (see p. 134), the whole of the leaves of the plant assume this form, the resemblance is so great that confusion of the species is likely to occur.

Although such transitional leaves in the distal part of the leaf shoot have only been met with in autumn, the following observations show that they may also be produced at other seasons. Of seven plants grown in aquaria since February, 1921, from turios taken at East Ruston, which were examined on May 22nd, three showed transitional leaves.

(1) This plant had been grown in a vertical glass tube with the leaf-shoot pointing downwards and the earth-shoot upwards. The latter became transformed into a leaf shoot, while the leaf-shoot itself grew little, but produced an earth-shoot which, on emergence from the tube, developed assimilating leaves. The old leaf-shoot had normal, blunt-ended leaves, but the lower transformed earth shoot, about 3 ins. long, bore a number of simple bipartite leaves, the segments of which were tapered at the ends and bore finger-like lateral processes,





UTRICULARIA INTERMEDIA



UTRICULARIA VULGARIS

1. Leaf of dwarf form, East Ruston. 5/9/20.
2. Fifth leaf of plant about 1 inch long grown in incubator from a turio measuring 1 mm. x 1.5 mm. The plant bore 11 leaves in all. (Lateral hairs omitted).
3. Leaf from a similar plant 1 1/2 inches long.
4. Young leaf from near apex of plant from East Ruston, 24/7. 20, showing bladders developing on secondary branches.
5. Leaf of small plant about 4 1/2 inches long. E. Ruston. 11/8/20.
6. Leaf of plant about 8 inches long. E. Ruston. 11/8/20.
7. Portion of leaf of larger plant. E. Ruston. July, 1920.



with from one to four spines, exactly as in *U. ochroleuca*. One leaf bore a single bladder. (Plate V., Fig. 8.)

The leaves of the upward-growing shoot had none of these lateral processes, but, while the proximal leaves were blunt-ended, the distal leaves were narrow and tapered, except quite at the apex, where abnormal, broad-lobed leaves were produced, owing to emergence of the shoot into the air.

(2) Another plant, grown in a nutrient solution, and very vigorous, had the distal leaves with lateral processes and tapered ends, while the proximal leaves were normal in all respects.

(3) A third plant, grown in ordinary water, had all leaves normal except those which had developed at the end of an earth-shoot. These had lateral, spine-bearing processes, even more conspicuous than in *U. ochroleuca*.

The remaining four plants, all of which were in an unhealthy condition, showed no sign of lateral processes, though the leaves were tapered in some cases.

It is impossible to suggest any cause for the peculiarities of the three plants described, but it is clear that it cannot be unfavourable conditions.

A comparison of large numbers of leaves leads to the conclusion that the leaf is, as in *U. minor* and *U. vulgaris*, primarily two-branched, and that from the two-branched type both the normal water-leaf and the modified earth-shoot leaf are developed. In Plate V, Fig. 5, is shown a leaf intermediate between earth- and water-leaves, and in this case the biramous form is clear. In figs. 1-5, Plate V., the parts which I consider homologous are marked A. and B., and it will be seen that, in the earth-shoot, the branch B. becomes enormously elongated, and bears either one or two bladders. The arrangement shown in these figures is, I believe, invariable; that is to say, bladders, when present either on water- or earth-shoots, are always borne on branch B. before bifurcation. The second bladder, when present on earth-leaves, replaces one of the terminal segments of the leaf marked C. in fig. 4.

It is not at all unusual, at all times of the year, to find bladders on the normal water-leaves. There is never more than one bladder on a leaf, and its position is always that shown in Fig 2. As a rule there is not more than one bladder-bearing leaf on a plant, but I have seen as many as three on a plant from East Ruston. As showing the frequency with which these bladders occur in Norfolk specimens of *U. intermedia*, I may mention that, out of 17 small plants collected at Upgate Common in April by Mr. W. G. Clarke, *eight* bore bladders. It is obvious that the presence or absence of bladders on the water-leaves cannot, in Norfolk, be regarded as a character of the smallest value in discriminating between *U. intermedia* and *U. ochroleuca*.

The only characters which remain for discriminating between flowerless plants of *U. ochroleuca* and *U. intermedia* are—

- (a) Leaf tips tapering ... *U. ochroleuca*.
 ,, ,, blunt ... *U. intermedia*.
- (b) Spines borne on lateral processes ... *U. ochroleuca*.
 ,, sessile or nearly so ... *U. intermedia*.

But neither of these characters can, as shown above, be relied upon, and it appears that, if the species can be separated at all in Norfolk (which is doubtful), the only practicable distinction is that in *U. intermedia* *some* leaves are blunt at the ends, and lateral processes are *usually* absent, whereas in *U. ochroleuca* the leaves are *all* pointed and with lateral processes.

Whereas in *U. minor* the production of modified earth-shoots is readily suppressed by growth in abnormal conditions of lighting, the tendency to their formation is so strong in *U. intermedia* that it is, in my experience, unusual for a plant developing from the turio to fail to send out these shoots. Such shoots, in spite of exposure to light and absence of mud or moss to grow into, may, and commonly do, grow to a considerable length, while retaining the usual earth-shoot form. But the tendency to produce reduced, bladder-bearing leaves may be overcome by forcing the shoot to grow vertically upwards. Such shoots grown in glass tubes sometimes attempt at first to reverse their

direction, and to resume downward growth, but the reversal is not persisted in, and the shoot then changes into a normal leaf-shoot growing upwards. Although it is quite common to find single bladders on normal water-leaves, I have not seen either in laboratory specimens or in nature a bladder-bearing leaf on a leaf-shoot derived by transformation of an earth-shoot. Leaves of intermediate form often arise at the ends of earth-shoots, but as soon as the leaf-shoot form is assumed, the tendency to produce bladders seems to be definitely lost until, as is sometimes the case, the shoot again adopts the form of an earth-shoot. It is not unusual to find in nature shoots which are alternately leaf-and bladder-bearing (Plate III., Fig. 1), but I have not succeeded experimentally in inducing a leaf-shoot to produce bladders. Leaf-shoots grown in glass tubes directed downwards either reverse direction or continue to grow downwards till they emerge from the tube, retaining their normal leaves. In one case a turio was grown in a U-tube in such a way that the leaf shoot grew in the first instance normally upwards. On arrival at the bend of the tube the shoot grew round the bend and about 3 inches downwards, but then reversed its direction and grew back up the tube. This reversal was not persisted in, and, after changing direction repeatedly and causing a tangled growth in the tube, the shoot has now definitely adopted downward growth without change of form.

One may conclude that *U. intermedia* is a far more specialised plant than the other two species, in which the tendency to produce earth-shoots is deeply rooted and not simply a response to environment, as it appears to be in *U. minor*.

(2) STOMATA

The presence of stomata in submerged leaves has been recorded for a number of aquatic plants (see Arber, 1920, p. 166), but they must be regarded as exceptional, and in many cases functionless organs, in water plants. Luitzelburg (1910) has found stomata to be present in the leaves of the "land forms" of *Utricularia*, and they occur also on the so-called "air-shoots" of *U. vulgaris*, and *U. neglecta*, (Glück, 1906,

p. 79); but, so far as I am aware, they have not been seen on the submerged leaves of any species.

I have examined a number of specimens of *U. vulgaris*, *U. intermedia*, and *U. minor*, and find that, whereas they are apparently absent from *U. vulgaris*, they may readily be found in *U. minor* and *U. intermedia*. In fact, every leaf of *U. intermedia* examined, whether of plants grown under natural or artificial conditions, proved to be provided with numerous stomata.

I have even found stomata on the basal segments of earth-shoot leaves in *U. intermedia*.

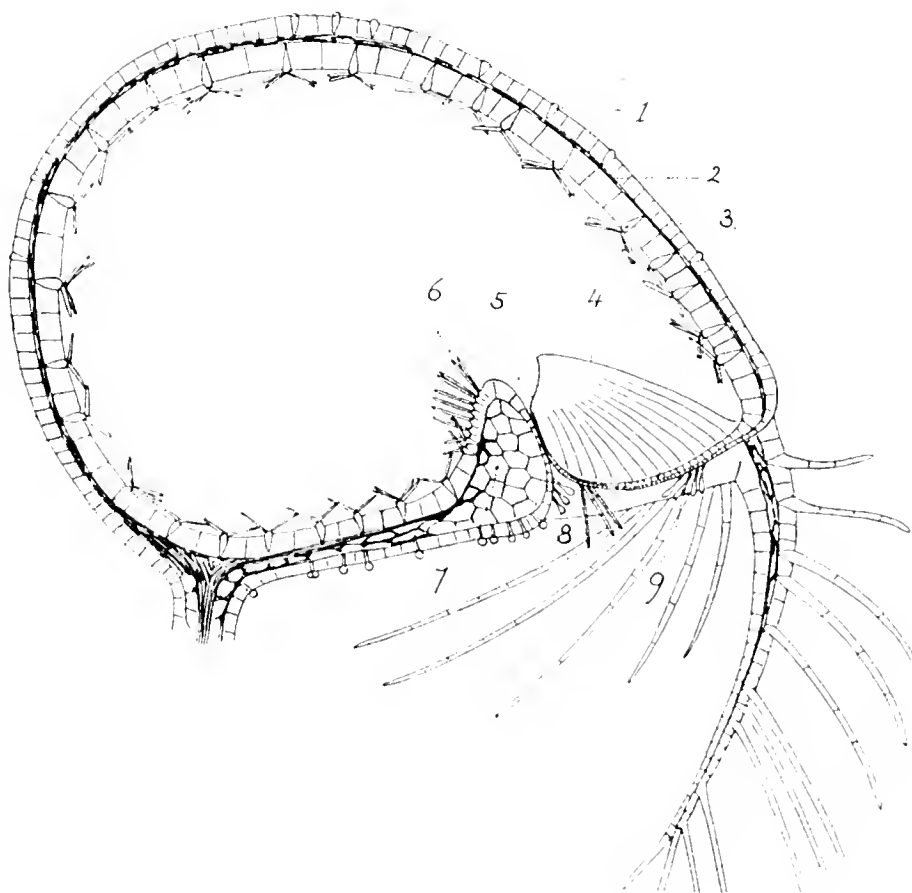
These stomata (see Plate V., Fig. 6) are placed near the edge of the leaf segments, and communicate with the air-filled intercellular spaces of the latter. Their presence is readily ascertained by focussing the edge of the leaf with a fairly high-power of the microscope, when the minute bubbles of air which fill the aperture between the guard cells appear as black spots along the leaf. Their structure is best seen in leaves kept for a time in spirit to dissolve out the chlorophyll and allow the air to escape from the tissues.

Stomata may also be found, but less frequently, in *U. minor*, but then only in leaves which approach the *platyloba* form. Plate IV., fig. 9 shows these stomata in a leaf of a young plant of *U. minor* taken at Uppgate Common in April, 1921, by Mr. W. G. Clarke.

(3) THE BLADDERS

The structure of the bladders is practically identical in all the British species, and is remarkably uniform throughout the genus. A very good account of the structure of the bladder of *U. neglecta* has been given by Darwin in his "Insectivorous Plants," and the main features are described in most botanical text-books, but some of the histological details are less well known.

The accompanying figure (Plate VII.) of the bladder of *U. intermedia* gives in semi-diagrammatic form the arrangement of the several parts. The two large "antennæ," with



UTRICULARIA INTERMEDIA

Longitudinal section of the bladder:

1. Gland cell in outer dorsal wall. Similar gland cells are shown scattered throughout outer wall, but more numerous ventrally.
2. Air-filled intercellular space containing also—in the dorsal and ventral middle line—a strand of vascular tissue.
3. Quadrifid absorptive cell embedded in inner wall. Side view.
4. Valve.
5. Free edge of valve.
6. Bifid absorptive organs of the "cushion."
7. "Cushion" or thickened posterior rim of mouth against which the free edge of the valve rests.
8. Club cells on outer surface of "cushion."
9. Club cells of the valve.



their forwardly directed hairs, and the group of lateral hairs projecting backwards, enclose a cone-shaped space leading towards the mouth of the bladder, which is closed by a thin fold or valve. The valve is attached to the bladder wall, except along its ventral edge, where it rests against the inner surface of a thickened ridge which may be called the cushion of the valve. Near the posterior edge of the valve are four forwardly directed hairs, the function of which is obscure, but which may be tactile and may be designated as the "trigger hairs." On the dorsal part of the valve and round the lip of the bladder mouth there are large numbers of hairs terminating in club-shaped cells, which form an almost complete ring round the mouth. These club-hairs (Plate VIII., Plate VII., Fig. 8) consist of a long, slender stalk, a short, thick-walled collar cell, and one, or sometimes two, elongated terminal cells. The latter are evidently gland cells secreting mucus, and the secretion can often be seen surrounding the cell and giving it a delicately hairy appearance. The form of the club-cells and length of stalk is variable, and it is possible that specific differences may be found between the three species with regard to their form and distribution, but I have not made a sufficient number of observations to be able to express an opinion on this point. In some cases, particularly in *U. minor*, the terminal cell may be spherical, and near the free edge of the valve where the four "trigger hairs" spring from it there are short-stalked gland cells which form a transition towards the glands commonly found in the bladder wall and on the leaves. These glands consist of a short stalk and collar cell, but the terminal cell is arranged with its long axis transverse to the stalk (Plate VIII., Fig 4a).

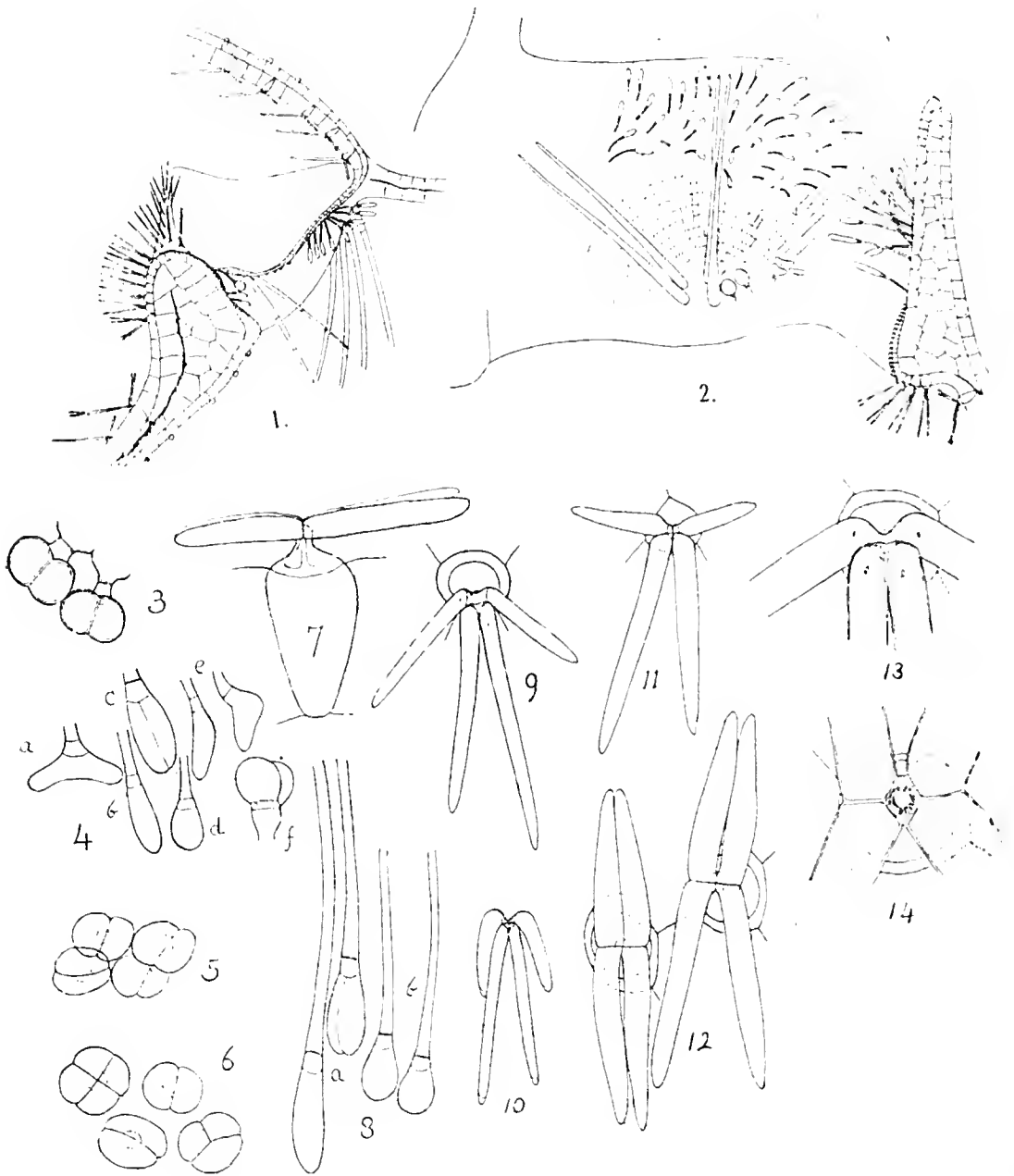
At the base of the "trigger hairs" are generally a few large globular cells on short stalks, and occasionally these terminal cells are in pairs.

The thick cushion against which the valve rests bears not only short-stalked club-cells, but globular or paired cells, closely packed, on short stalks, or with the stalk embedded in the inner cellular layer (Plate VIII., Fig. 3 and 5). These latter

resemble those of the bladder wall (Fig. 6), which in section appear simply as globular excrescences of the wall (Fig. 1), but in fact consist of basal cell or stalk, collar cell, and terminal cell, exactly the same as the club-cells which are the final term of the series. The bladder glands nearest the mouth may have the terminal cells in pairs, in threes, or even four together, but as a rule they are in pairs, and they are evidently the same structures as are found on the leaves, though in the latter the terminal cells are always in pairs and of elongated form.

The wall of the bladder consists of two layers of cells, with an intermediate space which is usually filled with air. The vascular bundle of the stalk of the bladder sends two small branches into this space, one of which runs dorsally and the other ventrally along the middle line. The ventral branch divides again near the mouth, which it appears almost to encircle. The outer layer includes a number of glands as described above, and these are more numerous on the ventral than on the dorsal side. The inner layer contains very large numbers of structures which are built on the same fundamental plan as the external glands, but probably have absorptive functions. Each consists (Plate VIII., Fig. 7) of a large, pear-shaped basal cell, a collar cell, and four terminal cells or processes. The collar cell is not sharply marked off from the basal cell, and is distally constricted to form a short stalk bearing the long, transparent processes. It is difficult to make out the relation of the terminal processes to the collar (see Fig. 13, 14), but the latter seems to have four thickened strengthening ridges, corresponding to the four processes, and these processes appear to be, as it were, hinged on the apex of the stalk where the four ridges meet. The whole organ may be called the "quadrifid organ."

The inner surface of the cushion bears a large number of absorptive organs, which closely resemble the quadrifid organs, but have two processes instead of four. The two processes have the appearance of being direct prolongations of the



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STRUCTURE OF BLADDER



basal cell, but probably the collar cell is really present, though I have been unable to see it.

The arrangement of the four processes of the quadrifid organs shows characteristic differences in the three species examined. In *U. vulgaris*, and also in *U. neglecta*, according to Darwin, these processes are arranged in two pairs, of which the posterior pair are much the longer and project into the interior of the bladder at an angle of about 45° . They usually diverge from each other at an angle of about 30° , but may be parallel and contiguous. The anterior pair usually diverge at an angle of about 70° , but this angle varies from 50° to about 150° . In *U. minor*, on the other hand, all the processes are directed backwards, but in a very variable degree (Plate VIII., Figs. 9, 10), ranging from a condition in which the anterior pair are almost at right angles to the posterior pair, to a position in which all four are approximately parallel. But though there is so wide a range of variability in both species, the specific distinction remains constant, namely, that the anterior pair always point forwards in *U. vulgaris* and backwards in *U. minor*. In *U. Bremii* the arrangement appears to be exactly the same as in *U. minor* (Meierhofer, 1902). In *U. intermedia* the anterior pair, which are but slightly shorter than the posterior pair, point as a rule directly forwards, so continuing the line of the posterior pair, and the members of each pair are parallel and contiguous (Plate VIII., Fig. 12). I have not seen any figure of the quadrifid organs of *U. ochroleuca*.

VI. CAPTURE OF PREY

It has long been known that the bladders of *Utricularia* act as traps for the capture of Crustacea, insect larvæ, and other animals, and the means by which this capture is effected and the purpose served were very thoroughly investigated by Darwin (1875), who considered that, although the prey was not digested as it is in *Drosera*, the products of their decay were absorbed by the quadrifid processes which line the interior of the chamber. Luitzelburg (1910) has now proved that the bladders do secrete an enzyme, and that actual digestion takes

place, and both he and Büsgen (1888) found that the plants grow with greater vigour when supplied with animal food.

Although there can be no doubt that nitrogenous food is obtained by the plant from these captured animals, it is difficult to believe that they can depend largely upon this source of food. For instance, the most luxuriant growth of *U. minor* and *U. intermedia* that I have seen was at Roydon Common, and, in this case, there was a remarkable scarcity of Entomostreca, and all the bladders examined were entirely empty.

Suggestions have been made as to the reason why animals should find their way into these bladders, and it has been noted that those found within them are usually animals of creeping and not free-swimming habit. If it were the case that these animals find their way in by chance or, as has been suggested, in seeking refuge from pursuit, one would expect that they would be fairly evenly distributed among the bladders of any given plant. But such is not the case. It is much more usual to find one bladder crammed with captured prey while adjacent bladders are perhaps quite empty; and individual plants from the same spot vary greatly in their success in capturing such food. The number of species captured is generally extremely limited, which indicates a certain selection among the many species present, and it is a curious fact that, in the case of Cyclops and sometimes in Canthocamptus, a large proportion of the individuals found in the bladders are either males or are immature. It is, in fact, unusual to find an egg-bearing female entrapped. It appears to be probable that the club-shaped cells of the bladder mouth produce some secretion which is attractive to certain species, just as Bees are attracted to flowers by the secretion of honey. That these cells are secretory can be proved by microscopical examination. It is not unlikely that the secretion may act more strongly on one sex than on the other, and on young more than on adult individuals.*

*Dr. T. Scott (1894) has drawn attention to the preponderance of male Copepods in the bladders of *U. vulgaris*, and suggests that this preponderance is due to the difference in structure of the antennæ in the two sexes. With this suggestion I am unable to agree.

It might naturally be expected that the prey captured by the different species of *Utricularia* would not be the same, partly by reason of the different position and size of the bladders, and partly from a specific difference in the secretion of the club-cells, and this is actually the case, as the following examples will show.

CONTENTS OF BLADDERS—*U. VULGARIS*

The bladders of which the contents are noted below were taken from a plant which had been left for 24 hours in a jar containing large numbers of Entomostraca, etc., with the special intention of seeing if the free-swimming *Daphnia longispina*, which was present in abundance, was captured. No attempt was made to identify the species of Copepods taken.

- Bladder 1 and 2. Empty
- „ 3. Ephemeroïd larva caught by its head.
 - „ 4. *Corixa* sp. caught by one leg.
 - „ 5. *Volvox globator*, 1. *Cyclops*, 2.
 - „ 6. *Cyclops*, 2.
 - „ 7. *Cyclops*, 1.
 - „ 8. *Corixa* sp. caught by leg. *Eurycercus lamellatus*, 1. *Cyclops*, 1. *Canthocamptus*, 1.
 - „ 9. *Cyclops*, 3. *Acroperus harpæ*, 1.
 - „ 10. Empty.
 - „ 11. *Simocephalus vetulus*, 1. *Acroperus harpæ*, 1.
 - „ 12. *Cyclops*, 3 (one alive).
 - „ 13. *Cyclops*, 2.
 - „ 14. *Cyclops*, 2.
 - „ 15. *Chironomus* larva. *Cyclops*, 3. *A. harpæ*, 1.

It is remarkable that, though confined with the plant in a comparatively small body of water, not a single specimen of *Daphnia* was caught.

A similar experiment was made with *Daphnia pulex*, a number of which were placed in a watch-glass with some leaves of *Utricularia vulgaris*. Twenty-four hours later several *Daphnias* were found with the tip of one antenna held firmly by

the valve of a bladder, but not one had been wholly entrapped.

The bladders of *U. vulgaris* frequently capture such large animals as *Asellus aquaticus*.

CONTENTS OF BLADDERS—U. INTERMEDIA

- Bladder 1. Cyclops bicuspidatus, 1 male. Simocephalus vetulus, 1. Nematode sp.
 „ 2. Cyclops bicuspidatus, 2 females.
 „ 3. Cyclops bicuspidatus, 2 females, 1 male.
 „ 3. Cyclops bicuspidatus, 2 females, 1 male. Cypria sp., 1. Young Ostracods, 3. Chironomus larva.
 „ 4. Cyclops albidus, 1 young. Cyclops viridis, 1 male. Chironomus larva.
 „ 5. Hydrachnid sp., 1. Cyclops viridis, 1. C. albidus, 3 young. C. bicuspidatus, 1. C. agilis, 1 male.
 „ 6. Cyclops bicuspidatus, 1. Ostracod sp.
 „ 7. Chironomus larvæ, 2. Simocephalus vetulus, 1. Cyclops agilis, 2. C. viridis, 1. Cyclops young, 2.

All these species are characteristic of open water or of the surface of the moss.

CONTENTS OF BLADDERS—U. MINOR

Bladders from three earth-shoots of the same plant:—

- Shoot 1, Bladder 1. Canthocamptus gracilis, 1 male.
 2. C. gracilis, 1 male.
 3. Herpetocypris reptans, 1.
 4. C. gracilis, 7 males.
 5. C. gracilis, 3 males.
 6. Acarine sp.
 7 and 8. Empty.
 Shoot 2, Bladder 1. Alona sp.
 2. Cyclops sp.
 3 to 6, empty.
 Shoot 3, Bladder 1. Chironomus larva.
 2. Chironomus larvæ, 2. Cyclops viridis, 1, Alona affinis, 1. Ostracoda, 2.

3. Chironomus larva. Candona euplectella, 1.
4. Dipterous larvæ, 3 (2 of Chironomus).
Cyclops viridis, 2. Candona euplectella, 1. Cyclops sp., 1.
5. Chironomus larvæ, 3. Candona sp., 1.
6. Candona sp., 5. Chironomus larvæ, 2.
Hydrachnid sp., 1.
7. Candona sp., 5. Metacypris cordata, 1.
Cyclops young, 2. Chironomus larvæ, 2.

There is a striking contrast between the contents of the bladders on these three earth-shoots, indicating that they did not penetrate equally deep into the moss. Shoot No. 1 probably went deepest.

I would like to draw special attention to the case of the capture by *U. minor* of the Copepod *Canthocamptus gracilis*. This is a species which I have hitherto regarded as very rare in Norfolk. I have taken it, it is true, in a number of places, but in all cases only single specimens; yet here, in the bladders of *U. minor* at East Ruston, it appears to abound! The conclusion is fairly obvious. The species lives evidently deep down in submerged moss, or even in the mud below the moss, and, acting on the hint thereby obtained, I have since found it quite common in some places if searched for in the moss through which the earth-shoots of *U. minor* penetrate. It would be instructive if the earth-shoots of these Utricularias from other parts of the country could be examined, for, in all probability, species of Entomostraca would be found in them which escape the ordinary methods of collecting.

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PLATE III

- Fig. 1. *U. intermedia*. Part of plant from East Ruston, 11.8.20, showing alternation of earth- and water-shoot form.
- Fig. 2. *U. intermedia*. Part of a young plant grown in aquarium showing transition from earth-shoot to leaf-shoot.
- Fig. 3. *U. intermedia*. Young plant grown in aquarium 6.4.10, showing leaves in opposite pairs.
- Fig. 4. *U. intermedia*. Young plant 5 days after germination in incubator at temperature of 70–80° F. One bladder-bearing leaf.
- Fig. 5. *U. intermedia*. Young plant from aquarium, 7.4.10, showing one bladder-bearing leaf. Leaves widely separated.
- Fig. 6. *U. minor*. Young plant grown in aquarium from turio.

PLATE IV

UTRICULARIA MINOR

1. Leaf of plant bred from turio from East Ruston in full light. Drawn 15.7.20. Plant without earth-shoots and with few bladders.
2. Seventh leaf from apex of plant from East Ruston, 15.7.20, with one bladder.
3. Leaf with two bladders, Buxton Heath, 7.8.20. The majority of leaves had one bladder, or none.
4. Leaf from dwarf plant grown from a turio from East Ruston in incubator 19.4.21. The plant consisted of two branches about 1 inch long each, with about 8 leaves of similar form. These leaves had stomata.

5. Eighth leaf of same plant as that from which Fig. 2. was taken. Fig. 2 is drawn from posterior, and Fig. 5 from anterior, surface.
6. Leaf from near apex of shoot, bearing 4 bladders. Flordon Common, July, 1920.
7. Leaf with 7 bladders from young plant grown from turio from East Ruston, 6.4.20. This leaf was taken from a lateral branch in the axil of the 12th leaf of the main stem. The first leaf of this branch was of the shape of a turio leaf.
8. Twenty-second leaf of main stem of the same plant, with six bladders. The last 6 leaves of this plant bore bladders as follows :—3, 6 (22nd leaf), 4, 4, 2, 5.
9. Stomata and gland cell from a leaf of a young plant, Ugate Common, April, 1921.
10. Leaf of earth-shoot, Buxton Heath, 7.8.20.

PLATE V

UTRICULARIA INTERMEDIA

1. Leaf from East Ruston plant, 26.7.20, showing normal type of branching. The leaf segments are more pointed than is usual in late summer.
2. Leaf from young plant grown in incubator, 17.2.21.
3. 4. Leaves from earth-shoot of young plant, 25.4.21.
5. Last bladder-bearing leaf of the same shoot. The next following leaf was a normal water-leaf.
6. Part of the leaf of a plant grown in incubator April, 1921, showing stomata.
7. Apex of leaf segment of the same plant, showing normal blunt type of leaf.
8. Apex of leaf of plant grown in aquarium from East Ruston turio, 22.5.21.
9. Apex of leaf segment of plant from Barton Fen, 25.9.12.
10. Apex of leaf segment of *U. ochroleuca*, Coniston Lake, August, 1911.

PLATE VIII

1. *U. vulgaris*. Section of mouth of bladder, showing valve cushion and gland cells.
2. *U. vulgaris*. Part of valve and cushion in section.
3. *U. intermedia*. Gland cells of median border of cushion, seen in section.
4. *U. intermedia*. Various forms of Club cell from centre of valve. *a*. Short-stalked transverse type. *b*. and *c*. Long-stalked club cells (*c*. is divided). *d*. Spherical club-cell. *e*. Two short-stalked intermediate cells. *f*. Double-headed, short-stalked cell from base of trigger hairs.
5. *U. intermedia*. Gland cells of median border of cushion ; surface view. Collar cells dotted.
6. *U. intermedia*. Gland cells of bladder surface immediately behind the mouth. Surface view.
7. *U. intermedia*. Quadrifid gland, side view, showing cell embedded in bladder wall, and constricted collar cell with strengthening thickenings, bearing four arms.
8. Long-stalked club-cells from sides of bladder mouth. *a*. *U. intermedia*. *b*. *U. minor*.
9. *U. minor*. Quadrifid gland, normal type.
10. *U. minor*. Quadrifid gland, extreme form.
11. *U. vulgaris*. Quadrifid gland.
12. *U. intermedia*. Two quadrifid glands.
13. *U. minor*. Quadrifid gland more magnified. Each arm of the gland contained a single small body showing brownian movement.
14. *U. intermedia*. Quadrifid gland highly magnified. The central shaded area represents the knob of the collar cell with thickened wall and central space.

III

SPRING BIRDS AT GENEVA

BY ANTHONY BUXTON, M.B.O.U.

All through the winter months the harbour of Geneva was used as a sanctuary by countless water-birds. The little launches which continually plied across it had no terrors for the Black-headed Gulls, Pochards, Tufted Ducks, Coots, and Dabchicks, who merely paddled quietly a yard or two to one side to avoid being run down, and fought for the food thrown them from the bridges. Outside the limits of the harbour, where shooting was allowed, these same birds took flight back to the town for safety at the approach of any boat within 200 yards. March saw a change. One or two Snew arrived, but the other ducks and gulls began to go north, and by April 15th the only water-birds remaining were one pair of Dabchicks.

The spring bird famine on the water was compensated for on land. There was no lack of bird life in the winter, but it was greatly increased in spring. All three Woodpeckers, all our British Tits, Goldcrests, and an almost unbelievable quantity of Nuthatches passed a very comfortable five months in and around Geneva, but on March 10th, although other signs of spring showed later than in England, the northward migration began with the arrival of the first Chiffchaff.

The date of the first Chiffchaff in any locality for some reason always sticks in my mind. Some years ago I found the great bulk of these birds passing St. Jean de Luz at the western end of the Pyrenees about March 10th. They seem to pass Geneva about March 20th, and, from observation at the War, the north of France about March 25th, to reach the neighbourhood of London about [March 30th. This great invasion of minute creatures is always preceded by a few scattered individuals who arrive a week or ten days in advance. With the Chiffchaffs came the Blackcaps, or rather the cock Blackcaps. (The first hen Blackcap only arrived on April 6th, and there was a deal of excitement about her appearance.)

We do not expect to see Blackcaps in England at the same moment as Chiffchaffs, and why they should travel together as far as Geneva and then lose time in reaching England is a mystery to me. With the Blackcaps and Chiffchaffs came a number of Woodlarks, a few of which remained to breed, while the majority passed on after a week's stay, during which they enjoyed perfect weather, and sang as well as they always do in March.

The place of the Goldcrests was taken by their cousins, the Firecrests, a change for the better in my eyes, as I had everything to learn about Firecrests. Though a rather silent bird, in the autumn, the Firecrest engaged on domestic business keeps up a perfect buzz of twittering conversation, even when his mouth is full of moss for the nest. He can hardly be said to be gifted with a proper song, like a Goldcrest; he just babbles happily and incessantly, and has no objection to human beings standing within a few feet of him. He is rather longer than, but not quite so chubby as a Goldcrest. The nest looks exactly like a Goldcrest's, and is hung in the same way to the lower side of a fir bough. I saw the skeleton of one nest a few hours after the birds began to build, and it looked like a spider's web in the shape of the nest. The garden of the offices of the League of Nations boasts about three fir trees, and, in consequence, a pair of Firecrests. They were not, however, the only occupants: Great Tits nested in a hole in the wall; Blue Tits, Redstarts, Goldfinches, Chaffinches, Greenfinches, Blackbirds, Blackcaps, Magpies, Nuthatches, Swifts, all lived within its narrow limits, apart from stray visitors. From its windows, almost every day in the spring, Black Kites could be seen slowly beating up and down the lake, looking for dead fish, of which there were plenty after a storm. Some Marsh-Harriers also appeared, but there were no signs that they nested in the district.

The Willow-wrens arrived remarkably late and were never numerous. One was seen in a mountain valley on April 14th, and a few appeared at Geneva at the end of the month, but there were always more in the mountains than on the plain.

All the other British Warblers except the Dartford- and the Sedge-Warbler were seen, but the Lesser Whitethroat was only noticed twice, and did not seem to remain in the country at all. Great Reed-Warblers and Marsh-Warblers were common in suitable country, and there was a fair sprinkling of Icterines, but they were much more local than in Northern France. They were about the last warblers to appear, the first being seen on May 6th, wandering about aimlessly, without any fixed place of abode. A pair of Icterines near my house persuaded me that they had built a nest in a particularly prickly hedge, and several early mornings were spent in transferring thorns from their proper places to my body before any sign of a nest was found. At the end of the week two or three bits of grass which I could not remember to have seen before were noticed in a low fork. Next day the nest was almost complete, and could be seen from the lane without even entering the thicket. I had been right about the position but a week wrong in the date. This incident is given as a warning against paying too much attention to the excited call-note of the Icterine; it is sometimes made too soon, before there is any just cause for anxiety. The Icterine is the comic artist among warblers, and it is our misfortune that he never crosses the Channel. His song is a series of musical howlers, with an occasional fine note thrown in as it were by mistake. He always seems to be trying to make his audience either laugh or jump. You never know what noise is coming next: a nasal twang, a mysterious whisper, a patter of notes reeled off as if by heart, a fine flute-like whistle ending in an atrocious squeak.

The first cock Golden Oriole appeared on May 3rd, and my particular pet bird about a week later. I had taken a house and garden near Geneva on the strength of a report that Orioles nested there, and was therefore quite as disappointed as the bird himself at the non-arrival of a hen. Anxious days followed of waiting and whistling (we both whistled) for the lady who would not come. Ought I to have repaired the tennis court? Should the gardener have been confined to the conservatory? At least one other Oriole had nested; was there anything

wrong? As a matter of fact she was merely being fashionably (a fortnight) late, and when she did come she was not alone. At six o'clock one morning the cock was particularly noisy and attracted me out of the house and down to an open park, where he took up his position in a solitary tree bare of leaves, and opened his throat to the full. I was enjoying him through the telescope when the cat-like call of the hen Oriole sounded in the garden beyond him, and two of these birds flew out to perch on the bough below the cock. He whistled on in pretended ignorance, but there was no unnecessary coyness or hesitation on their part. They flew straight up to him in the most brazen-faced manner and proposed simultaneously. An exciting chase followed, over, under, and round a yew bush, the three birds whistling and calling continuously. I had to go to my work before seeing the end of the affair, but next morning my bird had settled down to a respectable married life in my garden, and the other hen had no doubt consoled herself without much trouble. I could have told her where to go. The frequent journeys of the bird to an oak tree shading the tennis court gave all the general information required, and a place from which operations could be watched was found. No nest was visible, for only the most preliminary work had been begun. The hen brought small portions of some teased-out grey material which looked like either wool or lichen, and proceeded to wind it carefully with her bill round two small branches which formed a fork on the very top of the tree. The cock followed and whistled encouragement and advice to her wherever she went, without, however, doing any work himself. The greatest care was taken to ensure that each branch received an equal amount of material. Drawing back from her work to get a better view, the hen would often remove some material from one branch and transfer it to the other. It was quite impossible to reach the nest, and I therefore never discovered exactly what this material was. The complete nest is a hollow ball made of long, narrow cords of bark, each cord being attached by both ends to the forked branches from which the structure hangs. The object of the preliminary stage of

winding material round the branches from which the nest is to be suspended is probably to prevent the slipping and fraying of the cord. In a high wind the nest swayed dangerously, and the strain must have been very severe. Unfortunately, I had to leave the garden before the first knot was tied, and when I returned, the outside structure was finished, though the lining of the nest entailed several more days' work.

Orioles will attack marauding birds round their nest with great boldness. I saw one terrify a Carrion Crow, and another chase an inoffensive Woodpigeon across several fields. The cock occasionally took turns at sitting on the eggs, which must have been appreciated by the hen, for, owing to the depth and small circumference of the nest, the head and tail are held at an angle which must surely produce stiffness, if not cramp.

A Starling which lived between two pairs of these birds completely took me in for several days by his imitation both of the whistle of the cock and the cat-call of the hen Oriole. He finally gave himself away by mixing up his proper noises with those of his betters, after which I stood under his tree and watched him at the whole performance. The Orioles probably lost their tempers with him in the end, for a day or two later he had disappeared, or at any rate lapsed into silence.

The habit of nesting immediately upon the arrival of the hen was not confined to Orioles. The Nightingales, very common birds round and even in Geneva, had to wait a fortnight for their mates. The arrival of the hens was obvious from their croaks, and also from the altered song of the cock, several variations being added, and more frequent intervals introduced into the song. I was away from April 8th to 11th, and in that interval my three cock Nightingales had all secured hens. Two began to build on the 11th, and the third on the 12th. At 11 a.m. on the 15th the three nests contained respectively three, two, and one eggs, a good performance immediately after a journey of many hundred miles.

The number of Redstarts both Common and Black is astonishing in Switzerland. The Black Redstart is really a bird of the mountain villages, but some of them remain in the plains and

live side by side with their black, and, if I may say so, more amusing cousins.

Geneva is a great place for Finches; Chaffinches, Greenfinches, Goldfinches, Bullfinches, Hawfinches. The last two move up into the mountains to breed, and their place is taken in the spring by the Serins, jolly little birds, with a very high trilling song.

The cock Serin, when courting, makes the most of his very minute form. He sits on the top-most twig of a tree, or, if he can find one, on a telegraph wire, puffs out his throat, cocks his tail, drops his wings, and keeps a continuous quivering movement of his body. He gives the impression of a self-conscious singer with a poor voice. Now and then he makes a heavy, slow flight to another perch, quivering all the time and looking twice his natural size. Although the birds are very common, the only nest found was high up in a thick fir bough impossible to reach, and that was not discovered until the end of June. A bird which the Englishman misses at Geneva is the Thrush. A single individual rested for a day in the spring, but in Switzerland Song-Thrushes keep strictly to the lower wooded slopes of the mountains, which they share with the Missel-Thrushes, Pied Flycatchers, Crested Tits, Tree Pipits, Woodwrens, and other warblers.

Protection is well organised. There are heavy penalties for the taking of eggs and the destruction of birds, and if the cats were fed instead of being made to search all day for their own living in the fields, the birds would have little to fear in the nesting season. The fact that nearly all shooting is free and that licenses are comparatively cheap, accounts for the great scarcity of game birds and game of any kind.

No attempt has been made to touch upon the birds of the mountain region, but a country like Switzerland, in which it is easy in a single day to visit all the various types of country, from marsh and cultivated plain through forest slopes to the open mountain region, is a paradise in spring for anyone who has an ear and an eye for birds.

IV.

THE TERN COLONY ON BLAKENEY POINT *

BY KATHARINE M. WATSON, D.Sc.,

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In the summer of 1913 and 1914 a series of observations on the nests and eggs of the birds which breed on Blakeney Point was carried out by Mr. William Rowan. Particular attention was given to the common terns, which form so large a part of the avine population of the Point in the summer, and all the available eggs of these birds were carefully measured and the colour and type of mottling recorded. The results of these observations have been published; the more general ones by Mr. Rowan,† while the more detailed measurements of the terns' eggs were handed over to Professor Karl Pearson, of the Galton Laboratory. After undergoing mathematical treatment these observations were published in "Biometrika."‡ In 1920 it was possible to undertake again the measurement of the terns' eggs, and a party of four field workers§ spent the period from June 14th to July 1st on Blakeney Point for that purpose. The detailed observations are again being utilised by the Galton Laboratory and the object of the present article is simply to give a general account of the methods of work and some of the observations made.

We wish to make clear from the outset that no one of this group of field workers can lay any claim to being an ornitholo-

* Blakeney Point Publication, No. 19.

† Some Observations on a Tern Colony, by Wm. Rowan, "Knowledge," Vol. XXXVII., No. 547, pp. 52—54, Feb., 1914.

The Blakeney Point Ternery, by Wm. Rowan; British Birds, vol. viii., pp. 250—266, 1915.

‡ 1. On Homotyposis and allied characters in the eggs of the common tern." "Biometrika," Vol. X., No. 1, April, 1914.

2. On the nest and eggs of the common tern, a co-operative study. "Biometrika," Vol. XII., Nos. 3 and 4, Nov., 1919.

§ The field workers were Miss Noel Karn, Miss Helga Pearson, Prof. D. M. S. Watson, and the writer. Suggestions made by each of the first three have been incorporated in this article, and all are in agreement on the general results.

gist, in fact we were dependent on Mr. R. J. Pinchen, the Bird-watcher on the Point, for the identification of most of the birds we saw and heard. The writer had indeed assisted Mr. Rowan in 1913, when the first census of terns' eggs was made, but apart from this none of us had done similar work before.

Our general method of work was as follows. In accordance with the advice of Professor F. W. Oliver we worked for only two hours at a stretch, and found that our accuracy fell off if we worked longer. Moreover, we found two such periods per day as much as we could do in addition to the duties of the camp, which were shared. We worked in two couples, keeping the same partners throughout the visit; each couple would select a small area and explore it thoroughly. On finding a nest we sat down beside it, and one partner did all the measuring for that nest, the other partner recording; but both gave an opinion in matters not susceptible of mathematical determination, e.g., colours of eggs. After we had measured an egg, we painted a number (applying to all the eggs of that clutch) and a letter (applying to the individual egg) on it in fixed Indian ink. This mark of identification was not removed by weathering, and appeared to have no adverse effect on the chicks! The measurements made for each egg were as follows—greatest length and greatest breadth (taken with calipers): longitudinal and transverse girths (found by wrapping a narrow strip of paper round the egg, first lengthwise, and then round its equator, marking it and measuring it when extended). Further records were made of the ground colour and type of mottling of each egg, and of the type of nest and the general colour of the surroundings. The last two items were accorded a short verbal description, but, in order to facilitate classification, scales were designed to include the different types of ground colour and mottling (see Fig. 1). The eggs of the Common Tern vary in colour from a beautiful shade of green to a distinct brown, with every possible intermediate between these two extremes. We accordingly constructed our colour scale on the following method: A two-and-a-half inch square of white paper was divided into half-inch squares. Two colours, one

representing as closely as possible the lightest tint of the brown type of egg, the other the lightest tint of the green type of egg, were prepared. One line of squares (Fig. 1—the lowest line) was left blank, and the brown colour was washed over the remaining squares once. This wash was allowed to dry, and the green was applied to all the squares except those of the left-hand vertical line (O—D). One square (O) was thus left white (see Fig. 1), one line, A, B, C, D were “pure” brown; another line, 1, 2, 3, 4, were “pure” green; the rest were mixed. The green wash having dried, another coat of brown was applied to the three rows of squares furthest from the brown row (rows 2, 3, 4). This process was carried out

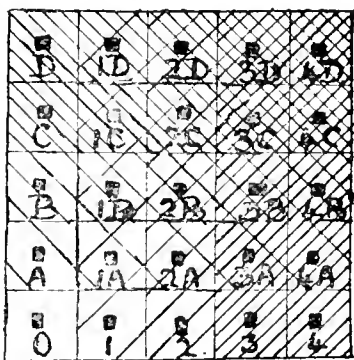


Fig. 1.—Diagram of colour scale before application of last wash.

1—4. Shades of green. A—D. Shades of brown.

The density is represented by the proximity of the oblique lines.

so that eventually we had four shades of “pure” green (1 to 4), four of “pure” brown (A to D), and sixteen squares of mixed colour containing all the possible combinations of the four green and the four brown shades. A small square hole was cut in each individual square (shown black in Fig. 1), so that the eggs could be held behind the paper for purposes of comparison. By this method we obtained a colour scale into which all the normal eggs fitted with a fair degree of accuracy, but the scale would have been improved had we extended the pure brown and pure green lines (particularly the brown) so as to obtain a darker shade of brown and of green, without mixture. The need for this is evident from notes on the colour of an egg, such as “D, but much darker,” and “4D, but much browner.”

The method by which the type of mottling was determined was as follows:—Two main factors were observed to be concerned, viz., (1) The size of the markings, (2) Their distribution. (It was not found possible to estimate the amount of mottling relative to the surface of the egg except in the way of noting exceptionally densely or sparsely mottled eggs.) Two series of types were accordingly made (Fig. 1, A—H), one for coarse, the other for fine markings, each series containing four types of distribution, viz.:—(1) Distribution even; (2)

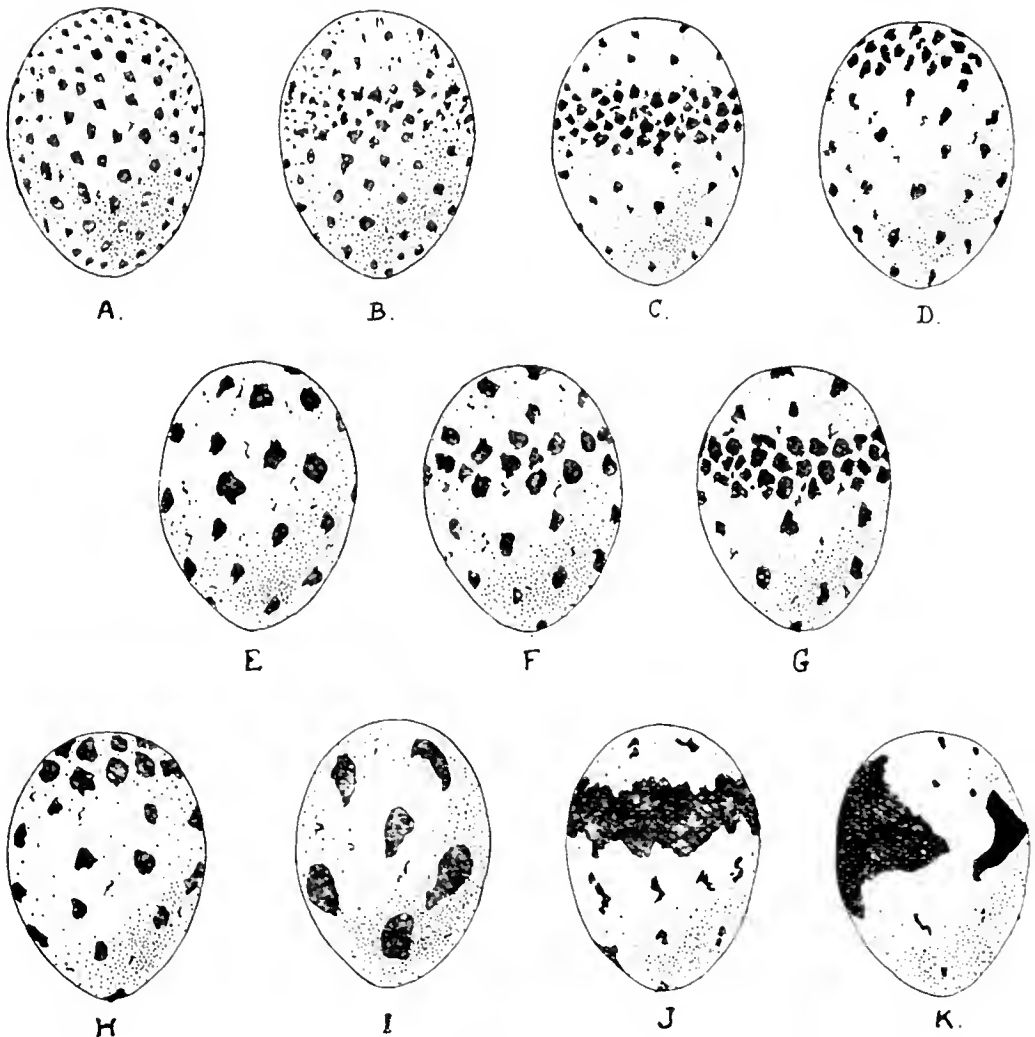


Fig. 2. Mottling and colour scales.

- A—D Fine markings.
 E—H Coarse markings.
 A and E Distribution even.
 B and F Slight concentration at equator.
 C and G Marked concentration at equator.
 D and H Concentration at one pole.
 I Few, coarse blotches, irregularly distributed.
 J Dense equatorial belt.
 K Very few, large blotches.

Slight concentration in a belt ; (3) Marked concentration in a belt ; (4) Concentration at the pole. In addition to the eight types thus defined, three rather aberrant types (Fig. 1, I—K) were found and put in the scale, viz. :—(1) Few coarse blotches, irregularly distributed ; (2) A dense continuous (or almost continuous) belt with few markings elsewhere ; (3) Very few, very large blotches. In practice we found the greatest difficulty in deciding whether the markings on an egg were to be regarded as fine or coarse, as the two types grade into each other so completely. Furthermore, the so-called equatorial belt may occur at almost any height on the egg, and a series of types based on the position of the belt could be made.

The colour of the dark spots which form the mottling is generally some shade of brown. Three types of markings seem to occur :—(1) not very dark, greyish-brown splashes, usually of medium size, which appear to be buried in the substance of the egg shell. The colour of these marks becomes lighter towards their margins. (2) Dark brown spots which lie on the surface and have sharply-defined margins. These form the bulk of the mottling of most eggs. (3) Very small, absolutely black spots, seen only very rarely.

We recorded 412 nests, containing over 900 eggs. When we arrived on June 14th a number of chicks had already hatched out, and many of the remaining eggs were already cracking. We frequently listened to the chick chirping inside an egg while we were measuring it. About June 20th the birds started laying again, so that we were able to measure some eggs of the second period ; but the birds were still laying when we left on July 1st. The majority of the nests were in the neighbourhood of the tern dunes (see Fig. 3), some actually amongst the embryo dunes, many on the shingle immediately to seaward of these dunes, and a fair number in Great Sandy Low. Another large group of nests was situated on the new shingle beach— isolated nests being found on most of the minor spits, a good number on the large far point (see Fig. 3), and a few scattered all along the ridge joining this beach to the shingle ridge in front of the tern dunes. A small colony of nests was found





FIG. 4
The Bird on the
Nest



FIG. 5
Nest, Type 1



FIG. 7
Nest, Type 3

at the foot of the Beacon hills on the seaward side, about level with the Lifeboat house. Two or three nests were found on the lower slopes of the dunes (facing S.E.) adjoining the Pelvetia marsh, two in the east end of Glaux Low, and several on the fairly high dunes on the seaward side of Glaux Low at its point of junction with Great Sandy Low. A number of the nests in Great Sandy Low and amongst the tern dunes were robbed by rats, and according to Pinchen this caused the birds to start laying again. Much to his regret the terns repeated their original indiscretion of laying near the dunes, and in some cases we saw

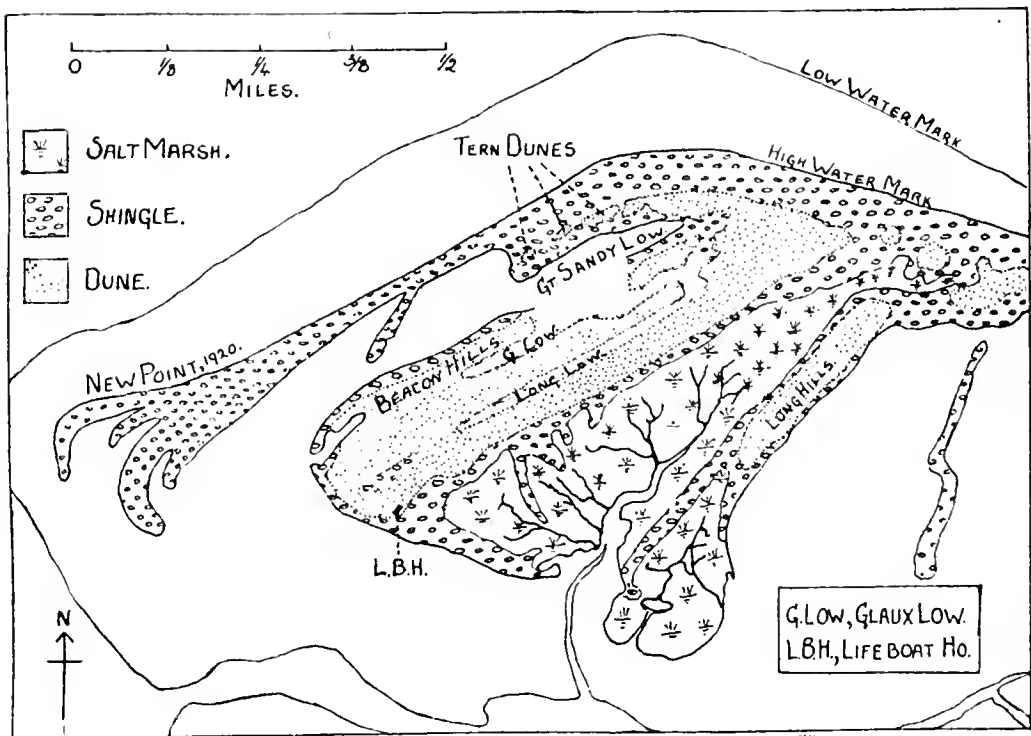


Fig. 3.—Map of Blakeney Point.

[Drawn by D.M.S.W.]

the second nests emptied by rats. The second laying gave us the opportunity of collecting some data as to the laying habits of the tern and the method of nest building, as we were able to watch individual nests from day to day, and in this way we obtained some information to supplement the observations of Mr. Rowan on this subject. To this subject reference will be made later.

The eggs varied in length from 3.70 cms. to 4.68 cms., and in breadth from 2.69 cms. to 3.28 cms.

As regards colour, we found a few eggs which would not fit into our scale. The most striking of these were blue eggs. One nest was found in Great Sandy Low containing three pale grey-blue eggs with dark brown markings. In addition to this nest several odd blue eggs were found in nests with eggs of another colour. The following descriptions relate to some of the more striking of these nests: Nest 176 (egg a) Gd. col. 3, (egg b), pale blue with a few faint coarse markings. Nest 325 (egg a) 3, but brighter, (egg b) light blue. Nest 326 (egg a) 3, (egg b) bright blue, mottling all over but concentrating on top and very fine. Nest 342 (egg a) about density of 2, but perfectly blue, (egg b) 2. Of these nests No. 176 was situated on the drift-line on the new Point, 325 and 326 on shingle. 342 and 91 (which contained two bluish eggs) were on the shingle near the tern dunes. A number of eggs were found which were too yellow, others too grey, to fit accurately into our scale. An interesting case was shown in nest 197, which contained two eggs of different colours, viz., (a) 4D, (b) 2B, but both eggs were marked with slight ridges running round the eggs horizontally. This was the only case in which such markings were seen, and it may therefore be taken as certain that these eggs were both laid by the same bird. We noted that the eggs when first laid had a peculiar brightness; in several cases when we observed nests for a second time some days after making our original notes we found that the colour had faded perceptibly.

The common tern shows a remarkable degree of variation in the construction of its nest. The accompanying figures (figs. 5 to 8), the blocks of which (made from photos by Mr. Rowan) have been kindly lent by the Editor of "Knowledge," show several types. Some of the nests are simple holes scraped in the ground (Fig 6); indeed, occasionally the eggs are found deposited flat on the sand or shingle, without any protection (Fig 5). On the other hand some of the birds build excellent nests such as that shown in Fig. 7. Between these extremes every intermediate condition was found. We noticed considerable variation in the materials used for building nests (Fig. 8). A few were made exclusively out of shells; dried star-

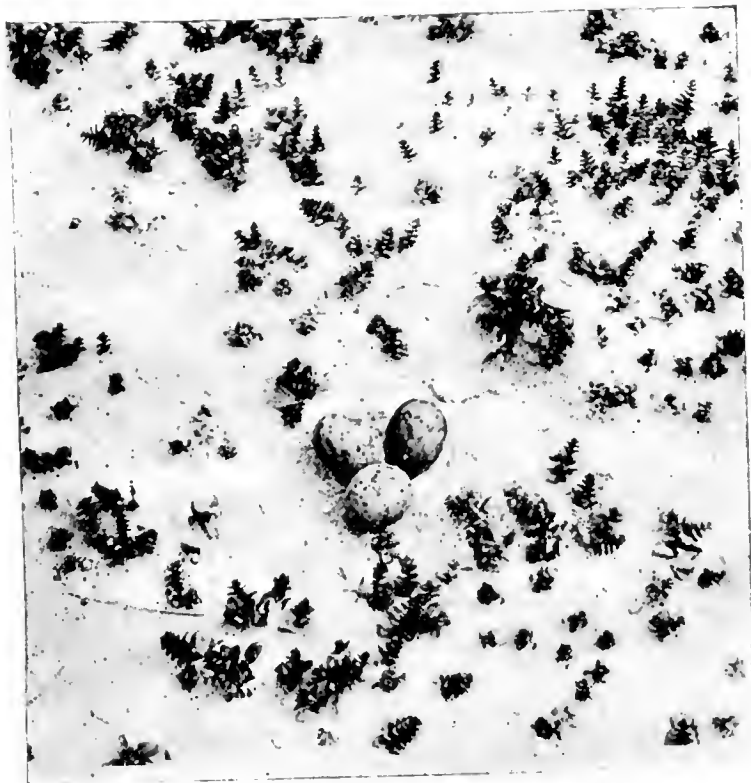


FIG. 6
Nest, Type 2.



FIG. 8
Nest of Wood Chips
and Shells



fish, cast crab shells, parts of the skeletons of birds, and a small dried cuttle-fish were amongst the curiosities found in nests. One bird, with a taste that appeared to us morbid, had actually collected two skeleton legs and used them as building material. Dried *Psamma* and fine twigs were the most popular nesting materials. In several cases we saw that additions were made to a nest after the first egg had been laid, e.g., nest 24 when first observed on June 16th at the latest had "one piece of *Psamma*, one stick, and one or two short sparse tufts of grass." Later on, June 27th, it had become "a very well-made nest; lots of *Psamma*, sticks, and straws circularly arranged and padding nest well; a long feather, several small chips of wood, and a small chunk of drift." Two eggs had been laid in the interval. Our observations went to show that the type of nest built depended mainly on the availability of material. Thus the nests on the New Point, where materials were scarce, mostly contained only a few chips; whereas the nests near the dunes, where materials were abundant, were often most elaborate; whilst the nests actually in the lows and on the dunes were made for the most part of *Psamma*, which grows freely in those localities.

With regard to the number of eggs in the clutches, we were all of opinion that a genuine one-egg clutch occurs seldom, if ever. In most cases in which we found only one egg in a nest, it was either the last egg to hatch and we found chicks in or near the nest, or it was the first egg laid, or the other eggs had been stolen, or it was an addled and deserted egg. A certain number of genuine two-egg clutches do occur, but the number of these is smaller than our records imply, because many apparent two-egg clutches are produced in the same way as the apparent one-egg clutches. The majority of the nests certainly originally contained three eggs, the normal clutch for the common tern. One nest was found with four eggs in it, but one of these was addled and broken. A few days later the nest was revisited; a fifth egg had been laid and the broken one had been ejected. We concluded that a bird had started laying again in an old nest and that eggs a and b, which resembled each other, belonged to an old clutch, whilst c, d, and e were probably new.

We were fortunate in being able to make some accurate observations on the intervals between the laying of the first, second, and third eggs of the common tern. Mr. Rowan stated in his (MS.) Blakeney Report for 1914 that the bird which he photographed laid her eggs on three successive days. She appears to have been somewhat exceptional in this, as the laying period in most of the cases which we noted this year appeared to be longer. On June 21st, when going round Great Sandy Low, Miss Karn and the writer found several nests with only one egg which appeared to us to be new laid. We made special notes of these nests, and from that day until June 27th we went round Great Sandy Low every afternoon, noting eggs and nests. We also made similar records of some nests on the New Point.

Although we went over the areas in which the birds were nesting very carefully, we often found that we had missed nests completely, so that it is only in one or two cases that we feel convinced that a nest was new on the date on which we first found it. When we had spotted a new nest, however, we always marked it in some way, so that our records for the second and third eggs are fairly accurate. As a rule we did not visit the nests more than once a day, though on one occasion we went at 10 p.m. as well as at 3 p.m. The following are records of nests observed in this way:—

145	June 22nd	a.
	„ 23rd	a only.
	„ 24th	a and b.
	„ 25th	a and b.
	„ 26th	a, b, and c.
169	June 21st	a
	„ 22nd	a and b.
	„ 23rd	a and b.
	„ 24th	a, b, and c.
77	June 21st	a.
	„ 22nd	a and b.
	„ 23rd	a and b.
	„ 24th	a, b, and c.

186	June 22nd	a.
	„ 23rd	a.
	„ 24th	a and b. No third egg laid by June 27th
153	June 21st	a and b.
	„ 22nd	a, b, and c.
168	June 21st	a only at 3.30 p.m. a and b at 10 p.m. No 3rd egg laid.
304	June 25th	a only.
	„ 26th	a and b.
301	June 25th	a.
	„ 26th	a and b.
184	June 23rd	a.
	„ 24th	Not examined.
	„ 25th	a, b, and c.
305	„ 25th	a.
	„ 27th	a and b.
291	June 25th	a.
	„ 26th	a and b.
	„ 27th	a and b.
	„ 28th	a, b, and c.

Nests 301 and 304 were almost certainly new on the days on which they were first recorded, for in one case Pinchen, and in the other we, had been over the ground very carefully on the previous day. In each of these cases, then, the bird appears to have laid an egg on two consecutive days. The only case in which a bird might have laid an egg on three consecutive days was that of nest 184, in which one egg was found on June 23rd and three eggs on June 25th. Even this may not be a genuine case, for there is no proof that the nest was new on June 23rd. It seems probable, then, that the laying period generally extends over four or five days.

The mortality amongst the young chicks appeared to be fairly high. A good number of birds die whilst they are trying to get out of the egg, so that many were found chipped and with the beak of a dead bird protruding. A good many, both eggs and small chicks, fall victims to the rats, in spite of Pinchen's untiring efforts to protect them. Gulls destroy a

certain number of eggs. The cause of death in so many small chicks was not at all evident, but certainly only quite a small percentage of the eggs laid ever produce mature birds.

With regard to nests of birds other than the Common Tern, only general observations were made. There were a good many Lesser Terns' nests, mostly on the fine shingle, and all unmade. In 1920, for the first time for many years, two clutches of Sandwich Terns' eggs were found on the Point. Pinchen told us that he had seen a pair of these birds, and we found one clutch of three eggs on the drift line on the far side of the new Point. One was washed out of the nest, and they were obviously deserted. Later we found one egg not far from the place where we had found the three. As this was not obviously deserted we left it, but the bird did not appear to be sitting, and no second egg was laid before we left.

The nests of the ringed plover were numerous, and several times while we were at work we had the good fortune to see a ringed plover do the broken wing trick to perfection.

The Terns showed themselves as fearless as ever, sitting on their nests or feeding their chicks within a few yards of us when we were at work. We learned to recognise some individual birds by their peculiar ferocity, and for the first time in our records several birds did actually attack the workers, each of whom was at some time pecked on the head! On one occasion two of us happened to get a full view of the tern colony on the far beach mobbing a gull, and it soon became evident that if the birds choose to co-operate in attacking a human being as they do in ejecting an intruding gull, we should soon be driven off the ground. Another instance of the value of co-operation was seen when several enterprising babies took it into their heads to swim out to sea. A group of old birds by their united efforts succeeded in chivying them back to safety on the shore. The greater part of the time, however, the birds seemed to be as intolerant of each other as they were of us, their constant calling being generally intermingled with the yet more raucous sounds of squabbling. To us the unmusical voice of the Common Tern still summons up memories of Blakeney

Point with its sun and wind, of the whiteness of the dunes and the blue sea and sky, of the shingle ridge shimmering in the heat, and of the sunburn and healthy appetites which few places can produce in such perfection.

Explanation of Figures 4—8 on Plate (from photos by Mr. Wm. Rowan, reproduced by the courtesy of the Editor of "Knowledge.")

Fig. 4. The Common Tern on its nest.

Fig. 5. Egg laid on shingle.

Fig. 6. Nest consisting of small hole in sand, no materials used.

Fig. 7. Nest built of *Psamma* amid patches of *Arenaria peploides*.

Fig. 8. Nest built of chips of wood and shells.

V.

NORFOLK TOPOGRAPHY IN "THE BOTANIST'S
GUIDE"

BY W. G. CLARKE, F.G.S.

Read November 30th, 1920

"The Botanist's Guide through England and Wales" (London, 2 vols., 1805, was edited by Dawson Turner, F.R.S., botanist and antiquary, who was born at Yarmouth in 1775, and educated partly at North Walsham and partly at Barton Bendish. He had as collaborator L. W. Dillwyn, F.R.S., F.L.S. The fact that Norfolk records occupy 40 pages compared with 19 for those of Surrey is therefore understandable. Much information concerning the contributors of these records has been given by Miss Geldart in her Presidential Address on "Sir J. E. Smith and some of his friends."*

The flowering plants and ferns recorded for Norfolk number 261, the mosses and hepatics 23, the lichens 46, and algæ 59.

Of the various localities given, the majority deal with the parish or town, and therefore lack sufficient detail to enable the exact site to be identified. While these are of value to the topographical botanist, as indicating places where plants were,

*Trans. Norf. & Nor. Nat. Soc., vol. ix., p. 645.

and still are, found, and others where they do not now occur, the main interest of the list is in the identification of definite localities. It is, however, of little advantage to know that *Erodium moschatum** was discovered "in the hedge of a field by a footpath into Cromer," that *Melampyrum arvense* occurred "In the corn on the right hand just before you come to Lycham," or that *Galium anglicum* was found "on a wall between Fincham and Lynn."

• Many of the others disclose changes in the topography of the county, the methods of agriculture, and the effects of drainage, and are therefore worthy of more detailed consideration. Obsolete spellings of place-names are found in Babergh, Berg Apton, Braydon, Brook, Broom, Brundle, Costesey, Fornets, Franze rivulet, Haddisco, Haddisco Thorp, Hellsdon, Lycham, Moundford, Moushold, Ranaugh, Rowton, Salehouse, Skoulton, Staninghall, Trigby, Wesenham, Weyborn, Woodbastick, Woolverton, and Wrongay.

Enclosure has affected the topography of the county in many ways. Fens and marshes have been drained; heaths and commons brought under cultivation; and the great open fields divided by turf balks, cut up into small enclosures bounded by hedges. Even in 1787 Marshall in his "Rural Economy of Norfolk" said that "The enclosures are in general small, and the hedges high and full of trees. This has a singular effect in travelling through the country; the eye seems ever on the verge of a forest, which is, as it were by enchantment, continually changing into inclosures and hedgerows. There is not, generally speaking, a piece of woodland in the whole district (North-east Norfolk), and even plantations are thinly and partially scattered."

Eight commons are mentioned in the "Botanist's Guide," and all have been enclosed. Costesey, for which *Gentiana campestris* and *Polygonum minus* were recorded, was not enclosed until 1857. *Mentha Pulegium* was found on Ditchingham Common, marked near the river Waveney, south of

*The nomenclature throughout has been brought into accordance with that of the 10th edition of the "London Catalogue."

Broome in 1797, and enclosed in 1812, and *Radicula sylvestris* on Earsham Common, which was "near the bridge at Bungay," and was also enclosed in 1812. For Filby Common, which was east of the village and was enclosed in 1802, *Pilularia globulifera* was noted. *Taraxacum palustre* was found on the Lower Common at Heydon, perhaps that mentioned in the time of Elizabeth as "the common from Blakebrigge (Cawston) towards Heydon, north, eight score acres set out by marks and crosses," though there was a Heydon Common west of the Hall in 1797. Hoveton Common, which was west of Burntfen Broad, and was enclosed in 1819, yielded *Cicuta virosa* and *Stratiotes Aloides*, the latter "in great abundance." For Rollesby Common, which was east of the Broad in 1797, and was enclosed in 1813, *Hieracium umbellatum* was recorded, and for Scoulton Common, east of the Mere on the way to Hingham in 1797, and enclosed in 1803, *Mentha aquatica* a. *hirsuta*.

The arable common fields which were almost universal in Norfolk until the middle of the 18th century, have vanished and left few traces. There are still half-year lands with turf balks at Runton, and fields similarly divided at Hapton, Tacolnstone, and Tivetshall, but otherwise there is little existing evidence of the open-field system. The change must have injuriously affected certain species of plants which flourished on the turf balks, and have favoured those of the hedgerows. The "Botanist's Guide" mentions *Apera Spica-venti* in Gayton Field which was enclosed in 1810 but marked north-east of the village in 1824; *Linum angustifolium* in Gunton Fields; *Apera Spica-venti* in Witton Field, enclosed in 1812; and *Melampyrum arvense* "in the common field at Sporle, especially among wheat." This was enclosed in 1804. *Panicum lineare* was recorded for "sandy fields between Brandon and Moundford," evidence that intermittent cultivation was then, as now, possible on these barren heathlands. "Mundford Field" was in 1826 south of the village and west of the road from Brandon. *Salvia pratensis* recorded in Camden for Horsford Meadow, was probably found in the common

pasture. *Orobanche ramosa* found in a hemp-field at Brome, makes mention of a crop now rarely cultivated.

The heaths also serve to indicate some of the results of enclosure. Cawston Heath, for which *Tillæa muscosa* and *Malaxis paludosa* were noted, and Drayton Heath for which the former plant was recorded, still remain, though restricted in area. For Filby Heath, which was enclosed in 1802, and appears to have been land slightly above the water-level adjoining the Broad, *Centunculus minimus* was noted "very near the water," and *Polygonum minus*, *Alisma ranunculoides*, and *Carex binervis* for the same locality. *Pilularia globulifera* was recorded for Hainford Heath, which in 1797 was east of and adjoining the road from Norwich to Aylsham, but this was enclosed in 1802 and is now cultivated. There is, even now, plenty of heathland "between Hillington and Houghton," for which Gough's Camden recorded *Verbascum Lychnitis*; but Dawson Turner was probably correct in suggesting that *V. pulverulentum* was intended. Leziat Heath (Warren in 1797) is still in existence, though *Gentiana Pneumonanthe* appears to have vanished. Mousehold Heath has, however, been greatly restricted in area. In 1739 Blomefield said: "Mousehold is a large heath now, but most of it was wood formerly, and is about 4 or 5 miles in length and breadth," that is, it covered an area of between 16 and 25 miles. As recently as 1797 it extended to Salhouse and Woodbastwick, as the act for enclosing the northern part was not passed until 1801. This will explain the record in Gough's Camden of *Lycopodium inundatum* "by the spring on Mousehold." There are still moist places in various parts of the larger area which would then probably have fitted the description. *Trifolium glomeratum* was found "by Kett's Castle on Mousehold Heath." This was actually on the heath in 1803. It stood at the top of the hill opposite Bishop Bridge, and consisted of the ruins of St. Michael's Chapel, subsequently called "Kett's Castle" because Kett made it his residence during the rising associated with his name. Other records for Mousehold were *Tillæa muscosa* and *Botrychium Lunaria*, and a lichen "on Mousehold Heath

towards Rackheath." *Thlaspi arvense* was found "on the shooting-ground, Norwich," apparently that part of Mousehold Heath on which the barracks and prison now stand, marked as "Shooter's Hill" on Faden's map in 1797. Poringland Heath has quite gone, though in 1797 it covered all the high ground in the parish. For this were recorded *Chrysosplenium alternifolium*, *Alisma ranunculoides*, *Scirpus pauciflorus*, and *Carex binervis*, so that it was obviously a wet heath which has changed greatly since these plants were found. It was enclosed in 1800. For Rollesby Heath, which was enclosed in 1813, *Gentiana Pneumonanthe* and *Alisma ranunculoides* were recorded. Like Filby it appears to have adjoined the Broads, and neither was marked in 1826 when Ormesby Heath occupied a large area to the east. *Centunculus minimus* was plentiful on South Wootton Heath (described as Warren in 1797), of which South Wootton Common is a portion remaining. Stratton Heath on which *Antennaria dioica*, *Gentiana Pneumonanthe*, *G. campestris*, and *Botrychium Lunaria* were found, was marked in 1826 on each side of the road from Stratton Strawless to Felthorpe, west of the Aylsham highway. *Dianthus deltoides* was recorded for Swaffham Heath by Barton Bendish; *Herniaria glabra* for Caldecote, near Swaffham Heath; *Gentiana Amarella* and *G. campestris* for Swaffham Heath near Beechamwell; and *Antennaria dioica* for Swaffham Heath. Both Caldecote and Barton Bendish are now four miles from the nearest part of Swaffham Heath. Both in 1797 and 1826 it only extended to the boundary of the parish beyond which to the west was Beechamwell Warren, and to the south-west Cley Field, Shingham Field, and Caldecote Field. When Swaffham was enclosed in 1868, 2,500 acres of heath and common, and 2,000 acres of half-year lands were allotted to various owners.

There are indications that the county is much better drained than in 1805, partly due to improvements in arterial drainage, and partly to the effects of enclosing and draining the fens. In the Waveney valley, for example, *Anthoceros punctatus* was recorded for Brome "on the borders between the high and

boggy ground"; *Drosera longifolia*, *Taraxacum palustre*, *Utricularia minor*, *Helleborine longifolia*, *Scirpus pauciflorus*, *Cladium mariscus*, *Carex Pseudo-Cyperus*, *Osmunda regalis*, and *Chara hispida* for Ellingham Fen; *Helleborine longifolia*, *Osmunda regalis*, and *Splachnum ampullaceum* for Geldeston Fen; and *Carex Pseudo-Cyperus* for Kirby Fen. The Act for enclosing Ellingham, Geldeston, and Kirby fens was passed in 1802, and as a result they were drained and converted into grazing marshes. Prior to this they were doubtless similar to Roydon Fen, for which *Drosera anglica*, *Utricularia minor*, *Liparis Læsellii*, *Helleborine longifolia*, and *Chara hispida* were recorded. This is still common fen containing about 44 acres. *Salix Croweana* (which Babington gives as a form of *S. phyllicifolia*) was noted from Cranberry Fen, East Winch. Bryant's map (1826) shows that this was at the south-west end of the parish, adjoining Blackborough Abbey and Carr. It was enclosed in 1815. *Malaxis paludosa* and *Rynchospora alba* were recorded for Felthorpe Bogs, which appear to have been on the banks of the small stream which rises in the parish and flows into the Bure between Belaugh and Wroxham. They now form part of Felthorpe Common, of which the shooting only is let, and the proceeds divided among those parishioners who have been resident three years, and whose rent does not exceed £5 per annum. *Pilularia globulifera* was found on the sides of turf pits in Horning Fen, for which *Lastrea Thelypteris* and *Osmunda regalis* were also recorded. In 1797 this extended along the north bank of the Bure from Hoveton Broad to Ant Mouth, but it was enclosed in 1807. *Carex lasiocarpa* was noted for Old Buckenham Fen, and *Potamogeton heterophyllus* was found in turf pits there. This now consists of 80 acres, where the poor have the rarely exercised right of turf cutting, and according to Morden's map (1695) surrounded "Ye Mere." The sides of turf pits at (Potter) Heigham was given as a locality for *Pilularia globulifera*. The enclosure here took place in 1801. Newton St. Faith's bogs (enclosed in 1800) were apparently a happy hunting-ground for local botanists but have evidently changed greatly. They formed part of the

area now known as Newton Common in Horsford. For these were recorded *Stellaria palustris*, *Drosera longifolia*, *Senecio palustris*, *Utricularia minor*, *Liparis Læsellii*, *Helleborine longifolia*, *Habenaria viridis*, *Sparganium affine*, *Alisma ranunculoides*, *Scirpus compressus*, *Cladium mariscus*, *Carex diandra*, *C. limosa*, *C. inflata*, *Lastrea Thelypteris*, *Equisetum hyemale*, *Pilularia globulifera*, and *Bryum dealbatum*. Shouldham Fen is given as a locality for *Drosera anglica* and *D. longifolia*, and has probably changed but little, as there is still a Mow Fen (marked as Turf Fen in 1834) west of Shouldham Warren. *Rhamnus catharticus* was noted for "boggy marshes at Surlingham," and in 1826 all the area between Surlingham Ferry and Coldham Hall was marked as "wet marsh." To a limited area the expression is still applicable, though here the vegetation has greatly encroached on the open water of Surlingham Broad. Wrongay Fen, for which *Salix nigricans* was recorded, perpetuates the Domesday Book nomenclature for Wormegay. An Exchequer Deposition in 1578 has references to Roughfien, Bushefen, and Hemp-pitts, and Wormegay Fen was between the village and the Nar in 1797.

The only references to moors are to *Salix triandra* on Badley Moor, East Dereham, now containing 26 acres, but much larger prior to the enclosure in 1815. For Dersingham Moor, *Oxycoccus quadripetala*, *Osmunda regalis*, and *Polytrichum strictum* were noted. In 1826 the area was known as Dersingham Common (enclosed in 1857), but the plants named undoubtedly grew in the swampy area at the western foot of the greensand ridge.

Most of the woods mentioned are shown on Bryant's map of Norfolk, 1826. The moss, *Phascum serratum*, was recorded for Acle Wood, another for "marshes near Acle Wood," and a lichen for "a barn door at Acle between the town and the wood." Richard II. granted to the inhabitants of Acle certain privileges, including "a turbary in the park of Acle."* There was a Special Exchequer Commission in 1581 as to the spoils of Her Majesty's Wood in Acle Wood, and an Exchequer Deposition

*Blomefield's Norfolk, Vol. xi., p. 93.

in 1605 as to taking oaks out of Acle Wood. Acle Wood and Little Wood were in 1826 two miles south of the village, east of the road to Moulton, where there is still a Wood Farm, though the wood itself has been destroyed. *Gnaphalium sylvaticum*, *Arnoseris minima*, *Veronica montana*, and *Equisetum hyemale* were recorded for Arminghall Wood, which was west of the church and was called Priest Wood in 1797. Its northern portion still remains. Dawson Turner quotes Gough's Camden as the authority for *Paris quadrifolia* in Blackwell and Pismill Woods, but these I have been unable to trace, though there was a Blackwall near Waxham. *Viola hirta* was recorded for a wood at Boughton, which still remains between the village and the fen, of approximately the same size as in 1826. *Paris quadrifolia* was found in Bedingham Wood, but this undoubtedly refers to Sexton Wood, which is on the Bedingham boundary, though in the parish of Hedenham. Hedenham Wood formerly occupied a considerable area north of the church, but the wood for which *Carex strigosa* was recorded was, according to Wigham in the "Norfolk Tour," Sexton Wood. Earsham Wood, for which *Ophrys muscifera* and *Calamagrostis epigeios* were recorded is not so easy to identify. "Earsham Woods" were to the east of the road to Hedenham in 1797, and in 1826 Holy Grove and Banters Wood were marked in the parish. *Campanula latifolia* was found in Forehoe Wood near Kimberley. This was each side of the main road from Norwich to Hingham in 1797, and Four Hill Wood adjoined the road on the south in 1826. *Calamagrostis canescens* was found in "Blake's Grove, near Gawdy Hall, Harleston," and *Neottia Nidus-avis* in Gawdy Hall Wood. The former is north-west of the Hall and the latter (now "Big Wood") south. For Hethel Wood, which was immediately east of Potash Farm, *Calamagrostis epigeios* was recorded, and *Geranium sylvaticum* for Holt Wood in Leziate. Holt or Holthouse was part of the parish (Blomefield, Vol. VIII., p. 337), and Holt Wood was on the south-western boundary of Leziate, adjoining Mintlyn, west of the present Holt House, which was formerly the property of James Crowe. "Prior's Wood between Downham and Lynn" is a somewhat

vague locality for *Geum rivale*. It probably formed part of the extensive area of woodland at Wallington-cum-Thorpland. *Paris quadrifolia* was recorded for Rackbeath Wood, which was north of the road from Norwich to Wroxham. *Lichen Turneri* was found in fruit by Dawson Turner at Stanninghall Wood, which seems identical with Broom Wood, through which the road from Norwich to Coltishall passes at 5 miles from the city. *Peucedanum palustre* was noted in a marsh adjoining Wayford Wood, at Stalham, which still remains north of Wayford Bridge, though greatly reduced in area. Woolverton Wood was a site for *Geum rivale*. This was south of Wolferton (marked Woolverton on the Ordnance Survey map of 1824) on the border of Babingley, and is still in existence. It was referred to as "Woolferton Wood" in the 16th century Household Accounts of the le Stranges of Hunstanton.*

Hills are not frequent in Norfolk topography, although *Campanula Rapunculus* was noted for the artificial hill at Old Buckenham Castle, and *Helleborus fœtidus* and *Calamintha Nepeta* "on the castle hill at Castleacre." *Lathyrus sylvestris* was found "on the brow of a hill on the south side of Brundall church"; *Thesium humifusum* and *Orchis ustulata* on Shouldham limekiln hill, which is east of Shouldham, where the road turns north to Marham; and *Narcissus poeticus* on Worstead Hills, probably Sandy Hill, between Worstead and North Walsham. *Anemone Pulsatilla* was recorded for the Tulip Hills near Lexham, a ridge of ground south-west of East Lexham; and *Trifolium scabrum*, *Vicia lathyroides*, and *Veronica verna* for Balking Hill, Harleston, a locality I have been unable to identify, unless (as seems likely) it is Beacon Hill, north of Shotford Bridge. For the Bath Hills, Ditchingham, the records were *Pyrus torminalis*, *Blackstonia perfoliata*, and *Iris fœtidissima*. In mediæval times part of the slope of the hills was the site of the Earl's Vineyard, and in 1275 40 gallons of home-grown wine from this spot were sold at 2½d. a gallon, and in 1278 16 gallons at 3d., the price indicating that the

* J. H. Gurney's "Early Annals of Ornithology," p. 139.

quality was little inferior to ordinary Bordeaux or Gascony.*

Norwich records show that the topography of the city has changed greatly since the publication of the "Botanist's Guide." A plan of Norwich in 1807 shows that there were very few houses outside the city walls where there was chiefly arable land. In 1818 the city area was reckoned "from Conisford Gate to Magdalen Gate and from Bishop's Gate to St. Benedict's." *Setaria verticillata* was then found on a "field out of St. Giles' Gates," *Camelina sativa* "out of St. Giles' Gates by the roadside," *Ranunculus parviflorus* "between St. Giles' and St. Stephen's Gates," *Cynoglossum montanum* "out of St. Benedict's Gates," and *Papaver hybridum* "Just out of St. Benedict's Gates." All these areas have now been built on. "Between Norwich and Heigham towards the river" was a site for *Peucedanum palustre*; "meadows between Norwich and Thorpe," and "osier ground at Thorpe" for *Geum rivale*; and "King Street Meadows" for *Cardamine amara* and *Salix purpurea*. The 1807 plan shows that most of the area between the city end of King Street and the river then consisted of meadows and gardens, and in 1779 part of the area was "My Lord's Gardens." *Holosteum umbellatum* was recorded for "wall in St. Faith's Lane," and *Teucrium Chamædris* "in profusion on the city walls between St. Magdalen's and St. Austin's gates." A lichen was recorded for "Mr. Crowe's plantations at Lakenham." James Crowe, as Miss Geldart has pointed out,† owned an extensive property at Lakenham, and lived there at Tuckswood House, in the garden of which he grew all the available species of willow.

The Yarmouth records chiefly specify the Denes, though "wet heaths about Yarmouth" are given for *Scirpus pauciflorus*, and "salt marshes round Yarmouth" for *Cochlearia officinalis* and *Alopecurus bulbosus*. H. Swinden's map of Yarmouth in 1779 showed that the town was then contained within the walls, between which and the sea on the east was a wide stretch of Denes with a number of windmills. In a

*Thorold Rogers' "History of Agriculture and Prices," vol. I., p. 29.

†Trans. Norf. and Nor. Nat. Soc., Vol. IX., p. 665.

charter granted by Edward I. it was stipulated "that they of Yarmouth shall not build but five windmills upon the Denes, and these mills shall be built to the least damage and nuisance of the Denes, and of those who shall dry their nets there." For the Denes a moss was recorded "in wet ground by the oil houses." These were low warehouses on the south side of Selby Road, and were erected by a company formed to carry on the whale fishery.* *Chenopodium Vulvaria* was noted "among the dung-hills on the Denes"; *Corynephorus canescens* was found "particularly by the South Battery." *Tillæa muscosa* was found "especially about the Whale's Jawbones," and *Ornithopus perpusillus* in the same locality. These jawbones stood on the South Denes, and are now in the Tollhouse Museum. They are illustrated in Palmer's "Perlustrations." *Frankenia lacvis* was recorded for "moist parts of Yarmouth Denes, near the Ferry, on the edges of ditches." This was probably the Lower Ferry.

Senecio palustris was recorded for "sides of Haddisco Dam," and *Stratiotes Aloides* for "ditch on the side of Haddisco Dam by the Turnpike Gate." The turnpike extended a distance of eight miles from St. Olave's bridge to the Beccles turnpike, and the gate was at the village end of the dam. Reedham Dam was given as a locality for *Chara hispida*. *Ranunculus Lingua*, *Stratiotes Aloides*, and *Scirpus triqueter* were said to have occurred on the "sides of Acle Dam," and *Stellaria uliginosa* in "ditches on Acle Dam." The record for *Scirpus* has, however, always been doubted. *Carum segetum* was found in a "hedge adjoining a public-house at Acle by the Dam." This might be either the "Angel" or the "Hermitage." An interesting record is associated with Acle Bridge. R. C. Taylor in his "Geology of East Norfolk" (1827) says that "the bridge called Weybrigg at Acle, and the great causeway connecting with it, were certainly in existence in the 11th century, and we find that payments were made towards their repair in 1101 and succeeding years." Sherard in Ray's "Synopsis Methodica Stirpium Britannicarum" (3rd ed., by J. J. Dillenius, 1724)

*Palmer's Perlustrations, Vol. III., p. 228.

recorded *Senecio palustris* as found "In the way from Norwich to Yarmouth a little before you come to Oakley Bridge," and in the British Museum Herbarium there is a specimen from "Near Oakley-bridge between Norwich and Yarmouth. August, 1725. Rev. J. Hemsted." Mr. Arthur Bennett says* "I have failed to find this on any Norfolk map, and no one seems to know of such a place in the county." He suggests it may have been Oakley in Suffolk—a roundabout route to get from Norwich to Yarmouth. The explanation is simple. In the Yarmouth Hutch Map Acle is spelt Ockley, as it is in H. Moll's map of Norfolk, 1724; while in Robert Morden's map 1695 it is marked Acle, als. Ockle. Blomefield derived the place-name from A-Clee or A-Cley, a place subject to inundations, and A-Clee is still a pronunciation common in the neighbourhood. Dawson Turner understood this, for in the "Botanist's Guide" Sherard's record for "Oakley Bridge" is given for Acle. *Myriophyllum verticillatum* was found in "ditches adjoining Acle bridge."

Among the varied localities given is "about the battery at Cromer" for *Medicago falcata*. A map of the town in 1747 shows a gun battery at the end of Jetty Street; but another was constructed during the Napoleonic wars, on a site thought by Mr. Walter Rye to be that of the present Coastguard Station. In 1799 the Cromer Volunteer Artillery practised from a "platform on the edge of the cliff." I have been unable to trace "Maplebush Lane at Gressenhall," which was a locality for *Melampyrum cristatum*. *Dianthus prolifer* was found "in a close on the bank side over against Hellsden Old Hall about half a mile out of St. Austin's Gates, Norwich." This was between the road to Drayton—close to the first mile stone—and the river Wensum. Between the Old Manor House and the river there are still traces of old buildings, probably the Hellesdon Hall begun by Augustine Somerton, who died in 1584.

"Brancaster very near the public-house" was a locality for *Succeda fruticosa*. On Faden's map (1797) this inn was marked

*Trans. Norf. & Nor. Nat. Soc., Vol. IX., p. 645.

as "Ship Ale-house," and still remains. *Utricularia minor* was found at Cawston Decoy, which the late Mr. T. Southwell said* was formerly in the Bluestone Plantation, but no records of it remain. It was not marked on any of the maps between 1797 and 1826, but there is still a pool at the spot. *Leonurus Cardiaca* was recorded "by the windmill at Wortwell," and *Arabis glabra* "in a hedge by the windmill at Wortwell." In Faden's map (1797) this windmill was marked east of Redenhall church at a spot still known as "Mill Hill." "Tunstead, in a pit near the public-house," was a locality given for *Mentha Pulegium*. The inn was probably the "Horse and Groom" near which there are still several pits. *Lathyrus Aphaca* was recorded "about a gravel-pit in the road from Norwich to Brooke," probably that at Poringland, and *Teesdalia nudicaulis* for Needham sandpit. *Ophrys muscifera* was noted on "the walks of the moat garden at Fincham" (a square moat south-west of the Hall), and *Mentha rotundifolia* on the "edge of an old moat at Shingham." For a lichen found at Toft, and another "on the pound at Toft," either Toftrees or Toft Monks is the locality. Both are equally likely, as in contemporary maps the former was always marked as "Toft Trees," and Toft Wood and Toft Farm were marked on the O.S. map of 1838.

Veronica triphyllos was recorded in Camden as "at Rowton between the town and the highway 12 miles before you come to Norwich." The highway was probably that from Aylsham to Cromer, a continuation of the turnpike from Norwich to Aylsham, but the distance from Norwich at Roughton would be 18 miles. The 12 miles alluded to are probably the "old British mile" mentioned in Harrison's "Description of Britain" (1577), and the equal of the Gallic *leuga* of 2,200 metres. On Morden's map of Norfolk (1695) the scale of miles is given in three forms marked "Great," "Middle," and "Small," representing the variations between statute and customary miles. Marshall's "Rural Economy of Norfolk," published in 1795, mentioned a Norfolk rod of seven yards. The "Norfolk Tour" (1808, p. 11) states that in the south aisle of St. Nicholas

*Trans. Norf. & Nor. Nat. Soc., Vol. II., p. 538.

Church, Great Yarmouth, there was a tablet written before the Reformation in which certain historical information was given, including "distant from Norwich 100 furlongs." If this applies to the distance in a straight line, and not by the road, which then passed through Loddon, it is substantially accurate according to the standard of the "old British mile." 100 furlongs were $12\frac{1}{2}$ miles, which equalled $18\frac{3}{4}$ statute miles, and the distance as the crow flies is about 18 miles. It is improbable that this explanation affects the record for *Artemisia campestris* found "By the roadside about a mile from Thetford on the road to Norwich in great abundance," as there were milestones on the road in 1805. *Silene Otites* was also found "a little way from Thetford in the road to Norwich." In 1797 there was no plantation by the roadside at this spot as there is now, and was in 1826, rendering the locality a most unsuitable one for either *Artemisia* or *Silene*. It seems to me probable that the *Artemisia* found at Thetford in July, 1885, by Mr. H. D. Geldart, came from near the first milestone on the London Road. Miss Geldart has a specimen collected there in September, 1885, by Mr. J. Edwards, and it still occurs. *Fritillaria Meleagris* was found in "a field called the Seven Acres and the adjoining ones by the side of Mendham Long Lane, near Harleston," and *Crocus vernus* in one of the same fields. This was probably the road that winds round to Mendham by Shotford Bridge, the only one marked in 1797, though a nearer way marked as Mendham Lane appears in Bryant's map, 1826. From the diary of Professor C. C. Babington it appears that on May 10th, 1837, he and a friend walked from South Elmham St. Margaret's to Harleston. He continues: "Returned by Mendham Long Lane and saw plenty of *Crocus vernus* (of course out of flower) in a field on the right of the lane near to Harleston. We also observed a single specimen of *Fritillaria Meleagris* in a field called the Seven Acres on the left of the lane," * and *Crocus vernus* was "still abundant and apparently spreading" in 1888†

*"Memoirs, Journal, and Botanical Correspondence of Charles C. Babington," p. 61.

†Flowering Plants of Harleston".

Of the Norfolk plants recorded in the "Botanist's Guide" the following are now considered to have been inaccurately identified:—*Viola lactea*, Sm., *Lavatera arborea*, L., *Erodium moschatum*, L'Hérit, *Enanthe pimpinelloides*, L., *Anaphalis margaritacea*, Bentham and Hook fil., *Cnicus neterophyllus*, Willd., *Cynoglossum montaneum*, L., and *Scirpus triquetus*, L.

There are other plants of which the records are not disputed, but which have either not been seen in the county since the early years of the 19th century, or are now practically extinct. It is improbable that the eleven following species can now be found in Norfolk:—*Anemone Pulsatilla*, L., recorded for Sporle and on the Tulip Hills, near Lexham; *Glaucium phœniceum*, Crantz., found by Stillingfleet in 1775 and not again recorded until I found it on a waste patch in Norwich in 1915; *Holosteum umbellatum*, L., recorded for wall in St. Faith's Lane, Norwich, and apparently last seen in Norfolk by the late Mr. H. D. Geldart in 1887; *Antennaria dioica*, Gaertn., recorded for Stratton Strawless and Swaffham Heaths; *Campanula Rapunculus*, L., found on the hill of Old Buckenham Castle; *C. patula*, L., recorded for near Holt in the way to Binham; *Teucrium Chamaedrys*, L., "in profusion on the City Walls between St. Magdalen's and St. Austin's Gates, Norwich," but not noted for many years; *Orchis ustulata*, L., for which the only record is Shouldham Limekiln Hill; *Scirpus sylvaticus*, L., recorded for Ditchingham; *Gastridium lendigerum*, Gaud., recorded for cornfields at Gillingham; and *Bromus giganteus*, L., b. *triflorus*, Syme, the only Norfolk record for which is that for "fields at Saham" in the "Botanist's Guide." To these Dr. G. Claridge Druce considers that *Senecio palustris*, Hook., should be added as a plant now extinct. (Rep. B. E. C., Vol. V., p. 734.)

Of the mosses and hepatics, Mr. W. H. Burrell, F.L.S., informs me that *Neckera antipendula*—*Antitrichia curtispindula*, Brid., has only been recorded once apart from the record in the "Botanist's Guide"; and *Bryum dealbatum*—*Amblyodon dealbatus*, Beauv., owes its Norfolk status to Crowe's record in the "Botanist's Guide."

VI.

WILD BIRD PROTECTION IN NORFOLK

BY SYDNEY H. LONG, M.D., F.Z.S.

The principles underlying the bye-laws of the Norfolk County Council for the protection of wild birds are : (1) the proclaiming of certain areas as "protected areas" during certain months of the year ; (2) the enumeration of certain birds which it is unlawful to take or to kill within specified dates ; (3) the protection of the eggs of certain birds ; (4) all-the-year-round protection to a limited number of birds for which, either from their rarity or because of their usefulness to man, protection has been considered advisable.

Speaking generally, it may be said that the "protected areas" are embraced by (a) the whole of the foreshore of the county between high-water mark and the first boundary of enclosed or cultivated land, and (b) the area known as the Broads district. In the central parts of the county it has not been deemed advisable to proclaim any areas as being specially protected, but rather to rely upon owner or occupier to afford protection when such is specially needed, *e.g.*, at Scoulton Mere. From time to time the County Council has been memorialised by our Society on the subject of protected areas, and has been offered suggestions as to the birds (and their eggs) which should be scheduled and, in the main, the representations that we have made have been acted upon.

The first Wild Birds' Protection Act was passed in 1880, but it soon became obvious that unless measures were taken to enforce the act the latter would become a dead letter. Various Wild Bird Protection Societies were formed in different parts of the country, with the object of collecting funds for the employment of watchers during the nesting season in different localities, and Norfolk was not behindhand in this movement. Up to the present year (1921) the following local societies have been undertaking this work for the county.

THE BREYDON WILD BIRDS' PROTECTION SOCIETY

In 1888 this Society was formed with the object of stopping the indiscriminate shooting of the rare birds known to visit this tidal estuary during the summer months. With Mr. Henry Frederick of Great Yarmouth as its honorary secretary, it has yearly maintained, during the summer months, a watcher, who lives in the Society's house-boat moored in the centre of the area. The results of this protection have been published from time to time in the pages of these Transactions. During the past season Mr. H. H. Halls, of Norwich, has undertaken the secretarial duties of this Society, as the successor to Mr. Frederick, and he reports that the watcher (George Jary) was on duty from April 2nd to August 13th. From the latter's note-book we find that the first Whimbrel turned up on April 5th, an early date, and on April 23rd a few Little Terns were seen. Two Black Terns were seen on May 23rd. A Spoonbill appeared on June 8th, and was joined by a second on the 13th; one of these birds left on the 16th, and the other on the 19th. No other spoonbills were seen during the season.

THE BLAKENEY WILD BIRDS' PROTECTION SOCIETY

To Mr. Quintin Gurney must be given much of the credit for the success that has attended the work of this society, which was formed in 1900, and for which he has acted as honorary secretary and treasurer ever since. On Blakeney Point, as those of our members who visited this reserve on May 29th will know, there is a strong and flourishing colony of Common and Little Terns with an increasing number of Sheld-ducks. It is interesting to note that Sandwich and Roseate Terns are also making an attempt to colonise on this area, where two nests of each species with eggs were found this year. We visited the Point on August 28th, when there were still 200-300 Terns in residence. Amongst these we were able to identify a number of Sandwich Terns and a few Roseate Terns. There were also a few quite young chicks on the nesting ground. These late hatchings are probably explained by a high tide early in June which swept the area of most

of the eggs and drowned many young birds. For many years Robert Pinchen has been the watcher during the nesting season, and he is now employed as such all the year round by the local committee of management of the National Trust, it having been arranged (at a meeting of the Committee at Cley in January, 1921) that his wages shall in future be paid by the latter body, supplemented by monies collected by the local W. B. P. S.

THE WELLS WILD BIRDS' PROTECTION SOCIETY

At about the same time as the Breydon Society was started another bird-protection enthusiast, the late Mr. Charles Hamond of Twyford, took in hand, with the co-operation of the late Col. Feilden, the supervision of the large ternery at Wells, and Mr. Hamond annually collected from his friends funds sufficient to defray the expense of a watcher on this section of the coast. This he continued to do until a year or so before his death (in 1914), when the protection of the birds was taken over by the Holkham Estate. The present watcher is Tom Cringle, who reports that the birds have had a good season, though he thinks that there was a slight falling off in the number of Common Terns' nests this year. No Sandwich Terns nest here, but there are a few pairs of Little Terns. Also about ten pairs of Oyster-catchers, and some thirty pairs of Sheld-ducks, in addition to Redshanks and Ringed Plover, nest on the area. The Black-headed Gulls, which until recently confined their nesting sites to the neighbourhood of the Mow Creek, have this year nested "all over the marshes as far as Stiffkey Marsh." Cringle laments the fact that the eggs of *L. ridibundus* are not on the scheduled list, the result being that many of the eggs at Wells are robbed by boys and others.

THE WOLFERTON WILD BIRDS' PROTECTION SOCIETY

H.M. The King is Patron, and H.R.H. The Prince of Wales Vice-Patron of this Society, which will always be associated with the name of Col. George Cresswell, who has been its honorary secretary and treasurer since its foundation more than

fifteen years ago. Not only has Col. Cresswell made himself responsible for collecting the funds, but during the nesting season he has regularly visited the area two or three times a week. Writing (July, 1921) he says:—"With regard to the present season Common Terns were more numerous, Little Terns about the same, and Ringed Plover appeared to show an increase over last year. No eggs were lost this season owing to exceptionally high tides. One thing I cannot account for, and that is that the colony is far more scattered than formerly, and consequently the watcher has more ground to cover. With regard to the Sheld-duck on Wolferton and Dersingham heaths, I made an estimate a few years ago, which was naturally only a rough and imperfect one owing to the nature of the ground, and came to the conclusion that about 100 pairs were nesting. I do not think that any Herons nest in Dersingham decoy now, but they do in Wolferton Wood." The Society possesses a hut for the watcher, and is the only one that can shew a credit balance in its accounts.

OTHER BREEDING AREAS

Our own observations as to the fortunes of the new colony of Little Terns at Horsey lead us to believe that there was a good hatching in 1921, and that the numerical strength of this colony remains about the same as that of last year, namely, some forty to fifty pairs. Several pairs of Ringed Plover also nest on this part of the coast. By arrangement with a keeper on an adjoining beat we were able to exercise some supervision over the area during the past breeding season.

Although we are not in a position to give a census of the Bitterns' nests in Norfolk in 1921, we have good reason to state that at least ten pairs hatched off, and we are of opinion that the number of nests is still increasing yearly. We are satisfied that in all the districts in which these birds are known to nest they are given good protection.

As regards the Harriers, we have received reliable evidence that six pairs of Montagu's Harriers brought off their young

this year, and one pair of Marsh Harriers. Also, that two pairs of Short-eared Owls nested in the same district. All these birds have been jealously guarded.

A few pairs of Garganeys nest in the county (we heard of two nests having been found this year), and Ruffs and Reeves continue to visit us during the vernal migration, but we have not heard of any nest of this species having been discovered this year. Our observations confirm those of others about the Bearded Tits, which would now seem to have recovered from the high mortality produced among them by the severe winter of 1916.

The Norfolk population of Great Crested Grebes must be very considerable at the present time, for not only are these birds to be found generally distributed over all the broads—a year or so ago we one day counted twenty on South Walsham broad—but they are also to be found breeding on many other pieces of water in different parts of the county.

In the Breckland district, where more species of ducks breed than in any other part of Norfolk, good protection is given by most of the landlords, and although some of the meres have wasted considerably owing to the prolonged drought, the number of Tufted Ducks, Gadwall, Pochards, and other fowl that nest on these sites does not seem to have diminished this year.

We have paid several visits to the Scoulton gullery during the past season, where the number of Gulls appeared to be about normal. The first eggs were laid on the 2nd of April, and by July 6th only some 200 gulls remained on the mere. In spite of the parched condition of the surrounding arable lands there was no undue mortality among the chicks: in this our own observations were borne out by those of the keeper.

The above brief résumé of the history of bird protection in the county shows that through the instrumentality of enthusiastic and influential local secretaries funds can be collected for this purpose, though not without difficulty. Why, then, has our Society at its last annual meeting decided to form its

own "Wild Birds' Protection Committee" and to take over the responsibility for bird protection in the whole county?

It was known that two of the local secretaries, Mr. Frederick and Mr. Q. E. Gurney, were anxious to be relieved of the onus of collecting these funds, and since then a third, Col. Cresswell, has also been obliged to resign. In the past there has been no concerted action between these different societies, and, what is a very practical point, there could not be any intermingling of the funds, although these were all collected for a common object, and, as experience has shown, mostly from the same people. Moreover, if the services of a watcher were ever called for unexpectedly for any new section of our coast-line, as at Horsey last year, there were no funds upon which our Society could draw to give the necessary protection. For these reasons it has been considered advisable to co-ordinate the work, and to bring it under the responsibility and control of a central representative committee of Norfolk ornithologists. Such an arrangement will facilitate any future co-operation with adjoining counties, if, as is strongly held by some, the geographical units for bird protection should be enlarged.

Our first effort must be directed towards increasing our funds and extending our clientèle, because, as stated above, the subscription lists have hitherto been limited to a very few names. We believe that the majority of our members will be prepared to take their financial share of this work and induce their ornithological friends to assist them. The amount required is about £100 a year, and we hope for a liberal response to this appeal. Subscriptions should be sent to our Hon. Treasurer, Mr. Robert Gurney, Ingham Old Hall, Norfolk.

VII

THE TRAVELS OF PETER MUNDY

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

To Mr. N. B. Kinncar, of The Natural History Museum, I am indebted for a reference to "The Travels of Peter Mundy," whose quaint Diary was discovered in the Bodleian Library at Oxford, and has now been printed by the Hakluyt Society.

Mundy was a most observant man, and from his journal we now learn that there may have formerly been a second Devonshire breeding-place of the Gannet (*Sula bassana*).

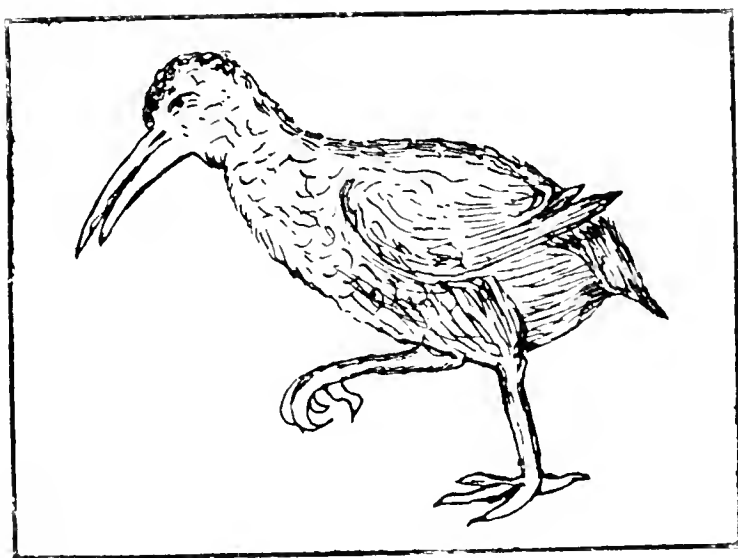
The exact date at which the explorer or his seamen visited the island where the Gannets were is not quite clear, but it was either in 1635 or 1636. His vessel was starting for India, and after leaving Falmouth harbour, the captain "stopped at a rock standing out a little in the sea, commonly called the Gull Rock, there to take in some crabs . . ." "Hither," continues Mundy, "doe resort all the Sea fowle thereabouts to breede, as Gannetts, Gulls, Seameawes, Shaggs, Murres, Divedappers, etts., which belongeth to a gentleman in the Country, whoe att tymes fetch away their Younge." The rock here alluded to, which still bears the name of Gull Rock, lies off Nare Point, about five miles from the Eastern extremity of Falmouth Bay. Reaching to a height of about 125 feet, it has probably always been a breeding place of Gulls, which still resort there, together with Shags and Murres, but no Gannets are known to have nested within living memory.

A few days afterwards Mundy's ship moved on to Weymouth, where he did not fail to visit the Great Portland beach, six miles or more in length. Here he tells us "bredd many Swanns, the Royaltie apperteyninge to Sir George Stranginge [? Strangeways]". This celebrated Swannery, which dates back to before the Reformation, has often been described. In 1892 I found the number of nests had somewhat decreased, but there were quite enough of the birds to make a good show. Mundy goes on to say that in the Portland cliffs there do "breed a Certen

sea fowle named Pewitts, many of them from hence [are] carried to London . . .” “Pewitt” was usually applied to the Black-headed Gull, but the reference here is to the Herring Gull.

It was at Portland that Mundy also saw “a black fowle with Yellow Bill and Leggs, commonly called Cornish Dawes, many being of opinion that there were none elsewhere to be seen but in Cornwall, or neare adjoyning . . .” The Chough, which is the bird here meant, held its own for a long time, but is believed to be now extinct in Dorsetshire, though still found in Cornwall.

Some of Peter Mundy’s notes refer to foreign countries. Thus in 1638, when homeward bound from China, his vessel put in at Mauritius, and this gives us a paragraph about the Dodo, which, however, he did not himself see. But if in this he was disappointed, his crew caught what was almost as remarkable, viz., “a Mauritius Hen, a fowl as big as our English hens, of a yellowish wheaten colour.” This was the *Aphanapteryx*, which being good to eat, and easy to capture, did not long survive the inroads of man. Mundy supplies a sketch of this singular bird which is considered by Mr. W. L. Slater to leave no doubt as to the species (*see* “Ibis,” 1915, p. 316). By his permission I am glad to be able to reproduce it with this article.



VIII

STEVENSON'S "BIRDS OF NORFOLK"—

A CORRECTION

By N. F. TICEHURST, F.R.C.S., M.B.O.U.

It must be so unusual an event for anyone to be able to draw attention to a doubtful point in such an accurate book as Stevenson's *Birds of Norfolk*, that it is with some diffidence I venture to offer the following remarks on two of the footnotes in his Chapter on Swan History (Vol. III.). Neither of the points is perhaps of great importance, but the first clears up, in part, a question which was left in doubt, and the second puts right a quotation which is certainly misleading.

The first is in connection with the swan-marks of the Corporation of Norwich. In the footnote on p. 105 it is stated: "This mark" [*i.e.*, St. Giles' Hospital mark] "most resembles the one now in use for the Corporation, but that figured by Yarrell (No. 9)" [*B.B.*, IV., p. 339] "as the Norwich Corporate mark, does not answer to any I have seen on our local swan-rolls. Yarrell's figure No. 5" [p. 332] "is however identical with our present Corporate mark, though described as belonging to Sir Thomas Frowick. Possibly through a printer's error, the two woodcuts were transposed." This supposition is not correct, as I have recently verified by reference to Harley MS. No. 541, in the British Museum, whence Yarrell obtained the mark of Sir Thomas Frowick which is quite correctly rendered by him in his figure No. 5. This mark would no doubt have been used for the owner's swans on the Thames, so that presumably there is no impossibility of its having been used also by a different owner in East Anglia, and have thus been handed down to the Corporation of Norwich. The source of Yarrell's No. 9 is not given and up to the present I have not found anything to correspond with it in the swan-rolls I have examined in the British Museum.

The second point is concerned with the footnote on the Dawson Turner swan-rolls on p. 110, where their title is quoted

as "Swan-marks used by the Proprietors of Lands on the Yare and Waveney, preceded by the order for Swan Botes established by the Statutes for the Realm of England." This would lead one to suppose that these "orders" were for the regulation of the boats and the ceremony to be followed on upping-day, whereas they are nothing of the kind. This title is a verbatim copy of the *modern* title-page that was added, when the rolls were separated into their different membranes and bound up in book form, whether by Dawson Turner or not is uncertain, as it is not in his handwriting. Its latter half is a shortened version of the actual heading of the "orders" which, there cannot be much doubt, has been mis-read. In the Class Catalogue of MSS. the words are rendered "Swan Bots," which they might be, could any meaning be conveyed by them; there is certainly no "e" in them, and the second word does not begin with a capital. There is some attempt at ornamentation in the writing of this heading, and the ink being faded it is consequently not easy to be sure of the identity of the final letter, but taking the context into consideration there cannot be any doubt, I think, that the correct reading should be "The orders for swanns both by the statutes & by the Auncient orders & customes vsed within the Realme of England." This not only makes sense but is also word for word identical with the heading of the "orders" published by George Bowyer in *Archæologia* (1847, p. 423, *et seq.*), with which the orders themselves, apart from differences in spelling, are also identical. They have nothing to do with boats, botes, or bots, and none of these words occur anywhere in them.

IX

THE HERRING FISHERY OF 1920

BY ARTHUR H. PATTERSON

The herring fishery of 1920 was a notable one, distinguished rather by a variety of vicissitudes than by progress and all-round prosperity. There was little cause for grumbling on the score of weather, for, with the exception of one or two north-easterly gales in November, conditions were favourable for a good catch. Not a drifter came to grief, and not a fisherman was lost during the fishing. There were abundant shoals of herrings in the North Sea, but with the inability of Germany—one of our largest customers—to pay ready money, and Russia being an impossible market, the trade was handicapped from the start and something approaching, at one time, to disaster to the fishermen, boat-owners, and all others engaged in the industry, put a great damper upon the enterprise. The Government, however, lent a hand, seeing to it that the fisher folk had a living wage, and taking upon itself the regulation of prices, and guaranteeing shipping and marketing responsibilities. At the very height of the fishing came the coal strike, but a system of rationing and permits considerably minimised the difficulties, so that no boat had to be laid up for want of steam power, although the price of “black diamonds” went up as high as five pounds per ton. Nets, too, went up enormously in cost.

The fishing ran its normal length, starting late in August and ending in December. The boats fishing out of Yarmouth numbered 1,011, of which some 700 came from Scotland. The top boat made over £4,000 for its fishing; the lowest something like £800, barely enough to cover expenses. As to prices, the official minimum was £2 5s. 0d. per cran, or £22 10s. 0d. per last; and the highest figure realised was £9 8s. 0d. per cran, though, on one occasion, the price per cran dropped as low as 10s.

The following figures show the progress of the fishing :—

August (from the 21st)	...	...	...	1,324	crans
September	...	...	...	22,778	„
October	...	...	...	339,321	„
November	...	...	...	179,416	„
December	...	...	...	13,865	„

The largest delivery on any one day took place on October 28th, when 49,478 crans were brought in by 564 boats.

The total of the catch for the year was 616,707 crans, as compared with 453,571 crans in 1919. These figures are still far short of those for the year 1913, when 824,213 crans were landed. It is estimated that the value of the Yarmouth herring fishery last year amounted to well over £1,300,000.

The Lowestoft figures show a proportionately good year, the catch amounting to some 366,000 crans, with 495 boats engaged in the industry, among them being 51 motor-driven craft.

METEOROLOGICAL NOTES, 1920

(From observations taken at Norwich.)

BY ARTHUR W. PRESTON, F.R.MET.SOC.

JANUARY

This was a mild and stormy month. Mean temperature was 3 degrees above the average, and it was the warmest January since the abnormally mild one of 1916. The thermometer reached or exceeded 50 deg. on nine days. There were considerable rains at times, the month's total being 2.34 ins., or .64 ins. above the normal. Very slight snow fell on the 1st, after which day there was no snow whatever until March 7th. The barometer fluctuated much, and there were gales from the S.W. in the second week. A thunderstorm occurred on the

evening of the 11th. There were 57 hours of bright sunshine during the month, against 34 hours in December and 41 hours in the previous January.

FEBRUARY

Although a trifle less mild than February, 1918, this was a remarkably warm and dry month, with but little appearance of winter. Mean temperature was 3.4 deg. above the average, and the thermometer frequently exceeded 50 deg. There were few frosts, but none of any severity. The wind was almost constantly from the S.W. Rainfall was greatly deficient, the month's total being less than three-quarters of an inch. Sunshine was nine hours in excess of the average, and vegetation made a very early start.

MARCH

The mildness which characterised January and February continued throughout March, the mean temperature of which month (46.3) was 4.8 degrees above the normal, and higher than that of any March since 1859. The thermometer exceeded 60 degrees on seven days, and exceeded 50 degrees on twenty-three days. Rainfall was about half an inch deficient. There were some remarkable barometric variations. At 4 a.m. on the 15th the mercury descended as low as 28.50 in., but rapidly recovered. There were 147 hours of bright sunshine, or 23 hours above the average amount. Vegetation was exceedingly forward, more so than in any year at this period since 1903, pear and cherry trees coming into bloom before the end of the month.

APRIL

This month formed a disappointing sequel to the long period of summer-like weather which had prevailed for several weeks. It was a very rainy month, the total fall being as much as 3.60 in. Sunshine was 56 hours deficient. There were no very warm days, but the nights being generally mild for the season, the continued moisture was conducive to the rapid progress of vegetation. The hawthorn was in bloom in this neighbourhood on

April 15th, and by the close of the month was to be found in abundance. Many trees were in their full foliage early in the month, and lilacs and laburnums were in flower several days before the month's end.

MAY

For the fifth year in succession May gave a mean temperature considerably in excess of the average, and there was much bright weather throughout the month, although the total sunshine fell 40 hours short of that of the brilliant May of 1919. The earlier part of the month was dry, and Whitsuntide was very fine, the sun shining for over 14 hours on each of the four days 22nd to 25th inclusive. This was followed by a downpour of rain on the 26th amounting to .62 ins., supplemented by heavy thunderstorms on the 29th and 30th.

JUNE

The weather was unseasonably cold during the period 4th to 9th. On the latter day the exposed thermometer fell to 31.2 deg., but in more open parts of the country much lower readings were recorded; 24 deg. at Worstead and 22 deg. at Pulham. Considerable damage was done to potatoes and beans on that occasion. There were many fine days of moderate heat during the remainder of the month. The thermometer did not touch 80 deg., but the mean temperature slightly exceeded the average, as did that of the rainfall, notwithstanding that rain was registered on nine days only. Thunder occurred on the 13th and 18th, and it is remarkable that so little thunder developed in this neighbourhood, as in many parts of England thunderstorms were severe and frequent on many days. Sunshine of over 10 hours' duration occurred on eleven days.

JULY

This was a cold and very unsettled month, with but few warm days and no hot ones. The nights were seldom cold, for with cloudy skies terrestrial radiation was very restricted in its activity. Although rain was frequent the excess was less than

half-an-inch, and very much less rain fell here than in some of the south-western and western parts of the Kingdom. The highest temperature recorded here was 77 deg. on the 17th, which is the same height as that registered in the previous July, which was an even colder month. There was a remarkable absence of thunderstorms, only one being recorded here (on the 12th). Sunshine was 51 hours deficient.

AUGUST

As in July, the absence of warm days and deficiency of sunshine was remarkable. The thermometer exceeded 70 deg. on four days only, and on eight days it failed to touch 60 deg. The mean temperature of the month (57.4 deg.) was 3.6 deg. below the normal, and was the same as in the August of 1912 (the month of the Norwich flood), which enjoyed the reputation of having been the coldest August for 95 years. Sunshine was 53 hours under the average, and the rainfall was slightly deficient in quantity. Thunder occurred on the 5th, and on the 9th there was a severe storm early in the evening, although of short duration.

SEPTEMBER

In September it was unseasonably cool by day, the highest temperature recorded having been 71.5 deg., as against 86.5 deg. in the previous September. There was much fine weather in the second week, but from the 19th to the 25th more or less rain fell daily. The total rainfall was .40 ins. below the normal. Thunder occurred on the 21st and 22nd, in the former of which days a great storm visited Lowestoft and neighbourhood, accompanied by a destructive whirlwind.

OCTOBER

This was an unusually fine and dry month. The total rainfall was but .77 ins., which was a smaller amount than has been recorded in Norwich in any October since 1866. Rain fell on six days only, on three of which the fall was only .01 in., chiefly the deposit of fog. There was not a single day through-

out the month on which the sun did not shine, and it shone for seven hours or more on as many as 16 days. The total sunshine for the month (184 hours) was just 80 hours above the normal amount. There was a great prevalence of fog on many mornings, with an unusually large number of frosty mornings in the latter part of the month. By day the thermometer exceeded 60 deg. on 13 occasions. A thunderstorm occurred on the evening of the 15th.

NOVEMBER

This month was a continuation of the fine October, sunshine being excessive and rainfall deficient. The former was 22 hours in excess of the average amount, and the latter, which was almost exactly the same as in October, was 1.97 ins. below the normal. The combined rainfall of October and November was only 1.55 ins., instead of 5.77 ins. It was the first November since 1867 in which less than an inch of rain fell in Norwich, and no rain whatever fell on 21 days. There were morning frosts and fogs on many days followed by brilliantly sunny afternoons. Owing to the frosts the mean temperature was slightly below the average, the warm afternoons hardly compensating for the cold mornings, and there was, in consequence, an unusually large range of temperature for the time of year.

DECEMBER

A wintery period (following mildness) set in on the 8th and continued until the 19th, during which time the thermometer only once rose above 40 deg., and there were frosts nightly. On the 13th the temperature fell to 20.5 deg. in the screen and to 17.2 deg. on the grass, these being the lowest readings since February, 1919. The snow lay on the ground for ten days, and was four inches deep on the level. A very mild time set in on the 24th, and continued until the end of the month, the thermometer exceeding 50 deg. daily. Rain fell on 28 days, and the total for the month was about an inch above the normal. Sunshine was 13 hours deficient.

THE SEASONS

Tables of Mean Temperature and Rainfall of the four seasons of 1920, together with those of the five previous years, and compared with the average (including December, 1919, but excluding December, 1920) :—

TEMPERATURE								
Seasons.	1915.	1916.	1917.	1918.	1919.	1920.	Average	Departure of 1920 from average.
Winter -	degrees 39'7	degrees 41'7	degrees 35'4	degrees 38'7	degrees 38'7	degrees 41'2	degrees 38'4	degrees + 2'8
Spring -	46'4	47'6	44'9	47'5	46'9	50'0	46'3	+ 3'7
Summer -	60'2	58'8	62'2	60'0	58'9	58'9	60'2	— 1'3
Autumn -	48'6	50'6	50'0	48'6	46'8	50'2	50'1	+ 0'1
Year -	48'8	49'3	48'0	49'4	47'6	50'0	48'8	+ 1'2

RAINFALL								
Seasons.	1915.	1916.	1917.	1918.	1919.	1920.	Average	Departure of 1920 from average.
Winter -	ins. 13'35	ins. 10'41	ins. 6'55	ins. 5'63	ins. 10'29	ins. 8'12	ins. 5'37	ins. + 2'75
Spring -	5'18	8'20	6'27	5'10	4'98	6'61	5'13	+ 1'48
Summer -	7'47	7'63	8'61	6'03	6'15	7'34	6'87	+ 0'47
Autumn -	6'58	7'39	8'03	9'62	7'49	3'76	8'38	— 4'62
Year -	29'97	32'68	27'82	28'88	29'99	24'00	25'75	— 1'75

The winter was the mildest since 1916, but although very wet, was less so than the previous winter. The mean temperature of the three spring months was higher than that of any spring since these records were commenced in 1882, and we have to go back to 1859 for an equally warm period; the rainfall was slightly excessive. The mean temperature of the three summer months coincided exactly with that of the previous summer, and was 1.3 deficient, the rainfall being about half an inch in

excess of the normal. The autumn temperature, which departed but little from the average, was slightly above that of the three previous autumns, while the rainfall of the period was less than half the mean amount, constituting the driest autumn of which I can find any equivalent, after a search through old East Anglian registers back to 1830.

THE YEAR

The excess of temperature during the first six months was most remarkable. The mean of this period was as much as 3 deg. above the average. These warm months were followed by two cold ones, July and August, with normal values for the remaining four. The result of the warmth in the first half was to bring up the year's mean temperature to a higher figure than in any year since 1914. The total rainfall of the year, for the first time since 1913, was less than the average, the amount being exactly 24 in. February, October, and November were exceedingly dry, yielding only three-quarters of an inch each. The only really wet months were April, with 3.60 in., and December with 3.22 in. For the tenth year in succession Mr. J. H. Willis has kindly supplied me with his monthly sunshine returns. May was again the brightest month with 243 hours. The year presented many remarkable features, and was extremely interesting from a meteorological point of view. Not only was the spring the warmest and the autumn the driest for more than half a century (as above mentioned), but the summer was disappointingly dull and cold, and October and November the finest and brightest almost every known. In fact a description of the year given in a Norwich newspaper sums it up very graphically :—“ We have had a year without a summer, heralded by the most delightful spring, and followed by the most resplendent autumn.”

MR. PRESTON'S METEOROLOGICAL RECORDS FOR 1920

MONTH. 1920.	BAROMETER.				THERMOMETER.				HYGRO-METER. Mean Relative Humidity 9 a.m. %	SUN- SHINE. Hours.	RAINFALL.		WIND.						Mean direction force		
	Highest.	Date.	Lowest.	Date.	Mean.	Date.	Lowest.	Date.			Inches.	No. of Days.	N	E	S.E.	S	S.W.	W		N.W.	
JAN.	30.55	5	28.77	11	30.833	11	24.4	7	40.7	57.3	2.34	19	1	2	1	1	4	12	6	4	4.0
FEB.	30.65	5	29.64	10, 11	30.152	5	26.4	5	42.1	87.9	0.73	13	1	2	0	5	3	11	4	3	3.2
MARCH	30.61	3	28.50	15	29.871	8	29.0	8	46.3	147.0	1.23	17	1	0	2	2	7	6	9	4	3.0
APRIL	30.18	23	29.20	12	29.676	24	33.7	22	48.3	103.3	3.60	25	3	4	5	3	5	5	3	2	2.7
MAY	30.56	5	29.43	2	30.015	25	34.0	5	55.3	243.0	1.78	14	1	0	7	3	3	9	4	4	3.6
JUNE	30.32	23	29.75	12	30.010	19	35.4	9	59.4	224.7	2.11	9	5	1	6	4	1	2	8	3	3.0
JULY	30.23	19	29.47	23	29.874	17	43.9	27	59.9	159.4	3.16	20	1	1	0	0	9	8	7	5	2.7
AUG.	30.44	29	29.49	5	30.047	8	42.3	27	57.4	131.2	2.07	13	7	3	0	0	2	2	8	9	3.0
SEPT.	30.31	11	29.37	18	30.001	12	38.5	20	57.1	108.1	2.21	19	1	7	1	4	3	6	3	5	2.4
OCT.	30.36	25, 26	29.36	31	29.994	7	27.6	22	50.7	184.5	0.77	6	0	0	18	7	6	0	0	0	2.3
NOV.	30.49	18	29.44	1	30.069	15	23.0	21, 22	42.9	109.2	0.78	9	2	2	4	6	4	9	3	0	2.1
DEC.	30.39	15	29.22	21	29.956	3	20.5	13	39.7	29.8	3.22	28	2	7	8	0	7	6	1	0	2.5
MEANS					29.958				50.0												2.9
EXTREMES & TOTALS	30.65	Feb. 5	28.50	Mar. 15		78.0	20.5	Dec. 13		1585.4	24.00	192	25	29	52	35	54	76	56	39	

XI

MISCELLANEOUS NOTES AND OBSERVATIONS

SUMMER EXCURSIONS

BLAKENEY POINT, MAY 29th, 1921

In the year 1912 the area known as Blakeney Point, which consists of a spit of land about 1,100 acres in area on the north coast of Norfolk, was purchased by a few anonymous individuals and handed over to the "National Trust." It has since been managed by a local committee, on which our Society is represented, and of which Professor F. W. Oliver, F.R.S., of University College, London, is Honorary Secretary. At the invitation of Prof. Oliver just under one hundred members of our Society spent a day on the Point on May 29th last, and all those who were fortunate enough to be present will, we feel sure, consider it as one of the red-letter days of the Society.

Owing to the researches of Prof. Oliver and his pupils probably more is known of the natural history of this shingle spit than of any other similar area in the British Isles. Over 200 birds have been noted, including twenty nesting species; over 500 insects have been indentified, excluding some 80 or 90 spiders; mammals number six, exclusive of the seals which breed on the adjacent sand-banks and which were seen by the visitors; flowering plants of the dunes, marsh, and shingle number 125, and there is one fern; mosses and liverworts about 30; algæ 50; fungi about 50; invertebrates, not including protozoa, about 50. Four or five varieties of flowering plants found on the Point are not found elsewhere in the British Isles. Norfolk naturalists thus owe a debt of gratitude to Prof. Oliver and his pupils for their contributions to the fauna and flora of the county.

The members were met at Morston Quay and conveyed down the channel in boats to the Point, where they were

received by Dr. Oliver. With him were Mr. S. H. Hamer (Secretary of the National Trust), Dr. E. J. Salisbury, Miss Winifred Smith, Major T. G. Hill, and Mr. A. W. Cozens-Hardy (Chairman of the Blakeney Point Committee). Lunch was provided on the sand-hills, and tea in the Old Lifeboat House, the property of the Botanical Department of University College. The party was divided into four groups, which were under the direction of Prof. Oliver, Dr. Salisbury, Major Hill, and Mr. Hamer, and the organisation could not have worked better. By this arrangement the Long Hills, the Hood, the Watchhouse Bank, the Shingle Ridge, and the Ternery were all visited.

Before leaving, each guest was presented by Prof. Oliver with a printed souvenir of the visit, together with a reprint of his chapter on Blakeney Point in Carey and Oliver's "Tidal Lands."

HOLKHAM HALL, JUNE 26th, 1921.

On the invitation of the Earl and Countess of Leicester, some eighty members of the Society and of the Norwich Science Gossip Club paid a visit to Holkham on June 26th. Walsingham Priory was visited, en route, by invitation of Sir Eustace Gurney. On arrival at Holkham the members of the party were received by Lord and Lady Leicester, and a most enjoyable afternoon was spent in strolling round the gardens, the lake, visiting the sand-hills, and in being shown over the Hall with its wealth of art treasures. After having tea in the Bird Room, the party reassembled on the South front of the Hall, and expressed to Lord and Lady Leicester their appreciation of the hospitable welcome that they had received.

ABNORMAL SYCAMORE AND HORSE CHESTNUT.—The buds of the Sycamore (*Acer Pseudo-platanus* L.) and Horse Chestnut (*Æsculus hippocastanum* L.) are, as is well known, in opposite pairs, but occasionally young trees are found in which they may be placed in whorls of three. I have found in my own garden two young chestnut trees with the buds in this form,

and it is interesting to note that the bud scales in this case follow the same arrangement and are in threes instead of in pairs. Four examples of sycamore with this abnormality have been met with (cf. *Country Life*, 1921, p. 1273), three here at Ingham and one at Wroxham, but as they were in full leaf when discovered I am unable to say whether or not the bud scales were normal. The abnormality may effect a single branch of an otherwise normal tree or a small part only of a branch. At Westwick there is an old Sycamore tree which has three branches springing from a common level, apparently due to the same cause.

LATE BREEDING OF THE OTTER IN NORFOLK.—On July 11th, 1921, a message was brought to me that the nest of an Otter (*Lutra lutra* L.) containing two young ones had been found on Calthorpe Broad, and I at once went and photographed them. The "nest" was merely a small heap of reed and reedmace fragments, scarcely larger than that of a coot, and placed among reeds a few yards from the edge of the broad on ground which in normal years is always flooded, but which is now dry. In the hollow of the nest were two young otters, eight inches long from nose to tail-tip, and covered with short, silky, grey hair. They were still blind, and were very restless, and constantly uttering a plaintive, whistling cry. No sign of the parents was seen, though there were several "runs" from the nest into the reeds. There were no remains of food to be seen near the nest.

Mr. Southwell (*Trans., N. & N. Nat. Soc.*, Vol. 1., 1872-73, p. 84) has given a summary of the records of young otters then known to him, from which it appears that the young are born in Norfolk usually between October and March, though Millais (*Mammals of Great Britain and Ireland*, Vol. II., p. 18) states that they have been seen in every month of the year. The Calthorpe litter were estimated at a fortnight old by an experienced marshman, and he was probably near the mark, so that they were born at the end of June, which is an unusually late date for this county.

GOLDEN ORIOLE IN NORFOLK.—On May 27th, 1921, when in camp with boy scouts at Calthorpe Broad, I heard the call of a Golden Oriole (*Oriolus oriolus* L.), and fetched out all the boys to hear it too. The call of the Oriole, once heard, can hardly be forgotten; it is a rich whistle which has been likened to the words “cœur de lion,” with the accent on the “li,” and the Dutch name, “Willewaal” may be taken as a rough translation. Unfortunately, I was not able to search for the bird at the time, and although the call was heard again on two subsequent days the bird seems then to have passed on. Probably only a single male bird was present.

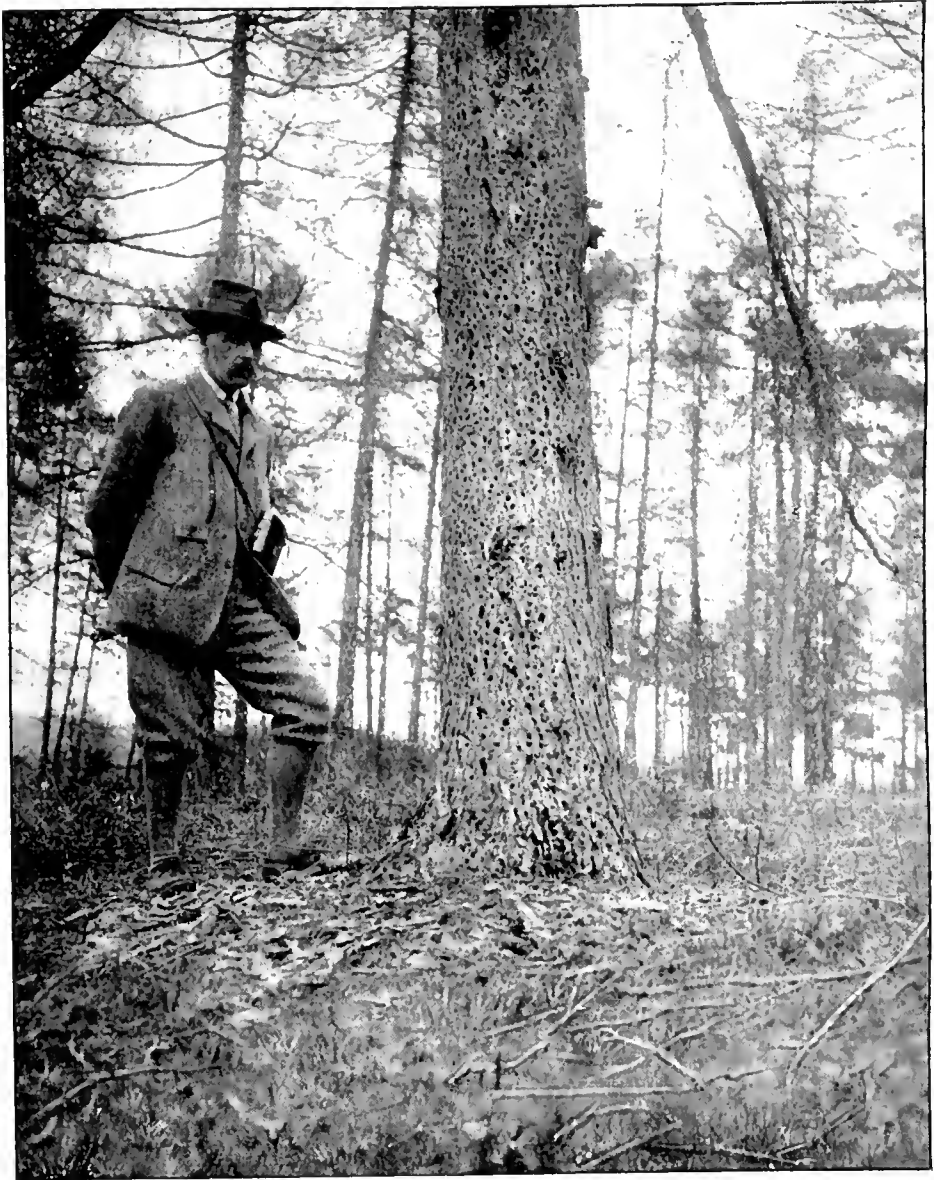
TWO CUCKOO'S EGGS IN ONE NEST.—Two Cuckoo's eggs, of different colour, were found in a hedge-sparrow's nest in a high hedge at Ingham in June, 1921.

REDSTART IN NORFOLK.—So rarely is the Redstart (*Phœnicurus phœnicurus*) seen in Norfolk in these days that it may be of interest to record the fact that I saw a male of this species near one of the quarries on Royden Fen on June 17th, 1921.

ROBERT GURNEY.

GREY WAGTAIL NESTING IN NORFOLK.—We are indebted to Mrs. Smith, of Ellingham Hall, for the following account of the nesting of a pair of Grey Wagtails (*Motacilla boarula*) in Norfolk. Mrs. Smith writes: “On April 30th, 1921, I watched a pair of Grey Wagtails building their nest on the point of masonry below the lock at Ellingham mill on the River Waveney. They made use of damp moss from the edge of the water by our boat-house. On May 2nd I found that they were continually being harassed by a pair of Pied Wagtails which had a nest about three yards away in some wood-work round the corner, just below the lock gate. When I again visited the spot on May 5th, the Grey Wagtails had gone, having evidently been driven away by their rivals.” This is an interesting record,





Larch Tree that has been attacked by Woodpeckers

as there does not appear to be any evidence of the Grey Wagtail having previously nested in the county. We hope the birds will return to nest again next year, and with more successful results.

WILLOW-WREN'S NEST IN A TREE.—It is very unusual for the Willow-wren (*Phylloscopus trochilus*) to nest elsewhere than on the ground, so that it is of interest to record a nest that was built this year on a lateral branch of a Pensapo tree in Ellingham park. The nest was of normal shape and construction, and about 2 ft. from the ground, and when taken to see it by Mrs. Smith on June 30th, we found it to contain young in the down.

WAXWINGS IN NORFOLK.—During December and January (1920-21) there was a small immigration of Waxwings (*Ampelis garrulus*) into the county, which were seen on the coast (Sheringham) and in Norwich and elsewhere. The broadly-tipped yellow band on the distal end of the tail looks white in the sunlight, and is a distinctive identification mark when the bird is in flight.—EDITOR.

WOODPECKERS FEEDING ON THE GRUBS OF *Tetropium gabrieli*.—At our meeting on March 29th, 1921, several samples of bark from alarch tree (*Larix europea*) were exhibited as showing numerous perforations by Woodpeckers, which in the opinion of the exhibitor, Mr. Enderby, had been made by the Lesser Spotted Woodpecker, but probably the Green Woodpecker had had its share in the digging. The birds had evidently been searching for the grubs of a beetle, some of which had been collected and were also shown. These were subsequently identified by Mr. H. J. Thouless as the larvæ of a large black Longicorn (*Tetropium gabrieli* Weise). Not long ago a similarly attached larch tree, dotted with holes large and small in exactly the same manner, came under Dr. S. H. Long's notice at Gaywood, and the accompanying photograph of this tree (taken by Mr. Robt. Gurney) demonstrates the amount of good which must be

done by Woodpeckers in ridding larch plantations of these pests, because diseased trees of this sort are not uncommon. All the larger holes are the work of the Woodpeckers, but there are also many smaller, round holes, and these are stated by Mr. Thouless to be the exits through which the newly-hatched beetles emerge. As soon as the grubs have disappeared woodpeckers cease to visit the affected trees, and these latter, if not felled, probably die.—J. H. GURNEY.

HERONRIES IN NORFOLK.—The breeding status of the Heron (*Ardea cinerea* L.) in Norfolk for the year 1921 would appear to be as follows:—

86	nests at	Reedham	<i>fide</i>	J. Goodrum
60	„ „	Islington	„	N. Tracy
26	„ „	Holkham	„	The Earl of Leicester.
				(Not more than five on any one tree.)
18	„ „	Catfield	„	A. H. Patterson
7	„ „	Hoveton	„	B. B. Riviere
6	„ „	Wolferton Wood	„	J. B. Bland
4	„ „	Earlham	„	J. Fitt
4	„ „	Buckenham	„	S. H. Long

A reference to Vol. X., p. 504 of our Transactions will show how small 'has been the variation in the number of nests at Reedham during the last twenty years.—J. H. GURNEY.

BLACK VARIETY OF THE SWALLOW-TAIL BUTTERFLY.—On August 9th, 1921, Mr. J. H. Lloyd, of Norwich, captured an almost completely black variety of *Papillio machaon* on one of the Broads. We have seen the specimen, which is entirely black with the exception of those parts which in an ordinary *machaon* are blue. The antennæ are practically identical with those of the ordinary form, otherwise yellow has been entirely replaced by black. This would appear to be the first specimen of the black variety that has ever been taken in the British Isles. We understand that the specimen has been acquired by Lord



Black variety of Swallow-tailed Butterfly
and normal insect



Rothschild for the Tring museum. Our photograph shows this black variety in contrast with an ordinary Swallow-tailed Butterfly.

ADDITIONS TO THE NORFOLK FLORA.—Mr. F. Long reports having found *Hieracium corymbosum* Fr at Hevingham in September 1901, though his specimen has only been recently identified. In June, 1921, he found *Lavatera cretica* L. (*Sylvestris* Brot.) in flower at Sheringham. He has both specimens in his herbarium.

A NEW NORFOLK MAMMAL.—We are indebted to Mr. John Auden, of Burton on Trent, for the following record of a Bottle-nosed Dolphin (*Tursiops tursio* Fab.), a species not hitherto recorded for the county. In January, 1920, Mr. Auden found a young male cast up on the east shore of Blakeney Point. It was nine feet in length, and he estimated its weight at about forty stone. Mr. Auden has compared the skull with specimens in the S. Kensington museum, and has verified its identity. The teeth were not worn, as is so commonly found to be the case with this species.—EDITOR.

THE MOLE CRICKET.—A recent interesting addition to the Norwich Castle Museum collection is a specimen of the Mole Cricket (*Gryllotalpa vulgaris*) captured on June 2nd, 1862, by Mr. W. M. Webster, on Barteley Hills, Castleacre, and presented to the Museum by the Rev. E. Farrer, of Botesdale. The species is considered very rare in Norfolk, but this is possibly to some extent at least on account of its subterranean habits. Several specimens were brought to me some years ago from Shottesham Common. This very remarkable insect is well worth examination. It will be noticed that the anterior legs are modified into organs for the excavation of the burrow, being short and broad, bearing a singular resemblance to the hand of the mole.—H. J. THOULESS.

OBITUARY

COL. H. W. FEILDEN, C.B.

1838—1921

Although a native of Lancashire, the late Colonel Henry Wemyss Feilden resided for so many years at Wells, and took so keen an interest in the welfare of our Society up to the time of his death that we cannot allow such a distinguished member to pass away without a brief record of his life in our columns.

Col. Feilden was the second son of Sir William H. Feilden, Bart., of Feniscowles. He entered early upon his military career, in which he distinguished himself in various campaigns, gaining a medal with clasp in the Indian Mutiny, 1857-58, and another medal with clasp in China two years later. He also served with the Confederate Army in the American Civil War, 1862-65, and in various other parts of the world. A man of strong physique and untiring energy he had an insatiable thirst for exploration and research, and during the various expeditions that he was able to make in the interim of his military duties he amassed much valuable information on the geology, fauna, and flora of many unknown lands.

The most momentous event in his life was his appointment as naturalist to what has come to be known as Sir George Nares's expedition to the North Pole. Sailing in H.M.S. *Alert*, in July, 1875, he was absent in the Arctic regions until October of the following year and, later, in 1878, edited the *Narrative of the Voyage*, which gives an account of his labours. It was when on this expedition that he discovered the young of the Knot (*Tringa canutus*), and the eggs and young of the Sanderling (*Calidris arenaria*), in 82° 33' N. latitude. After this expedition the Polar regions seemed to possess a magnetic



COLONEL HENRY WEMYSS FEILDEN



attraction for him, and he managed to find time to make several other exploratory journeys into the Arctic Circle, to Greenland, Spitzbergen, Novaya Zemlya, etc.

In 1880 Captain Feilden—for such he then was—first came into Norfolk and settled at Wells, where he continued to live, or it would be more exact to say, to make his headquarters, up to 1902, in which year he moved to Burwash, Sussex, to take up some property that had been left to him, and here he continued to reside up to the time of his death, at the end of June, 1921.

Feilden was not only a first-rate all-round field naturalist, but he also acquired a considerable scientific knowledge of the subjects that interested him, as may be seen in the numerous papers that he has left behind him. Especially was he interested in ornithology, and during his residence at Wells he added several specimens to the Holkham collection of birds, including a Norfolk-killed Great Bustard which he believed to be one of the aboriginal race. He was very fond of fishing and shooting, and the writer can recall memories of many pleasant days spent with him after wildfowl on the Wells marshes. He joined our Society in 1880, was President in 1885-86, and a Vice-President at the time of his death. Our library is indebted to him for the gift of a number of volumes. A few days after getting his copy of the Transactions he invariably sent a long letter of appreciative criticism to the Editor, which it was always most refreshing to receive. He contributed a number of papers to the *Zoologist*, the *Ibis*, our own Transactions, and other journals, and in many ways helped his life-long friend Harvie-Brown in the compilation of his well-known "Vertebrate Fauna of Scotland."

Mrs. Feilden died in 1920. There were no children of the marriage.

The portrait we are able to reproduce of Col. Feilden was taken on his 80th birthday, after he had been at work for six hours in his garden.—S. H. L.

HENRY MORRIS UPCHER

1839—1921

By the death of Mr. Henry Upcher, of Sheringham Hall, which occurred at Sheringham on April 6th, 1921, our Society loses one of its earliest members; for although not one of the original members—he joined in 1871—he was a member of fifty years' standing at the time of his death.

Born in London in 1839, Mr. Upcher was educated at Harrow, where he played in the eleven in 1858, and at Trinity College, Cambridge. When only a boy he began to show a more than ordinary interest in the study of birds and other things connected with natural history, and with the advantages that he enjoyed in the environs of his beautiful home, he was able to indulge to the full these hobbies, and all other out-of-door recreations such as one associates with the life of the country squire of what may, in comparison with the present unenviable position of landed proprietors, be called the good old times. At the same time it is a little difficult to give much information about him as a Naturalist, as he was always a very reserved, though keenly observant man, who rarely spoke much about what he had seen and more rarely committed his experiences to writing.

In the interval between leaving school and entering upon his college career Mr. Upcher, at the age of 19, accompanied Canon Tristram on the first of the latter's well-known journeys to Palestine. The party consisted of Dr. Tristram, the Rev. C. W. Shepherd, Mr. Medlicott, Mr. Bartlett-Woods, and others. They left on December 9th, 1858, and returned in the following June. Owing to the somewhat disturbed state of the country they were prevented from exploring as widely as they had intended but, in spite of the restrictions, about 100 species of birds were either seen or secured. Even at this early age Mr. Upcher was a first-rate shot, which fact earned for him from the Arabs the title of "Father of Two Eyes."

In April, 1862, he set out on another ornithological expedition, again with his friend the Rev. C. W. Shepherd, and Mr. E. G. Fowler, of Gunton Gall, Suffolk, but on this occasion to an



HENRY MORRIS UPCHER



unknown land—Iceland. Their object was to explore the N.W. peninsula of the island, which had never previously been attempted, and to investigate the Vatna Jökull range of mountains, and “to settle if possible some vexed questions in ornithology.” They left England “two months earlier than we had intended to set out, but we had certain ornithological enquiries in view which required our earliest presence in that Country.” Encountering exceptionally heavy weather with much snow, they were exposed to many hardships and a good deal of disappointment. However, by July they were able to visit the islands, where they found “a vast assemblage of ducks of many descriptions.” Among the birds that they found nesting were the Icelandic Golden-eye, Black Scoter, Gadwall, Wigeon, Pintail, Harlequin Duck, Slavonian Grebe, Iceland Falcon, Red-necked Phalarope, Great Northern Diver, and many others. Mr. Shepherd, from whom we have quoted, ends his account of the journey with, “Thus ended an expedition not wholly successful yet not without its rewards.”

As a sportsman Mr. Upcher was well known, and at the partridge-driving weeks at Holkham under the generalship of the late Lord Leicester, was never far from the top of the list when the “counting” took place. During the War years curious entries occur in his game-book, such as “Shooting stopped in afternoon owing to naval engagement off Lowestoft, as our shooting puzzled those who were listening for signals.”—Nov. 3, 1914.

Mr. Upcher had a fine collection of stuffed birds at Sheringham, many of them of his own shooting, which he was always pleased to show to anyone interested.

He was a good cricketer and very fond of fishing, and with this object made several visits to Norway and to various rivers in the British Isles. He was a man imbued with a strong sense of local patriotism, and the town of Lower Sheringham, which developed into a sea-side resort entirely within his life-time, owes much to his generosity and to his wise counsel. To the fisherman of Sheringham he was a real friend, and he bore the

cost of the upkeep of the life-boat, the "Henry Ramey Upcher," presented by his mother in memory of her husband, up to the time of his death.

In 1883-4 he was President of our Society, when he devoted his presidential address to an appeal for the more adequate protection of the fauna and flora of the county. At the time of his death he was one of our Vice-Presidents.

The accompanying portrait of Mr. Upcher was taken about nine years ago.—S. H. L.

JAMES REEVE, F.G.S.

1833—1920.

Mr. James Reeve, F.G.S., for many years Curator of the Norwich Castle Museum, died at Norwich on December 19th, 1920, in which city he was born on May 12th, 1833. He was one of the eight original members of the Norfolk and Norwich Naturalists' Society who were alive at the Jubilee of the Society in 1919. In 1910 he was elected a Vice-President, an honour he very much appreciated. Mr. Reeve was a Fellow of the Geological Society of London, and worked assiduously for thirty years collecting shells from a crag pit at Bramerton, near Norwich, a locality made classic by the work of Searles V. Wood and Samuel Woodward. His collection from this pit is one of the greatest treasures of the Norwich Museum, and he was very proud of one of his rare finds being determined by S. V. Wood as a new species, and named in his honour *Odostomia Reevei*. His original papers were published in the "Proceedings of the Norwich Geological Society," 1878-84, and innumerable references to specimens in his collection are to be found in the memoirs of S. V. Wood, F. W. Harmer, and E. T. Newton.

The account books of the Norfolk and Norwich Museum record that James Reeve started work at the museum on November 8th, 1847, and in the museum report for 1851 he is referred to as the Curator. He held this appointment with conspicuous success until 1894, when the collections were



JAMES REEVE



transferred by the shareholders of the museum to the Norwich Town Council and housed in the buildings provided under the Norwich Castle Museum scheme, inaugurated by the late Mr. John Gurney. The arduous and difficult work of moving the collections from the old buildings in St. Andrew's Street was carried out by Mr. Reeve, and it was due to his energy and knowledge of the exhibits that the collections were arranged in the new cases in October, 1894, when the Norwich Castle Museum was opened to the public by the Duke and Duchess of York. Mr. Reeve received the appointment as Curator under the Town Council in this year, and as Consulting Curator when he retired from active duties in 1910; this appointment he held at the time of his death, so that he was officially connected with the Museum for seventy-three years. He was a generous donor to the Museum, and as recently as 1910 purchased and presented a splendid example of the egg of the Great Auk (*Alca impennis*).

The Castle Museum reference library contains a bulky folio volume of the correspondence which passed between the late Mr. John Henry Gurney and Mr. Reeve during the years 1856-90, mainly relating to descriptions of plumage and measurements of birds required by Mr. Gurney for the further prosecution of his studies on raptorial birds during the formation of the collection at Norwich. The catalogue of this remarkable collection, in its day the best in England, is entirely in Mr. Reeve's handwriting.

The formation of the Art Gallery will remain a lasting memorial of the curatorship of Mr. James Reeve, as it was largely due to his insight and judgment that Crome, Cotman, and other artists of the now world-famous Norwich School of Painters are appreciated at their true worth in the world of art.—F. L.

PRESENTED

8 NOV. 1921





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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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NATURAL
HISTORY.

TRANSACTIONS
OF THE
Norfolk and Norwich
NATURALISTS' SOCIETY

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1921—22

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NORWICH

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OCTOBER, 1922

PRICE 10/-

Norfolk and Norwich Naturalists' Society



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K

- 1897 Kerrison Colonel E. R. A., C.M.G., Burgh Hall, Aylsham,
Norfolk
- 1904 Kinder Rev. E. H., Kirby Bedon Rectory, Norfolk
- 1909 King E. L., 4, Princes Street, Norwich
- 1898 Knight Edward, Keswick Old Hall, Norwich
- 1921 Knight John, East Walton, King's Lynn

L

- 1914 Laffan Major de Courcy, Little Acton, Wrexham, N. Wales
- 1918 Lascelles Miss Susan, Swanton Novers, Norfolk
- 1915 Laurence H. L. B., King's Lynn
- 1869 o.m. Laurence Rev. J. A., Dilham Rectory, Norwich
- 1894 Laurence R., Felthorpe Hall, Norfolk
- 1921 Le Strange C., Hunstanton Hall
- 1889 Lee Warner Henry, Swaffham
- 1909 Leicester The Right Hon. the Earl of, G.C.V.O., C.M.G., V.P.,
Holkham
- 1899 Leney F., Castle Museum, Norwich
- 1898 Lennard Sir T. Barrett, Bart., Horsford Manor, Norwich
- 1881 Long F., The Close, Norwich
- 1899 Long S. H., M.D., F.Z.S., M.B.O.U., *Hon. Sec.*, 31, Surrey Street,
Norwich
- 1907 Long Mrs. S. H., 31, Surrey Street, Norwich
- 1919 *Long Miss E. M., 31, Surrey Street, Norwich
- 1921 Lucas The Baroness, Hickling, Norfolk

M

- 1894 Manby Sir A. R., M.V.O., M.D., East Rudham, Norfolk
- 1905 Mann Sir Edward, Bart., Thelveton Hall Norfolk

Elected.

- 1909 Manning Rev. C. U., M.A., 20, Fonnereau Road, Ipswich
 1906 Marriott F. W. P., 2, Upper King Street, Norwich
 1892 Marsham Major H. S., Rippon Hall, Marsham, Norfolk
 1912 Mason A., Bank Plain, Norwich
 1922 Massingham H. J., 22, Westmoreland Road, Barnes, S.W. 13
 1911 Master George, M.D., Bury St. Edmunds
 1893 Mayfield A., F.L.S., Mendlesham, Stowmarket
 1898 Meade-Waldo Edmund G. B., Hever Warren, Hever, Kent
 1877 Miller Henry, Bosmere House, Norwich Road, Ipswich
 1922 Miller Osborne, "Beeleigh," Fakenham, Norfolk
 1919 Montague Rt. Hon. E. S., M.P., Breccles Hall, Norfolk
 1919 Morris S., Earlham Hall, Norwich
 1921 Moxey J. G., Framingham Hall, Norwich
 1919 Moxey Llewellyn, Framingham Hall, Norwich
 1920 *Mullens Major W. H., Westfield Place, Battle, Sussex
 1921 *Murton Mrs., Cranbrook Lodge, Kent
 1920 Myhill Miss M., Church Farm, Hethel, Norwich

N

- 1904 Napier A. J., *Hon. Mem.*, Teviotdale, Netley Abbey, Hants.
 1910 Nash J. T. C., M.D., D.P.H., Shirehall, Norwich
 1922 Nevill Rev. R. W., Beighton Rectory, Norwich
 1911 Newman L. F., St. Catherine's College, Cambridge
 1893 Newton E. T., F.R.S., *Hon. Mem.*, H.M. Geological Survey
 Office, 28, Jermyn Street, London
 1913 Newton W. C. F., The Meadows, Saham Toney, Watton
 1878 Nicholson F., F.Z.S., Ravenscroft, Windermere
 1889 Nicholson W. A., *Hon. Mem.*, 81, Surrey Street, Norwich
 1915 Nightingale S. R., Scratby Hall, Great Yarmouth
 1915 Norwich Public Library
 1919 Norgate Philip, Swanington, Norfolk

O

- 1921 Offord Miss Georgina, St. Giles' Plain, Norwich
 1914 Oliver Prof. F. W., F.R.S., *Hon. Mem.*, University College,
 London

P

- 1889 Page G. W., Fakenham, Norfolk
 1919 Pain Percy, Dersingham, King's Lynn
 1913 Paine Rev. N. W., Great Melton, Norfolk
 1919 *Palmer Mrs. P. Hurry, "Red Roofs," North Drive, Great
 Yarmouth
 1912 Parker H., 10, Aspland Road, Norwich
 1921 Parker The Hon. R. E., Easton Hall, Norwich
 1883 *Parkin Thomas, M.A., F.Z.S., High Wickham, Hastings
 1873 Partridge Rev. W. H., M.A., St. Peter's, Sandown, I. of W.
 1889 Patterson Arthur H., *Hon. Mem.*, 32, Lichfield Road, Great
 Yarmouth
 1920 Patteson Mrs. F. E., Great Hautbois House, Norfolk
 1901 *Paul J. J. Dawson, Eaton Grove, Norwich
 1911 *Payler Donald, Castle Museum, Norwich
 1920 Pelham Mrs. Sidney, 85, Newmarket Road, Norwich
 1903 Petre Col., Westwick Hall, Norfolk
 1921 Pigott, Miss M., Sheringham
 1872 Pigott Sir T. Digby, C.B., F.R.G.S., Sheringham, Norfolk
 1909 Platten Rev. T., The Close, Norwich
 1880 Preston A. W., F.R.Met.Soc., Christ Church Lodge, Norwich
 1919 Preston Sir E., Bart., Beeston Hall, Norwich

Elected.

- 1900 Preston F., Thorpe Mansions, Norwich
 1913 Purdy T. W., Woodgate, Aylsham
 1887 Pycraft W. P., A.L.S., F.Z.S., British Museum (Natural History),
 London, S.W.

R

- 1911 Rising A. P., The Manor House, Ormesby, Great Yarmouth
 1908 Riviere B. B., F.R.C.S., M.B.O.U., St. Giles' Plain, Norwich
 1893 Roberts E. T., 34, Carlisle Road, Norwich
 1919 Robinson F., Watton, Norfolk
 1869 o.m. Robinson H. S., Eaton, Norwich
 1908 Rogers Commander F. S., R.N., Ingham New Hall, Norfolk
 1909 Rogers Rev. Henry, Clarendon, Lowestoft
 1884 *Rosebery The Right Hon. the Earl of, K.G., 38, Berkeley
 Square, W. 1.
 1908 *Rothermere Rt. Hon. Lord, Hemsted Park, Cranbrook, Kent
 1897 *Rothschild Rt. Hon. Lord, F.Z.S., Tring, Herts.
 1879 Royal Microscopical Society, President of the, *Hon. Mem.*
 20, Hanover Square, W.
 1918 Rudd A. J., F.Z.S., London Street, Norwich
 1906 Rumbelow P. E., 27, Rodney Road, Great Yarmouth
 1919 Russwurm Mrs., Scarning Grange, E. Dereham
 1901 Rye Walter, 66, Clarendon Road, Norwich

S

- 1922 Sargeant Miss K., Mulbarton Hall, Norwich
 1921 Sherlock A. F., 45, York Road, Great Yarmouth
 1922 Shepherd Dr. Samuel, Aylsham
 1921 Silcock Chas., "Orgoodness," Claremont Road, Claygate, Surrey
 1919 Simpson F. T., Sheringham, Norfolk
 1917 Smalley F. W., "Hawthorns," 193, Clapham Road, S.W. 9
 1919 Smith Col. H. F., Didlington Hall, Norfolk
 1915 Smith Mrs., Ellingham Hall, Bungay
 1891 Smith W. R., Harleston, Norfolk
 1909 Snow T., The Craig, Windermere
 1921 Soman A. E., 37, St. Andrew's Street, Norwich
 1917 Sowels Miss, Thetford
 1911 Spurrell J. T., St. Faith's, Norfolk
 1922 Spalding G., 9, St. Stephen's Street, Norwich
 1921 Stimpson Edward, Sall Moor Hall, Recpham, Norfolk
 1919 Suffield Rt. Hon. Lord, Gunton Park, Norfolk
 1896 Sutton W. Lincoln, F.I.C., Eaton, Norwich

T

- 1921 Taylor Dr. Mark R., 49, Mount Pleasant, Norwich
 1921 Taylor Mrs. Mark, 49, Mount Pleasant, Norwich
 1878 Taylor Shepherd T., M.B., The Mount, Edgefield, Melton
 Constable
 1921 Thain D., West Somerton, Norfolk
 1906 Thomson D. G., M.D., C.B.E., 16, Mount Pleasant, Norwich
 1921 Thomson Mrs. D. G., 16, Mount Pleasant, Norwich
 1886 Thouless H. J., "Corfe," College Road, Norwich
 1910 Ticehurst C. B., M.B.O.U., 46, London Road, N. Lowestoft
 1896 Tillett Wilfrid S., 2, Claremont Road, Norwich
 1920 Todd Lt.-Col. Eardley, Mundham House, Brooke
 1902 Todd R. A., B.Sc., Plymouth

Elected.

- 1913 Tomes Sir Chas., LL.D., F.R.S., Mannington Hall, Norfolk
 1910 Tracy N., 3, King Street, King's Lynn
 1921 Troubridge Sir Thos. H., Bart., 48, Gt. Cumberland Place,
 London, W.
 1896 True F. W., *Hon. Mem.*, U.S. National Museum, Washington,
 U.S.A.
 1883 Tuck W. H., 5, Southgate Green, Bury St. Edmunds
 1906 Turner Miss E. L., F.Z.S., H.M.B.O.U., *President*, Langton
 Close, Girton, Cambridge

U

- 1921 Upcher H. E. S., The Gables, Upper Sheringham
 1869 o.m. Utting S. W., Stanley Avenue, Thorpe, Norwich

V

- 1880 Vaughan Matthew, The Limes, Marlborough
 1917 Vincent James, Hickling, Norfolk

W

- 1920 Wade Dr. E. W., Harleston
 1921 Wallis Rev. M. C., The Vicarage, St. Faith's
 1875 Walter J. H., F.Z.S., Drayton Hall, Norwich
 1921 Walton Miss, 17, Camberley Road, Norwich
 1872 Wheeler F. D., M.A., LL.D., Hellesdon, Norwich
 1883 *Whitaker Joseph, F.Z.S., Rainworth Lodge, Mansfield
 1901 Wild Edward, The Hawthorns, Eaton, Norwich
 1922 Willett W. L., The Rosary, Metfield, Kent
 1913 Williams Miss Margaret, 28, The Close, Norwich
 1909 Witherby H. F., M.B.E., F.Z.S., 326, High Holborn, W.C.
 1919 Woods Miss Amy, "Camiers," Mundesley-on-Sea
 1907 Wormald Hugh, M.B.O.U., Heathfield, East Dereham
 1922 Wortley Francis' "Congham," Sheringham
 1920 Wyllys Hugh, "Shrublands," Southtown, Great Yarmouth

Y

- 1915 Yarmouth Free Library, The, Great Yarmouth

TOTAL.

Honorary Members	...	...	11
Life	"	...	34
Ordinary	"	...	260
			<hr/>
			305
			<hr/>

The Treasurer in Account with the Norfolk and Norwich Naturalists' Society, Year Ending April, 1922

I. GENERAL ACCOUNT

	Dr.	£	s.	d.		Cr.	£	s.	d.
1921-22.									
To Balance on Deposit	...	56	2	0		By Norfolk and Norwich Library—Additional Rent,	3	3	0
" " Current a/c	...	30	19	0		1920-21	6	6	0
" Subscriptions	87	" " Rent of Room, 1921-22	...	...	...
" Sale of "Transactions"	117	" Cost of "Transactions," vol. xi., part II.	106	17	6
" Sale of "Flora of Norfolk"	3	A. E. Soman & Co.—Printing, etc.	27	0	6
" Transferred from Publication Fund	15	Illustrations	2	10	0
" Interest on Deposit a/c	36	Wrappers	15	11	3
" " from Life Membership Fund	1	Vitty and Seaborne—Illustrations	...	...	...
					1	Fire Insurance	151	19	3
					8	" Haydon—Bookbinding	...	...	...
					2	" Printing notices, etc.	...	...	...
					2	" Postages, etc.	...	...	...
					6	" Refreshments at Meetings	...	...	...
						" Assistant Secretary	...	...	...
						" Transferred to Life Membership Fund	...	...	...
						" Balance—Deposit a/c	12	3	6
						" " Current a/c	11	8	4
							23	11	10
							£247 17 9		

Examined and found correct,
W. A. NICHOLSON, Hon. Auditor.

ROBERT GURNEY,
Hon Treasurer.

II. SPECIAL PUBLICATION FUND

	£	s.	d.		£	s.	d.
1921-22.							
To Donations--				Transferred to General Account			
W. S. Tillett	5	14	0	...	...	...	...
J. H. Gurney	6	0	0	...	...	...	...
R. Gurney	10	0	0	...	...	...	...
S. H. Long	5	0	0	...	...	...	...
Mrs. Upcher	3	3	0	...	...	...	...
Sir E. Gurney	1	1	0	...	...	...	...
B. B. Riviere	1	0	0	...	...	...	...
W. A. Nicholson	1	0	0	...	...	...	...
L. F. Newman	0	10	0	...	...	...	...
R. J. Colman	0	10	0	...	...	...	...
H. Lee Warner	0	10	0	...	...	...	...
Sir E. Mann	0	5	0	...	...	...	...
A. B. Farn	0	5	0	...	...	...	...
Col. Todd	0	2	6	...	...	...	...
W. T. F. Jarrold	0	2	6	...	...	...	...
S. Morris	0	2	6	...	...	...	...
Mrs. Pelham	0	2	6	...	...	...	...
N. Sier	0	2	6	...	...	...	...
	£36	8	0		£36	8	0

III. LIFE MEMBERSHIP FUND

	£	s.	d.		£	s.	d.
1921-22.							
To £64 War Savings Certificates at cost	49	12	0	By War Savings Certificates dated 4/4/18	...	...	...
„ Balance at Norfolk and Norwich Savings Bank	33	12	10	„ £56 8s. 5d. 5 % War Stock, 1929-47	...	...	...
„ Life Membership payments	19	0	0	„ Interest Transferred to General a/c	...	...	...
„ Interest Savings Bank a/c	10	1	0	„ Balance at Norfolk and Norwich Savings Bank	...	...	...
„ Transferred from General a/c	20	0	0				
„ Interest on War Loan	1	8	2				
	£124	3	1		£124	3	1

Examined and found correct,
 W. A. NICHOLSON, Hon. Auditor.

BRITISH
MUSEUM
23 FEB 24
NATURAL
HISTORY.



ADDRESS

Read by the President, MISS E. L. TURNER, F.L.S., F.Z.S., Hon. M.B.O.U., to the Members of the Norfolk and Norwich Naturalists' Society, at their Fifty-third Annual Meeting, held at the Norwich Castle Museum, April 25th, 1922.

LADIES AND GENTLEMEN,

In reviewing the position of the Society at the end of my Presidential year, I think I am warranted in saying that this is an eminently satisfactory one. We have elected 39 new members during the year, and our total membership is now well over 300. Never before in the history of the Society has this figure been reached. The attendances at our monthly meetings have been above the average, and I think you will agree with me that the introduction of tea at these meetings has aided rather than detracted from the seriousness of our discussions.

During the year we have been honoured by the patronage of the King and of the Prince of Wales, both of whom have shown their practical interest in one of the objects for which we were founded, namely, the protection of wild birds in the county, and both have become subscribers to the new fund that we have started to carry out this work. I hope this fund will be well supported by members of the Society.

It is gratifying to report that no member has resigned on account of the subscription having been raised from 7/6 to 10/-. The cost of printing the Transactions is still nearly three times as much as it was before the War, and without the help of the "Publication Fund" it would be impossible for us to pay our way.

With these few preliminary remarks I will proceed to the subject of my address :

THE STATUS OF BIRDS IN BROADLAND

It is twenty years since I first explored the Broadland, and seventeen years since my houseboat was brought by land from Sutton Staithe, and launched on Hickling Broad. On March 18th, 1905, the "Water Rail" made her first voyage, carrying as her crew Mr. and Mrs. Bird and myself; steered and propelled by Alfred Nudd she came to anchor in the quiet haven, where some of the happiest days of my life have been spent.

If you would know people you must live with them, if you want to know birds you must live amongst them; but it is easier to understand human beings than birds. Being human, one possesses some kind of a key to the mind of man; but birds are more elusive. One longs to change places with:

"The faire Kynges daughter, Canacé,
That on her fynger bar the queynte ryng,
Through which sche understood wel every thing
That any foul may in his lydne sayn
And couthe answer him in his lydne agayn."

Between men and dogs there may be complete sympathy, but between humanity and birds there is a great gulf fixed:

"Birds, companions more unknown
Live beside us, but alone.
Finding not, do all we can,
Passage from their soul to man."

In spite of spending a large proportion of my life in a reed-bed, I have never yet been able to account for common everyday incidents of bird-life—such as the vagaries of coots (*Fulicula atra.*), their garrulousness all night in spite of their lively and strenuous days; or the sudden rending of the mystic Broadland silence in the autumn caused by their nocturnal evolutions—those combined rushes over the surface of the water, the sound of which is like the roar of surf against a rocky shore. Neither can one explain the meaning of the roll-call of the moorhens (*Gallinula chloropus*) round Hickling Broad. Close upon 10 p.m. (solar time) one bird starts crowing, and the challenge

is repeated by one moorhen after another all round the Broad. These are only two instances of the minor problems of bird life which baffle the enquirer at every turn.

Twenty years is a big slice out of one's own life, but less than nothing in the steady procession of Time. Nevertheless even in that comparatively short period, economic and physical forces have wrought considerable changes in the limited area which has been under my own observation. These changes react upon bird life, causing increase or decrease in the numbers of breeding birds of various species. Waste lands have been brought under cultivation, and cultivated areas have reverted.

The gradual silting up of channels leads to the rapid extension of reed-beds. Drifting "hovers" come to anchor in out-of-the-way places and form a nucleus of new land. Perhaps I should explain to the uninitiated what a hover is. The sudden release of marsh gas detaches portions of a reed-bed—blows them up, in fact—so that they float on the surface of the water. If wholly detached from their surroundings these derelict miniature reed-beds drift hither and thither, and become the sport of every wind. One August day in 1913, half the reed-bed fringing the south side of my little bay, and a large portion further east, blew up while I was absent for an hour. The whole aspect of the bay was changed, so that when steering my boat home I lost my bearings. The eastern portion of reeds was not wholly detached, and now, after a lapse of nine years, though still a floating mass, it has solidified. Soil has accumulated there, marsh-flowers and ragged robin (*Flos-cuculi* L.) grow upon it, and it is a favourite dressing station for moorhens and coots. This is only one instance of natural physical changes which are always taking place in the Broadland.

I am not taking into serious consideration climatic and seasonal changes; these, of course, for the time being largely affect the status of bird life. One bad season will work havoc with certain species, but a few favourable seasons restore the balance.

In order to understand the diminution in certain species, such as the lapwing (*Vanellus vanellus*), one must go back fifty

years or more. In the Golden Age of farming much more land was brought under the plough, and corn was grown right up to the edge of the Broad on the south-west side, where ridge and furrow are still easily traced. If you talk to the oldest inhabitant he will say that in his young days his wife and daughter used to "fill their aprons" with lapwings' eggs, daily, during the breeding season. Now that this ground has more or less reverted to marsh there are seldom more than eight or ten pairs to be found breeding there. I say more or less reverted to marsh, because land once cultivated cannot absolutely return to its pristine condition. Twenty years ago the lapwing was plentiful on the marshes all round Hickling; you could not walk anywhere between Hickling and Horsey without being mobbed by numbers of irate males. Now the majority of lapwings nest further away, on Martham Holms, and similar mown and cattle-fed marshes.

Changes which affect the status of the lapwing, affect also that of the redshank (*Totanus totanus*) and snipe (*Gallinago gallinago*). But the redshank is less particular in its choice of a nesting site than the lapwing, and may frequently be found breeding amongst vegetation that is both dense and tall. In spite of protection in certain areas, redshanks are steadily diminishing in numbers. Possibly what these three species—lapwing, snipe and redshank—would gain by protection, is checked by the depredations made amongst them by the larger birds of prey. In June, 1919, I watched a Montagu's harrier (*Circus pygargus*) raiding a small marsh day after day, until at last the remnant of young redshanks was moved across the Broad. The young swam while the old ones convoyed them from the air. This is the only occasion on which I have ever seen the redshank take to the open water. My attention was called to them by the agitated clamour and peculiar drooping of the wings of the old birds, as they hovered over the water, directing the movements of the young. The latter were not easily seen on the water and I did not realise what was happening until several half-grown birds landed on my island. After a brief rest, these tiny refugees moved on. The young are peculiarly buoyant

on the water and their attitude when swimming reminded one of the phalarope (*Phalaropus lobatus*).*

There are two great factors which in recent years have largely influenced the status of bird life on the marshes—namely motors and the Great War. Of the two the advent of the motor will probably produce the more lasting effect.

Time was when the marshes were regularly mown, and cattle fed, every year. Thirty years ago the whole of Rushills was annually cut and fed by cattle. On this ground you had shallow pools of water, and hillocks of dry ground, with sparse vegetation not more than nine inches to a foot high, and oases of short grass where waders revelled. Here ruffs (*Machetes pugnax*), lapwings, redshanks and snipes nested. But since this extensive cutting and feeding by cattle has ceased the growth of herbage has gone on apace, and now you have tall reeds covering the whole area which has entirely knocked out waders. Now bitterns (*Botaurus stellaris*), bearded-tits (*Panurus biarmicus*) and water-rails (*Rallus aquaticus* L.) breed there, while on the drier marshes, formerly under cultivation, harriers (*Circus*), short-eared owls (*Asio accipitrinus*) and corn-buntings (*Emberiza calandra* L.) nest.

When first I knew Hickling there was a large unsightly building near the "Pleasure Boat" Inn. This belched forth smoke and disturbed the Broadland peace with the scream of its engines. It swallowed up the picturesque lighter loads of marsh "hay" and vomited it into sacks as chaff. This underwent further treatment in order to make it palatable. "What will eat such stuff?" I once enquired of Alfred Nudd. "London 'bus horses," he replied with a wink; "they've no sense and don't know no better."

The tin shed has vanished, and the horse has nearly disappeared from the London streets. The marshes are now mown intermittently, and there is little or no sale for the haysel, except for litter. Some of the so-called meadows have reverted and their rough herbage is stronger and coarser than ever.

*I also saw the young removed this year, 1922.

Cattle no longer feed in them. Their rank vegetation provides abundant cover for corn-buntings and grasshopper-warblers (*Locustella naevia*), but excludes the dainty yellow wagtail (*Motacilla raii*). Horses and cattle and yellow wagtails were ever friends. During the breeding season you can see more yellow wagtails in an hour on the sheep-bitten turf of Romney Marsh, than you are now likely to meet in a week on many of the Broadland marshes. Yellow wagtails dislike coarse rank herbage, while they love cattle-frequented marshes where insects abound. Formerly I used to stumble across half-a-dozen nests in a morning ; but year by year this species has become scarcer until, in 1921, only one nest was found in a wide area round Hickling. But farther down the river, on the Potter Heigham and Acle marshes, they are still fairly numerous where cattle abound. During the Potter Heigham regatta in 1920 I watched a young brood of yellow wagtails playing round the feet of a huge cart horse. They clung to its great shaggy fetlocks—sometimes three birds together, and from this position hawked for flies ; or, reaching up, snapped at those infesting the horse's legs. When the horse shook himself they darted off with joyous call note, but returned as soon as the horse was tranquil.

The scarcity of the yellow wagtail is a great loss to bird lovers. Its brilliant nuptial dress, dainty ways and musical note, all combine to render it one of the most attractive of marsh birds. Every year a pair used to come at dawn and pilfer cocoanut fibre from my doormat for their nest. They are, by the by, given to petty thefts. I have seen them steal down from a mallard's nest while the duck was absent ; for what purpose I do not know, as a yellow wagtail does not line its nest with down. Nevertheless this pair took down and feathers three times in an hour. I could give many instances of their confiding ways and general fearlessness. One in particular stands out in my memory. Finding some difficulty in focussing the first nest of this species which I ever photographed, I covered it with my handkerchief. While I was adjusting the focus of my lens from the inside of my tent, the female returned, pulled the handkerchief aside, and snuggled down beneath it.

Numbers of yellow wagtails may be seen on migration, especially during the autumn when little companies come in to roost round the reed-fringed swamps ; but as nesting birds they have forsaken their old breeding haunts where these have reverted to rough wastes.†

During the war, many marshes, meadows and reed-beds, which, under ordinary circumstances, would have been mown annually or biennially, were entirely neglected. Consequently warblers, reed buntings (*Emberiza schæniclus*) and meadow pipits (*Anthus pratensis*) abounded in these areas. I have never heard such tremendous outbursts before dawn as occurred during the Springs of 1918 and 1919. The numbers of reed- (*Acrocephalus streperus*) and sedge-warblers (*Acrocephalus schænobænus*) that helped to swell the great chorus, seemed incredible.

The grasshopper-warbler—always a sparse breeder in the Broadland—holds its own. As a rule this bird returns regularly to its breeding areas, but its regularity cannot be called unflinching as is the case with some other species of warblers. In the few places where it nests one is sure to find *some* of the territories occupied while others may be vacant for a season. The following year *all* these territories may be tenanted. There is often no apparent reason for this fickle behaviour. As far as one can judge the conditions were the same ; the territory is simply “ to let ” one year and occupied the next.

The bearded tit is one of Norfolk's most precious possessions, and a species which certainly has benefited by more or less efficient protection. Nevertheless, but for the fact that it is an exceedingly prolific species, it would long ago have been wiped out. Latterly it has no more than held its own, and therefore still needs to be most jealously guarded. Its status is, of course, much higher than when Mr. J. H. Gurney, writing in 1899, gave an approximate estimate of its decrease in five decades, as follows :—

1848	1858	1868	1878	1888	1898
160	140	125	90	45	33

†There has been a slight increase in the number of breeding birds this season, 1922.

Mr. Gurney's estimate for 1898 (33 nests only) was based on returns from no less than twenty-one Broads. In 1909 I knew of seventeen nests in *one* small area only, all of which hatched off safely. An average clutch consists of five to seven eggs and the bearded tit rears two, and sometimes three broods in a season. Therefore one pair of bearded tits may hatch out a maximum of twenty-one young birds and a minimum of ten between April and September. Consequently the bearded tit ought to be the dominant species in the Broadland, which it certainly is not. Between 1908 and the severe winter of 1917-18, it had steadily increased in numbers. But in 1919 there was a scarcity of bearded tits throughout their breeding area. In the autumns of 1920 and 1921 I saw only two broods of fledged young roosting in a reed-bed which had formerly sheltered three times that number. This year, 1922, I have seen only three nests.

In spite of the persistence with which the bearded tit has withstood the rigours of a Broadland winter, it is not a particularly hardy species, as its food consists largely of insects and their larvæ. Three captive birds which I kept during one winter, and ultimately let loose at Hickling, could never be induced to feed upon seeds of any kind. They were always scratching like barndoor fowls on my aviary floor, and fed voraciously upon minute white larvæ which infested the matted roots of canary seed. In the wild they devour large quantities of *Laverna phragmitella*, a grub which bores into the reed-mace during August, and remains there all the winter. In hard weather parties of bearded tits may be seen clinging to the reed-mace pulling the "pokers" to pieces in their search after these grubs. Incidentally they *may* consume a certain amount of seed at the same time. That the reed-beds harbour vast stores of insect food during the winter is proved by the numbers of wrens (*Troglodytes troglodytes*) which frequent them. When the Broadland is frost-bound and swept by bitter blasts, the bearded tit finds it hard to support life. Then, the tinkling of countless fairy ice-bells fringing the dead reed flowers, must ring the death knell of many a little life. The food supplied to the

young bearded tits consists entirely of insects, chiefly flies, and the smaller species of *Neuroptera* and *Trichoptera*. Later broods are fed on the may-fly and scorpion-fly, while larvæ of all kinds enter largely into their diet.

I once spent some days watching and photographing a male bearded tit which was, apparently, the sole supporter of a brood of five nestlings. His visits to this, the second family, were often hampered by the clamorous attentions of his first family, consisting of five fully-fledged birds. He paid no attention to them, as they were well able to fend for themselves. It is very hard work for *one* bird to keep the nestlings fed; nevertheless, ultimately the second brood also got off safely.

The mortality among young bearded tits must be enormous, hence the abnormal number of possible progeny. All nature cares about, in order that the average may be maintained, is that one species shall produce during its life-time *one* surviving pair—the rest is mere wastage.

On May 5th, 1910, I came upon three families crouching on the ooze in a muddy oasis surrounded by reeds. The young birds, just out of the nest, were partially concealed and excellently camouflaged by dead reed sheaths, and the tawny colour of the mud. It was an ideal spot for shelter and food; the old birds collected any amount of insects close at hand, and the reed-beds afforded shelter in case of alarm. A narrow dyke ran alongside, and into this I edged my canoe. There were at least fifteen young birds dotted about and I watched them lazily for some time. Suddenly the brilliant May day clouded over, and across the water came the roar of lashing hail. In two minutes I was back in my house-boat, and behind closed doors. Twenty minutes later my man was shovelling ice out of the stern sheets of my boat, before the doors could be opened. I never saw those young tits again. Such sudden changes of temperature, together with the tremendous down-pour of rain and hail, must shatter birds' nerves. Inexperienced young cannot be quickly rounded up into safety by distracted and anxious parents. Camouflage is no armour against hail, and no law can protect birds from the elements. The food

supply of most insectivorous birds is often temporarily affected by storms, and especially by continuous rain. Observe the restlessness of swallows (*Hirundo rustica* L.) on hopelessly wet days, when hungry broods are clamouring and the supply of insects is limited for the time being.

I have dealt at length with the bearded tit, because I want to impress upon all who are interested in this gem of the reed-beds the absolute necessity for rigid and unflinching protection if it is to go on increasing. The protector is up against far mightier foes than mere man. The egg collector is very fond of stating that he does the minimum of harm compared with the havoc wrought by storms or an unusually high tide. He forgets that when he joins forces with nature and *both* together prey upon wild birds, the egg-snatcher may finish the work of destruction that the elements have started. On the other hand, the protector of any given area is often aggrieved at the slow results of protection, forgetting that a bird's natural enemies are both numerous and powerful.

The short-eared owl has reappeared in certain areas where it had not been known to nest since 1904. In April, 1914, a nest was unfortunately mown up. Since then it has nested sparingly most years on the drier marshes which have gone out of cultivation.

Long-eared owls (*Asio otus*) have increased considerably since 1914. Perhaps the increase of vermin during the war may account for this. Both species of owls are common enough on migration. Since 1912 the majority of nests of the long-eared owl have been found on the ground. This is largely due to the destruction of many trees round the Broads by the disastrous floods of that year.

That "handsome and specious fowle," the great crested grebe (*Podiceps cristatus*), when first rescued from the danger of extinction, increased rapidly under protection. In a very few years all the Broads were again stocked with grebes. Naturally, as soon as the average number of breeding pairs was reached, the increase was not maintained, for a given area can support only a certain number of birds. There has been no

increase on Hickling Broad during the last fifteen years ; six or seven pairs only are to be found there. Formerly these used to rear an average family of two or three young apiece. During the last five years, however, they have seldom brought off more than one nestling each. On the other Broads—South Walsham, Ranworth, Ormesby and Rollesby—the grebes rear larger families. I once saw a nest on South Walsham Broad with six eggs, all of which hatched off. It was a fine sight to see the old birds with their six young, but this of course was an abnormal number. In these Broads the water is deep and discoloured, and consequently the fish are less wary. In the clear, shallow water of Hickling Broad the grebes cannot get up sufficient speed to catch fish, for as soon as they are within striking distance the fish see the grebes and dash into the reeds. Hence grebes have some difficulty in obtaining a sufficient number of small roach, rudd and bream for the young, and are obliged to feed them largely upon eels, a diet not so well suited to the young grebes.*

The deep water in Hickling Broad is confined to certain areas each of which is frequented by one and sometimes two pairs of grebes. Nevertheless when the nestlings are first hatched, the male bird goes far afield in search of food. I have on several occasions picked up day-old nestlings dead and in poor condition. Last year two adult grebes were picked up. The gizzard of each bird was packed until it was as hard as a stone, with the green, slimy weed locally known as "lamb's skin." When pulled to pieces the stuff was like cotton-wool, interwoven with the feathers which grebes usually swallow for digestive purposes. No doubt these old birds had been working hard for food in the shallows and places where this weed abounds.

Pike are powerful enemies of young grebes, as they are indeed, of the young of all water-fowl ; but whereas young coots, moorhens and water-rails are kept within the seclusion of the reed-beds for some days : the young grebe leads an adventurous

* Owing to the abnormally high water this season, 1922, Grebes have fared better.

life almost as soon as he is hatched. It is taken out to the open water and sees life at a very early age. The young are of course guarded by one or both parents; but I have frequently seen the old birds utterly regardless of the young if another pair of grebes trespasses on their territory. While the parents are fighting and pursuing their submarine tactics, the very conspicuous young swim round uttering loud querulous cries. It is curious how conspicuous the young grebe is in spite of his tiger stripes. These markings camouflage it in the nest; but as it spends very little time alone in the nest, their use is limited. In the open the striped head and light down can be seen a long way off.

The ruff is still a frequent passage migrant, but has not been known to nest on the Broadland since 1907. The last previous record was in 1889. I photographed the 1907 reeve brooding over a clutch of red-shank's eggs. I did not know it at the time, but the reeve's own eggs had been sent to a well-known collector. I, in my innocence, thought they were being safely brooded by a neighbouring redshank during the hours when I was trying to obtain photographs of the reeve.

It is always stated in ornithological books that the ruff became extinct as a breeding species in Norfolk owing to the drainage of the fens. This is not true. In Holland where drainage is universal the ruff still abounds, and, like the black tern—another extinct British breeding species—has adapted itself to new surroundings. Our own British stock need not have become extinct. It was ruthlessly slaughtered for the table, and as its numbers diminished, the few remaining birds fell victims to the collector. Every season I hope to see this extraordinarily interesting bird nesting again in its old haunts; but it is so easy to destroy the native stock of any species, and so difficult to reinstate it. Inherited tendencies are all powerful where birds are concerned, and the homing instinct the mightiest force of all. It is a long time since the ruff had any home in the Broadland, and consequently any inducement to return there. Mr. Gurney recorded two Norfolk nests in

1878. Since that date it is doubtful if any broods have hatched off.

The fact that the bittern has returned and established itself again in Norfolk opens wide the door of hope for the ruff, black tern, black-tailed godwit and avocet.

It is hardly necessary for me to say much about the bittern in this paper, as I have already dealt at length with this species.* That 8th July, 1911, when James Vincent and I captured the first young bittern that had been seen in Norfolk since 1886, will never be forgotten by either of us.

Now once more

“ The bittern booms from the distant fen,” and its deep resonant note regularly accompanies the “ sweet jargoning ” of “ all little birds that are,” both by day and night throughout the breeding season.

But after all, ordinary everyday possessions are often more precious than choice gifts. Therefore one regrets the diminution in the numbers of familiar birds.

At the present time you can easily reckon up the few pairs of snipe bleating during the day or night. Yet I remember sailing up the Muck Fleet one April night in 1903, when the whole air was vibrant with sound. Numbers of snipe disturbed by the unwonted sight of a sail, rose and bleated in unison. It was one of the unforgettable thrills of my life. Now that so many of the regularly-mown swamps have become thick reed-beds there is no place for the snipe.

On the whole this is rather a pessimistic paper, for it seems as if so many of the commoner species of waders were gradually decreasing in spite of protection. The protector is up against forces with which he cannot always cope, nevertheless protection must be made as efficient as possible.

Extended agriculture is not necessarily destructive to bird life. In many cases it is beneficial. On the other hand, given sufficient protection, certain species which are in danger

* Transactions, Norfolk and Norwich Naturalists' Society, Vol. X. Part IV., p. 319.

of being ousted can and do adapt themselves to changed conditions. It is often very hard to drive away a well-established local species from its breeding area. Near my old Kentish home a disastrous fire occurred one April night. A tract of forest including all the low scrub was destroyed. One corner was the particular haunt of wood-warblers. Although this was a blackened ruin the birds returned and bred there as usual. They sang amidst the scorched branches of oak and beech, and nested amongst the charred undergrowth. The black tern is another well-known instance of adaptation to environment. This bird is as much at home on the Dutch polder lands as it was amidst the water-plants of the meres.

Ruskin has said—

“God gave us the earth for our lives. It is a great inheritance.”

Nowhere in England has the nature-lover a greater inheritance than in the Norfolk Broadland—

“Slow streams stealing through level meads;
Flats where the marsh with the ocean mingles;
Meres close guarded by sentinel reeds.”

Taking the county as a whole, nowhere can be found a richer or more varied bird life than on these marshes.

Perhaps no men have done more for the preservation of their great inheritance than the men of Norfolk. It is up to you to strain every nerve to maintain this heritage in the

“Land of windmills and brown-winged wherries
Gliding along with the gait of queens.

Land of the Broads, the dykes, and the ferries,

Land of the Sounds, the Brecks, the Denes.”

II.

THE DROUGHT OF 1921

BY THE REV. M. C. H. BIRD, M.A., M.B.O.U.

THE long-protracted drought of 1921 is an event of such an unusual nature and likely to have such far-reaching effects, that it must be of interest to place on record the results of this "annus mirabilis" upon the common objects of the country side. I will therefore endeavour to trace some of these so far as my own nature notes and observations, and the remarks of friends, enable me.

As "the proper study of mankind is man," let me commence by mentioning that according to the kind information of our local Medical Officer of Health, Dr. B. D. Z. Wright, of Hoveton St. John, the very remarkable and sunny season has certainly not been injurious in respect to its effects upon the weakest individuals of the genus homo. Far otherwise; for with the sole exception of tuberculosis, the small increase in which may probably be accounted for as an aftermath of the war, and partly too perhaps to the increased care taken in the early diagnosis of this "white man's scourge," it has been a remarkably healthy year. Only twenty cases of other notifiable diseases occurred in the forty-two parishes of the Smallburgh Union, and the death-rate for the United Kingdom has been the lowest on record.

Our pumps and our ponds may have failed; our rain-water tubs may have cracked and lost their hoops from constant dryness; but we have been spared much of the irritating music of the many gnats which in moist seasons were wont to use these latter receptacles as their convenient nurseries. One event of the past year, of which I have not heard any suggested explanation, is the fact that there is, and has been for some months, certainly two feet of water above record in the Perch Lake at Westwick, and no less than five feet more than it contained two years ago; and two other ponds, one on either side

of the road from North Walsham to Norwich, had in December last more water than usual.

Passing on from man to our wild and domesticated animals, a dry year has again proved to be a good rabbit year and a bad rat year. I never remember, whilst going round with the Stalham Farmers' Club root judges during the past ten seasons, noticing less work of these destructive rodents. Many moles died in consequence of the drought, young ones especially compassing their own destruction by coming out of their tunnels for water and being unable to burrow back into the hard, baked ground.

Much complaint has been made concerning the comparatively little growth made by grazing cattle and even by tame rabbits and ducks during the summer months, a fact which a scientific friend has attributed not merely to the shortness of grass and other green stuffs, but also to a deficiency in vitamins contained therein. On the other hand, turkeys, which consume much green food, did extremely well, and two or three cases of birds of the year laying between October and December (a very unusual occurrence) were reported to me.

The year will long be remembered by our sea-faring population as the most disastrous season on record. No herrings at all were taken after the second week in October, and instead of having a goodly sum of money to bring home at the end of the autumn fishing, most of the crews finished up in debt. No very reasonable account has been given for the lateness and comparative scarcity of the herring shoals arriving off our coast. The subject of fishing reminds me that some years ago I heard a man in the north of Scotland offer a sovereign in vain for half a pint of worms ; but I never expected that Broadland fishermen would have to pay five shillings for 120, as was the case during the past dry summer, the protracted drought having driven these humble creatures so deeply into the ground as to render their capture both laborious and expensive.

It was recently stated in the public press that many salmon had been killed in the Esk through the drought. In hot summers it is not an uncommon thing to see coarse fish floating

dead on the top of the water at Hickling, Heigham, and Horsey, and this is variously said to be the result of high temperature in the low waters, the effect of salt tides coming up the rivers (though there are salt springs in Horsey mere), or marsh gas ; but curiously enough I cannot learn of any fish having been so turned up hereabouts in 1921.

The effect of the season on birds is apparent from the following Brunstead records :—

Song Thrush first heard singing Jan 6, 11 days earlier than
23 years average.

Blackbird first heard singing March 18, 19 days later than
23 years' average.

Chaffinch, first heard singing February 19, 13 days earlier than
34 years' average.

Swallow first seen April 22, 4 days later than 34 years' average.

Cuckoo first heard April 13, 5 days earlier than 34 years'
average.

Spotted Flycatcher seen May 20, 4 days earlier than 34 years'
average.

Swallow last seen October 7, 1 day earlier than 23 years' average.

Grey Crow first seen October 12, 5 days later than 34 years'
average.

Woodcock first seen October 14, average date of 34 years.

Jack Snipe first seen October 17, 22 days later than 34 years'
average.

February Cuckoos were again reported last year, and also very early nests of Song Thrushes and Blackbirds. Young Robins flew on March 10th, but I did not record the autumn song of this species until August 15th, a few days later than the average. Mr. J. Vincent told me of two nests of the Great-crested Grebe as found by him on February 21st, and reported a big migration of insectivorous birds at Hickling as early as July 27th. We had remarkably few swallows in 1921, and I never remember them flocking so early ; there were no second broods, one pair leaving eggs behind them in my stable. Wild geese and swans arrived before the end of October, but this was

not such an unusual occurrence in Broadland as the correspondence in the local press indicated. There were the usual late broods of wood pigeons, and I came across nothing abnormal in the nesting habits of the starling, which may be looked upon as the best time-keeper of our British breeding birds; for I have never failed to chronicle young birds out abroad between May 31st and June 2nd during the last thirty years. Very few snipe bred on Brunstead and Ruston Commons last year, probably owing to their unusually dry condition.

Practically all the spring and summer insects were several days early in appearing. For instance, I noted—

Honey Bee visiting flowers on Feb. 15th, 9 days earlier than an average of 23 years.

Humble Bee first seen on March 5th, 5 days earlier than an average of 23 years.

Wasp first seen on March 24th, 22 days earlier than an average of 23 years.

Small Garden White Butterfly first seen on March 31st, 17 days earlier than an average of 23 years.

Orange-tip Butterfly first seen on April 13th, 25 days earlier than an average of 23 years.

Meadow Brown Butterfly first seen on June 22nd, 9 days earlier than an average of 23 years.

Brimstone Butterfly, first spring appearance March 24th, 14 days later than an average of 31 years.

Brimstone Butterfly, first autumn appearance October 7th, 25 days later than an average of 31 years.

I saw a Brimstone on the wing on November 24th, the latest record I have for this insect, though I believe it has been observed in previous years in December. I noted a Hummingbird Hawk Moth on October 14th

Humble Bees ,, 15th

Wasps ,, 28th

Honey Bee at small fuchsia, October 30th

Small Copper butterfly and many Gamma moths, October 16th

Red Admiral butterflies and small Garden Whites, ,, 7th

and during the late summer months two-spot ladybirds were

unusually numerous. As to the black variety of the swallow-tail butterfly obtained in the county last September, may not the unusual colour of this individual have arisen from the moisture-loving plant upon which the parent insect usually deposits its eggs having become so dwarfed by the drought as to render it inconspicuous? This explanation is suggested by school-day reminiscences of experimentally feeding silkworm and tiger moth larvæ on greenery other than mulberry and dock leaves.

VEGETATION

Vegetation soon responded to the unusual spring warmth, and snowdrops (*Galanthus nivalis*) were in bloom by January 3rd, and yellow crocus (*Crocus vernus*) on the 13th. This year (1922), owing probably to lack of moisture in the soil, neither had appeared above ground by the middle of the month. *Petasites fragrans*, owing to the same cause, did not blossom until December 26th, whereas we had several heads of expanded bloom a month earlier in 1920. *Ribes sanguinea* was out on March 12th, the earliest date I have ever recorded it.

The following list of plants gives a phenological representation of the summer of 1921 :—

- Lesser Celandine (*Ranunculus Ficaria L.*) in bloom Jan. 9th, 26 days early for 23 years' record.
- Blackthorn (*Prunus spinosa L.*), in bloom March 21st, 21 days early for 23 years' record.
- Garlic-mustard (*Alliaria officinalis*), in bloom March 29th, 24 days early for 23 years' record.
- Greater Stitchwort (*Stellaria Holostea L.*), in bloom March 31st, 21 days early for 23 years' record.
- Asparagus, first dish of, April 1st, 22 days early for 33 years' record.
- Horse Chestnut in bloom, April 23rd, 17 days early for 23 years' record.
- Hawthorn (*Cratægus Oxyacantha*), in bloom May 10th, 7 days early for 23 years' record.
- Oxeye Daisy (*Chrysanthemum Leucanthemum L.*), in bloom May 27th, 1 day early for 23 years' record.

Dog Rose (*Rosa canina L.*), in bloom May 31st, 10 days early for 23 years' record.

Knapweed (*Centaurea nigra L.*), in bloom July 8th, 3 days early for 23 years' record.

Harebell (*Campanula rotundifolia L.*), in bloom July 14th, 5 days early for 23 years' record.

Great Bindweed (*Convolvulus sepium L.*), in bloom July 13th, 6 days early for 23 years' record.

Scarlet Field Poppies (*Papaver Rhœas*) were still in bloom on October 28th. Mushrooms were found on the lawn, under snow, on November 8th, and dandelions (*Taraxacum Dens-leonis*) and daisies (*Bellis perennis*) were out in blossom on December 26th. Frosts in the last week of November killed a geranium which had survived the winter of 1920. It is a curious fact that plants growing in water are nevertheless affected by the annual rainfall. For example, the reeds (*Arundo Phragmites*) which fringe our Broads are this winter (1921-22) some twelve inches shorter than after an ordinary season, and slender too in proportion. Reedmace (*Typha*) was also dwarfed and died down exceptionally early. Candle or Pin-Rushes, growing on the inside marshes, scarcely made any start before August; in fact, marsh stuff of all kinds was so short as to bring forth the remark of those who had to cut it, that there was not so much litter as they had left after the previous year's mowing.

During the summer I saw two large plants of single petunia carrying over twenty blossoms a-piece, and these had stood out all the previous winter under an east wall. Many verbenas and yellow calceolarias similarly survived in my open borders, but the latter, though blooming well up to July, nearly succumbed to the subsequent drought. I came across several instances of second blooming in apples, which is not very unusual; and in September I gathered out of the way of the blackbirds five half-sized and half-ripe pears of an early fruiting but unnamed variety.

As an experiment to stay the ravages of the birds on fruit, including tomatoes, I placed a large pan of water on my lawn,

but was much disappointed at the fewness of visitors to it ; a covey of partridges made persistent but fruitless attempts to get through wire netting to reach a small pond in my orchard.

Early fruited strawberries blossomed again in the autumn, as also did *Lathyrus splendens*, and I found blackthorn in bloom on October 28th. *Oleasia Hastii* persisted until the November frosts, and *Philadelphus* made fresh growth in September, as did several trees, horse chestnut especially.

The most conspicuous feature of the country-side in November was its greenery ; many trees, oaks especially, retaining their summer dress until the frosts started. Several trees of other kinds, sycamore, lime, elm, ash, and beech had in some situations dropped part of their foliage much earlier in the year, perhaps as an effort of Nature to stay the loss of sap through excessive transpiration ; but as a general rule never were short stubbles and ripening roots, and even freshly springing wheat, surrounded by such a panorama of living greenery. The protracted drought killed many rhododendrons, and common laurels were in many instances browned to the ground, whilst Portugal laurels were but little affected. A remarkable instance of recovery from being apparently killed by the drought was observable in the fronds of polypody ferns growing on dried-out banks. These held up their heads again in the autumn as if nothing unusual had happened to them meanwhile. The ash put forth its leaves considerably in advance of the oak and yet no "soak" followed. It has been said in one of the gardening papers that no further credit can be given to the old saw about the respective leafing of these two trees indicating what the weather of the succeeding summer is to be like. I would remind you that in our Transactions for 1898 you may find a table drawn up by Mr. Preston, in which he gives the foliation of these two trees for the previous ten years together with the rainfall for each season, from which it may be seen that only in 1888, when the rainfall was about $1\frac{1}{2}$ inches below the average, did the ash come into leaf before the oak. In the wettest year of the series, 1892, and again in 1893, which was the driest, the two trees kept to their regular order. The average date of their respective leafing during the ten years

was oak May 3rd and ash May 10th. In order to ascertain which trees best withstood and which made least resistance to the drought I made some measurements, but found this to be a much more difficult task than I anticipated. In fact, with the exception of the coniferæ, which continue the annual growth of their leading shoot for many seasons, whilst nearly all other species soon begin to assume a more or less umbrella-like top growth, it is practically impossible, unless one has access to a well-stocked nursery of forest trees, to estimate the average annual growth of a whole tree otherwise than by possessing a record of trunk girth measurements for previous seasons, or by comparing the distances between the concentric circles inside the trunk. I found that measuring the annual growths on the branches gave very uncertain and even conflicting results. I must therefore content myself by recording a comparison of the yearly growth of forty spruce firs of about twelve years old, planted out at the same time and growing near together and under similar conditions.

The average growth made in each of the last three years was as follows :—In 1919, $17\frac{1}{8}$ inches ; in 1920, $14\frac{1}{8}$ ins.; and in 1921 only $5\frac{1}{2}$ ins. These growths are remarkably in proportion with the respective rainfall of each season : $5\frac{1}{2}$ ins. growth with $15\frac{7}{100}$ ins. in 1921, $14\frac{1}{8}$ ins. growth with 24 ins. of rain in 1920, and $17\frac{1}{8}$ ins. of growth in 1919 with $29\frac{9}{100}$ ins. of rain.

FARM CROPS

Both haysel and harvest were much earlier than usual and of shorter duration. The haycrop was a good deal below the average, and there was no second crop, so that although the cllands were too hard to break up in early autumn, there was no trouble in burying the aftermath when ploughing became possible, though the wiry stems of the deep-rooted wild carrot (which is supposed to be kind for the following wheat crop) were much in evidence.

The earliest autumn-sown corn vegetated very rapidly in consequence of the warmth of the soil, and one of the outstanding results of the fine summer was the remarkably fine

wheat crop, both as to quantity and quality, the yield running up to some eighteen coombs per acre. Some wheat, threshed at Westwick as soon as it was cut, was so dry that it was shot out of the sacks on direct delivery to the corn merchant without any fear of its heating.

Barley and oats were about up to the average in bulk, though there were some complaints as to the quality of the former, there being a good deal of small corn and also of smut in some localities.

Beans and peas were quite up to the average. Green field peas were sold in the London market during the first week of June, the earliest date for the past twenty-five years.

Potatoes, though looking well a-top, proved to be very disappointing when harvested.

As to the root crop, we here come to the second most remarkable effect of the drought upon agricultural produce, and this time for the worse. White turnips were an absolute failure, and Swedes not a quarter of our usual crop; in fact, the return for the United Kingdom was the smallest on record. On some of the best and best-farmed land in E. Norfolk the Stalham Farmers' Club root judges estimated the produce at only fourteen tons per acre, and after it had been carted had the unique experience of being told that they had given the farmer credit for more than he had produced. Aphides and mildew attacked the Swedes in early growth, and owing to the scarcity of rain to maintain and cleanse the foliage the leaves shrivelled and dropped, and as a consequence the bulbs did not swell. When slight rain *did* come, a number of adventitious roots were thrown out halfway up the bulb as an effort to absorb surface moisture, and the presence of these made pulling more arduous without adding materially to the weight or feeding-value of the crop. I heard of an early-pulled tumbrel-load of Swedes, which had been left on the cart all night, being covered in the morning with a blanket-like mass of blue-grey aphides, the insects having swarmed up to the top of the load for air.

Mangold, rooting more deeply than Swedes, were better able to withstand the protracted drought, and the average weight

per acre was even heavier than usual in our district, the best running up to some sixty tons. I never remember root crops being more free from weeds, and one of the benefits of the wonderful season has been the good and prolonged opportunity afforded for cleansing the land.

Harking back for a moment to the shortness of the Swede crop, I may just say that I heard a successful farmer endeavour to console himself and friends with the idea that it was but a blessing in disguise, for had there been a bumper crop of turnips as well as of mangolds he and his fellow-agriculturists would all have been ruined through the loss on the bullocks which they would have had to buy to consume it! I asked the same cheery individual what he reckoned were the most remarkable results of the drought and he said, *inter alia*, "that it did us no more harm than it did," and there is a good deal of truth in that remark. This applies to the Broadland district of the county, which probably suffered less than any other part of England; or at any rate the effects of the drought were less marked in this area, where we have deep soil which has been cultivated under the four-course shift for generations. My observations may therefore not agree with the experience of those members whose lot in life has not been cast in such a highly favoured district, adjacent both to the sea and to the Broads.

THE FAILURE OF THE NEWLEYS

Perhaps the worst damage to farm crops resulting from the drought may prove to be the general failure of the newleys, which have been so extensively ploughed up. Hay must therefore be exceptionally dear in 1922; but even this loss will not be so severely and directly felt as would have been the case before the days of motor traffic. Until last year it used to be said that "a dry stunt is always better than a wet one," that is, that crops receive less damage and recover more rapidly from the effects of excessive heat than after excessive rainfall. But after the experience of the past season and its disastrous effects upon turnips, clover, and grassland, the truth of this local

proverb may be questioned. Another old adage says that "grass which grows in Januaire, grows the worse for it all the year": pastures were green throughout January, 1921, and feed soon ran short in the early summer both on pasture and marshland, though there was subsequently a certain amount of grass quite up to Christmas.

Never before, perhaps, has the benefit of deep and frequent cultivation and the superiority of muck over artificial manures been more apparent than during the past season; on the other hand, never has the damage done to adjacent crops by hedge-row timber been more distinctly visible.

Mustard sown on riddled stubbles after harvest for green-soiling rapidly disappeared after it had grown some six inches high, the Mustard Beetle (*Phædon betulæ*) being the culprit; though doubtless these tiny pests were aided by other similar insects whose natural food-supply had been cut short by the drought. Linseed, which did so well hereabouts in 1920, was a failure last year. I may say that I heard of barley straw, which had been laid in furrows ploughed out for potatoes last spring in Essex, having been found quite dry and undecayed when the crop was lifted; needless to say that that crop scarcely paid for the seed. I was also told of 1920-stubble being turned out whilst 1921-stubble was being ploughed in, and it was stated that a casual observer could scarcely have told which was the old and which the new! Up to Christmas week there were cracks three to four inches wide and several feet deep in grass fields adjoining the river Chelmer.

THE FRUIT CROP

The fruit crop of 1921 was generally a good one. Gooseberries, strawberries, and currants were quite up to the average; raspberries, being surface feeders, suffered badly and produced the smallest crop for years, but the colts thrown up are fairly strong. Nuts and walnuts were poor and small, but sweet chestnuts remarkably good. Figs were a record crop. Plums were a failure, whilst cherries were good and did not crack and split as is so often the case in ordinary seasons. Apples

produced more than an average crop of rather small-sized fruit, though some varieties, such as Allington Pippin, were unusually large. Local markets were glutted until mid-November, and the high cost of railway freightage precluded many growers from sending their produce to the larger towns. The same general remarks that I have made concerning apples apply also to pears. Colonel Petre informed me that at Westwick they had a record crop, early.

Many apple trees dropped leaves in July, but I never remember currants and vines retaining their foliage so late. I had three good bunches of Black Hambro' grapes on one lateral, having left all three for curiosity. Several monstrous wheat ears and examples of fasciated growth in various plants came under my observation, but whether or not these abnormalities were due to the season is uncertain. A seedling Loquat, growing under glass in an unheated house facing east, bore a few blossoms in 1920 for the first time; last year it bloomed profusely in November and December, but set no fruit.

GARDEN VEGETABLES

Asparagus was about three weeks earlier than usual; I cut a good bunch from a bed, part of which at any rate is over thirty years old, on April 1st. Potatoes were a little below the average, of fine quality, and kept well. From the neighbourhood of Great Yarmouth a good second crop was marketed in mid November. Moisture-loving celery suffered badly, unless frequently watered, and celery fly was very troublesome. Shallots and onions were exceptionally fine and were free from mildew. Brussels sprouts refused to button up until very late in the season, and cabbage stumps left to produce a second crop made but little subsequent growth. In fact, greens of all kinds were exceptionally scarce throughout the year.

Tomatoes under glass were probably a second crop, and also ripened well out of doors. Carrots, parsnips, and beet were unusually small, and turnips and autumn-sown spinach more or less of a failure. Beans and peas cropped fairly well but soon went off bearing, and the latter were much infested with

Weevil. Parsley stood the drought remarkably well, even on ground which had not been dug for years. Jerusalem artichokes grew little more than half their usual height, and their produce was affected accordingly. The drought was especially trying to lettuces, "Daniels' Continuity," the least given to running away of all varieties in ordinary seasons, bolting with the rest.

SUMMARY

The outstanding features by which 1921 will chiefly be remembered are probably as follows:—

On Farms, by the great wheat crop, the best since 1868; by the record bad Swede crop; and by the general failure of the newleys.

In Gardens and Orchards, by the failure of many surface-rooting plants; by the lateness of spring bulbs appearing above ground ere Christmas; by the glutted early market for apples; and by the great crop of figs, tomatoes, and honey.

By the Countryside in general, on account of the many denuded trees, shrubs, and parched-up grass early in the season; but more especially perhaps in consequence of the abnormal lateness of the oak leaf fall.

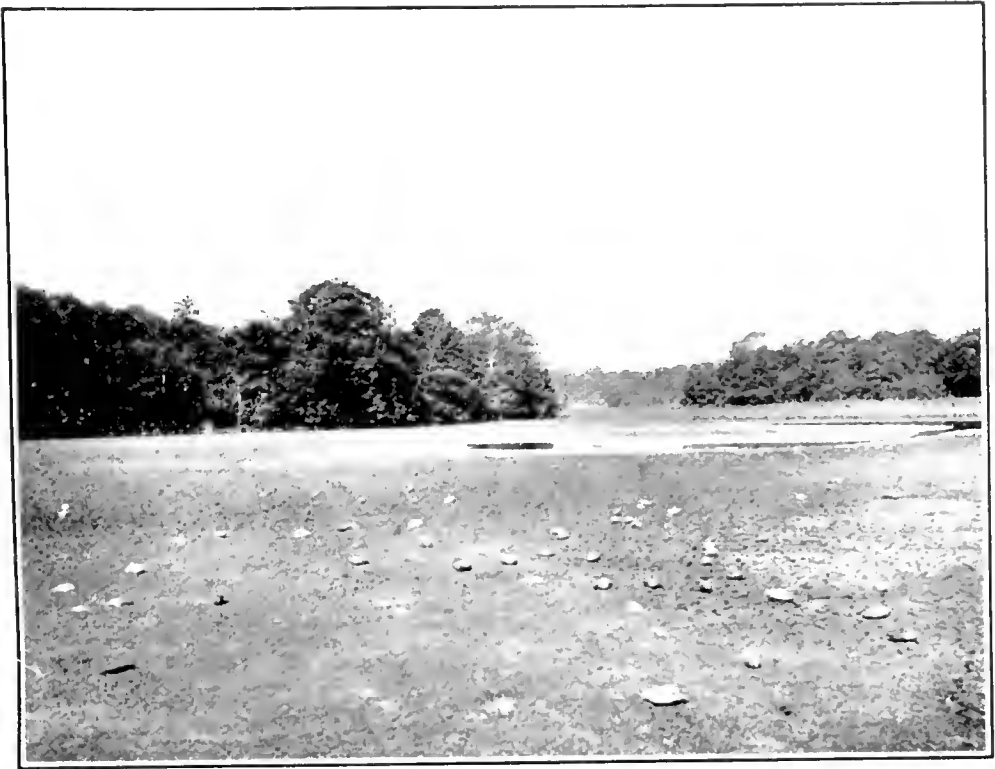
III.

EFFECTS OF THE DROUGHT IN THE BRECKLAND
DISTRICT

BY W. G. CLARKE, F.G.S.

THE average rainfall in 1921 at the twenty-five stations of the Norfolk Rainfall Organisation was 16.24 inches, an average deficit of 11.14 inches. On the basis that an inch of rain is equivalent to 100 tons per acre, the deficit for the whole county amounted to the prodigious total of 1,464,981,296 tons, or on an ordinary 300 acre farm to 334,200 tons. This amply accounts for the dried-up ponds and ditches, and great reduction in the volume of the rivers. The Little Ouse at Thetford was reduce to a trickle in mid-channel. Eels were caught in most of the ponds that dried up, however far they were situated from a stream. With the mean temperature of the year 2.6 degrees above the average, the effects of evaporation must have been much greater than in an ordinary year, when Ormesby Broad is said to lose 30 inches from this cause.

Meres and lakes fed by springs, such as Stanford Water and Beeston Lake, remained fairly normal; but those fed by rainfall or small streams, such as Thompson Water and Scoulton Mere, became practically dry. The Wretham Heath meres, which are dependent on the saturation-level in the chalk, were very full in the autumn of 1920. To the end of March, 1921, Ringmere, Langmere, and the Punch Bowl were low, but the effect on Foulmere was not very marked. In October, Ringmere and Fowlmere were very low, and Langmere and the Punch Bowl quite dry. On July 17th Langmere was quite dry with the exception of the pool on the north of the island, which, having the greatest depth, retains water the longest. The dried mud in Langmere and on the borders of Ringmere was covered with a liverwort (*Riccia crystallina*) not previously recorded for West Norfolk.



Photo

R. Gurney

Scoulton Mere, looking North. The mere was very nearly dry when this photograph was taken, Sept., 1921. Note the shells of the numerous dead mussels.



Photo

R Gurney

Fowlmere from the S.W., Oct., 1921

Note the adventitious roots on the trunks of the Alder trees, developed when the water was at a much higher level.

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The abnormally large acorns and the great quantity of well-matured chestnuts were noticeable in the autumn, and the barley fields presented an appearance outside the experience of any farmer. The quantity of shed corn was excessive, and this sprouted, so that in December it was six to nine inches in height, covering the fields with a dense mass of vegetation. Perennial weeds have rarely found the conditions of existence so detrimental to their well-being as during the summer, and many of the annuals either failed to germinate or were scorched up.

IV.

EFFECTS OF THE DROUGHT ON THE WATER SUPPLY OF NORFOLK

BY W. LINCOLNE SUTTON, F.I.C.

FOR its water-supply from underground sources the County of Norfolk depends upon—

(1) the Chalk, which underlies the whole of the county (except the extreme western edge), covered by a varying thickness of glacial Drift (up to 300 ft.) and Crag (up to 200 ft., in the east). The contours of its surface and its dip have been worked out by Prof. P. G. H. Boswell from all the borings known to date, and his map (*Trans.*, Vol. XI., Part 1, p. 24) is of the utmost value for the purposes of present and future water-supplies; especially as it is becoming more and more general, in spite of the extra expense, to dig or bore down to the Chalk, rather than trust to more or less uncertain and unsatisfactory supplies from shallow wells in the overlying Drift.

Prof. Boswell concludes that the surface of the Norfolk Chalk is "approximately a plain reaching to 250 ft. above sea-level, near Swaffham, and sloping gently eastwards at about 9 ft. to the mile . . . Eocene deposits and Crag cover the Chalk in the east, and the surface is seen to slope more rapidly (over 30 ft.

to the mile) under the former." He points out, as has been observed by those interested in the larger well-supplies, that the supply from the Chalk is much diminished where the latter is loaded with a considerable thickness of Eocene and Crag deposits.

The Chalk escarpment above referred to as rising to 250 ft. above O.D. forms a strip (5—10 miles in width) running nearly N.W. and S.E. from Hunstanton, just west of Swaffham and Watton, to about Brandon and Thetford, where it extends into Suffolk.

(2) The Drift, from which most of the smaller supplies, from "shallow" wells, are derived. This formation is a jumble of clay, loam, gravel, and sands, neither homogeneously pervious nor impervious, but holding reservoirs of water in pockets or basins of sands and gravels rendered water-tight by underlying and surrounding clays.

In its lower areas it may be fed with water by hydrostatic pressure from the Chalk which everywhere supports it. Its thickness extends from a few feet to as much as 300 ft., or, if the Crag and London Clay be included, to over 400 ft. (in the extreme east of the county).

Prof. Boswell states that "Of the 406 wells and borings which have been put down in Norfolk up to the end of 1914, a large proportion, viz., 264 (65%) do not reach the Chalk, being mainly in Drift; 131 (32%) are driven into the Chalk, generally through overlying beds; and 11 (2.7%) are sunk into beds lower than the Chalk" (mostly in the green-sand).

Generally speaking, the drought of 1921 did not seriously affect the yield from wells which penetrated well into the Chalk. In the W. of the county, the numerous springs issuing between the Lower Chalk and the Gault diminished, but, so far as I know, did not altogether fail.

The most general complete failure of water occurred on or near the Chalk escarpment already mentioned. Here the water-table or level of saturation appears to be unbroken over a considerable area, and thus when it receded the wells were uniformly affected. Thus, on the Sandringham Estate, in the

village of Anner, as in many other villages in the district, all the wells went dry. Two wells, respectively 126 ft. and 136 ft. deep in chalk, went totally dry, but when bored a further some 90 ft. through chalk into the Greensand, total depth 220 ft., abundance of water was recovered. At Massingham and Harpley, on the E. slope of the escarpment, 100—150 ft. of Drift overlie the Chalk. Here wells varying in depth from 90 ft. (in the Drift) to 160 ft. (just into the Chalk) went dry. A new well dug at Massingham to 230 ft., well into the chalk, yielded a fairly good supply. At Thornham, between the N. edge of the escarpment and the coast, two wells 50 ft. in sand regained the water-table in the Chalk when deepened a further 40 ft.

Amongst wells sunk in the Drift—the ordinary village and country-town shallow wells—the effect of the drought was very uneven, depending, as one would expect, upon the size of the water-bearing pocket or stratum into which they penetrated. The result was that all or none of the wells in a village would dry up, when they all drew from a common body of water or continuous water-bearing stratum. Whereas, when they drew from separate pockets, of varying capacity, some wells would go dry whilst neighbouring wells would not.

In the Dereham district in the centre of the county, where the Chalk is covered by about 120 ft. of Drift, a large number of wells (generally about 50 ft. deep) in the latter went dry. When bored to a depth of 130 ft. or 140 ft., *i.e.*, into the Chalk, these same wells all found water. Wells in the Long Stratton district, S. of Norwich, where only about 60 ft. of deposits overlie the Chalk, when deepened from 10 to 40 ft., regained water. Further south, at Mellis, Stoke Ash, Rickingham, and Botesdale (all over the Suffolk border) wells 50—60 ft. deep obtained water again on being deepened a further 10 ft. or so.

At Lingwood, E. of Norwich, where the deposits above the Chalk have a thickness of some 190 ft., a well 80 ft. deep went dry, but on being bored to a further 135 ft., total depth 215 ft., the Chalk and water were reached.

Thus, the Chalk supplies proved the salvation of the shallow wells of Norfolk.

On the other hand, in the St. Faith's district near Norwich, several wells when deepened a further 5 or 10 ft. obtained limited supplies of water, but most of these dried up again later, being still in the Drift.

I am indebted to Mr. F. H. Buckingham, the well-known well-sinker, of Hethersett, for most of the depths already recorded. Since the above lines were communicated to the Society Mr. Buckingham has kindly sent me further particulars of his experiences following the drought with regard to well-supplies in various parishes of the county. Here is his list of parishes, with his notes :—

Aylsham.—Well 25 ft. deep failed ; when bored 40 ft. to chalk a good supply was obtained.

Barnham Broom.—A well 25 ft. deep, deepened 10 ft., supply recovered.

Colney and Earlham.—Wells 25 to 50 ft. in depth mostly went dry, but have now (July, 1922) recovered a fair supply.

Cringleford.—Wells, 45 ft., dry, but have fair supply now (1922).

Dunham.—Well, 20 ft. deep in blue clay, deepened to 80 ft., has gradually filled up.

Earsham.—Well failed ; deepened to 60 ft., found water. This is probably in the crag immediately overlying the chalk.

Framingham.—Wells 30–40 ft. failed, but now (1922) have fair supply.

Garboldisham.—Well 30 ft. deep failed ; tube driven to 150 ft., *i.e.*, about 90 ft. in chalk.

Hellesdon.—Well 80 ft. (in chalk), deepened 10 ft., recovered water.

Hethersett, and Little and Great Melton.—Wells 50–60 ft. deep maintained good supply. Wells 25–35 ft. deep went dry ; some recovered water on deepening 10 ft., others now (1922) have plenty of water.

Hingham.—Wells 30–40 ft. went dry, deepened 5–8 ft.

Hoveton, Wroxham, and Horning.—Wells 20–40 ft. deep in sand, recovered somewhat when deepened 5 or 6 ft. Where boring was made into chalk (100–150 ft.) good supply obtained.

Ketteringham and Hethel.—Wells 25–35 ft. in blue clay ; same experience as at Hethersett.

Mulbarton and Swardeston.—Wells 30–40 ft. deep on sand and clay, deepened 5–10 ft.

Somerleyton, Herringfleet, and Fritton.—Wells 40–60 ft. deep in sand, dry ; deepened 5–6 ft. recovered water to some extent.

Southrepps.—Well 40 ft. in sand was bored to 170 ft., all in drift.

Sporle.—Well 100 ft. deep went dry ; deepened to 140 ft., in chalk.

Tacolneston and Fundenhall.—Wells 50–60 ft. in blue clay went dry, but have fair supply now (July, 1922).

Tivetshall.—Well 60 ft. deep, owing to insufficient supply bored to 140 ft. in chalk ; good supply.

North Walsham.—Boring 163 ft., insufficient supply ; deepened to 210 ft. (depth to chalk about 150 ft.), good supply.

Wicklewood.—Well 30 ft. deep failed ; deepened to 65 ft., just into chalk, recovered water.

Mr. L. F. Beckwith, Sanitary Inspector and Surveyor for the Rural District of Freebridge Lynn, which district lies largely upon the Chalk Escarpment mentioned above, has kindly sent me the following notes with regard to his experience with well-supplies during 1921 :—

Gt. Massingham, Little Massingham, and Harpley. Wells average 100 to 120 ft. in depth, strata chalk, blue marl, and a little gravel. These wells went quite dry : it was necessary to deepen them 7 to 10 ft. to get down to water. I averaged the general fall of water in these wells to be 25 to 30 ft.

Castleacre. Wells 35 to 80 ft. deep. The deeper wells were much more affected by the drought. One well was deepened 6 ft. before reaching water. Generally speaking, the water-level fell 15 to 25 ft. A new well sunk in this parish about Sept., 1921, on the higher land, obtained a supply from a gravel at 35 ft.

Gayton. In this parish there are several very shallow wells, and it is most remarkable that the water-level fell very little,

whilst in the deeper wells there was a fall of from 8 to 14 feet. A deep well on the higher land, at Gayton Workhouse, about 90 ft. deep, fell several feet and actually went dry on two occasions. This well usually has 20 ft. of water.

The parishes situate along the northern side of the River Nar were not so badly hit. They are chiefly shallow wells, the water-level generally falling from 4 to 6 ft. In Middleton a well sunk in October, 1921, reached water at 25 ft., but there was no quantity of water till the early part of 1922.

In Hillington, Fritcham, Congham, Roydon, and Grimston, where all wells are shallow, the water-level generally fell 4 to 6 ft. Some wells when deepened 4 ft. recovered water.

Some springs at Grimston, from the chalk, kept running, although the quantity of water was greatly reduced. These springs recovered very quickly towards the end of the year.

It is to be regretted that I have not been able to obtain a report on similar lines from the other rural districts.

V.

UTRICULARIA IN NORFOLK IN 1921: THE EFFECTS OF DROUGHT AND TEMPERATURE

BY ROBERT GURNEY, M.A., F.L.S.

THE spring and summer of 1921 will be memorable as one of the severest droughts on record, and the effect of it has been disastrous for *Utricularia* in most, if not all, of its habitats in the county. It seems very doubtful, in fact, if the genus will have survived at all in some localities, and it will be of interest to follow up its distribution in 1922.

Conditions up to April were exceptionally favourable owing to the warmth of the winter and spring, but the marshes began rapidly to dry up during May, though no serious harm was done until June. On May 18 it was possible to walk all over Roydon Fen near Diss dry-shod, but *U. vulgaris* and *U. minor* were found in the small pools which were still full of

water. No further visit was paid to this fen, but probably some of these pools retained sufficient moisture during the summer to preserve a few plants.

At Foulden Common on June 12th *U. intermedia*, *U. minor*, and *U. vulgaris* were found in considerable numbers, the two latter flowering freely, but the pools were shrinking and leaving the plants to dry upon the mud. Some *U. vulgaris* entangled in reeds and abandoned by the falling water was withered and dried.

A careful examination was made of many of the plants of *U. intermedia* in view of Mr. Bennett's record of *U. ochroleuca* from this locality. However, none of the specimens showed the slightest trace of the form of leaf characteristic of *U. ochroleuca*.

Roydon Common near Lynn, although all the higher parts were completely dry, retained a good deal of water in the lower pools on June 17th, but both *U. intermedia* and *U. minor* were far less abundant than usual, and plants on the edges of the pools were being left dry. *U. minor* was, in fact, very rare, and no plants of *U. vulgaris* were seen.

At Upgate Common, near Swannington, where in early spring Utricularia had been found by Mr. Clarke to be extraordinarily abundant, the marshy ground wherein they occur was nearly dry on June 19th, and both *U. intermedia* and *U. minor* were greatly reduced in numbers and suffering severely. The former had, in some cases, begun to produce turios or winter buds, mostly on the earth shoots, so that it is possible that these turios may have survived the summer even if all the plants themselves perished. Many plants, left almost dry, had developed into the "land form" described by Prof. Glück. It was easy to find plants which, being of normal form, had produced one or more shoots with the reduced, imbricate, and broad-lobed type of leaf characteristic of the "*forma terrestris*." A few of the *U. minor* had developed into the "*platyloba*" form, though the majority showed no broadening of the leaf segments. Most of the leaves had stomata, and bladders were very few.

The conditions at East Ruston on the north side of the stream remained favourable to the end of June, though even here there was a good deal of destruction by drying of the marsh, and on the South side it was almost impossible to find any *Utricularia* on June 21. On the north side *U. vulgaris* was then flowering profusely, though often nearly out of water, and some plants were already producing winter buds. Though the destruction here must have been very great, some plants may have been able to survive in the deeper holes in the marsh.

SOME NOTES ON THE FLOWERING OF *UTRICULARIA*

Although *U. vulgaris* flowers regularly year by year in most places, this is by no means the case with the two other Norfolk species; in fact, the only record of the flowering of *U. intermedia* is that of Mr. W. G. Clarke, who found a single flower on Roydon Common on July 18th, 1910. *U. minor*, which appears to flower commonly in some places in England, such as the New Forest, may grow luxuriantly in Norfolk for years without producing a single flower. This partial suppression of flowering is apparently characteristic of *U. intermedia* and *U. ochroleuca* throughout their range, and is most pronounced in the latter, but *U. intermedia* undoubtedly flowers with greater regularity in some of its continental stations than it does in England, and it is a problem of some interest to determine what are the causes which influence it and other species in this direction.

The past year, 1921, has been, in Norfolk, an exceptionally favourable year for the production of flowers by *Utricularia*, although the excessive drought eventually led to the disappearance of the plants from some of their stations.

At East Ruston *U. vulgaris* flowered with unusual profusion, though many of the plants were even then partially dried up, and on Sutton Broad not only were flowers more numerous than usual, but the plants were growing with conspicuous vigour. Many, perhaps most, of the plants measured over 6 feet in length, and two taken at random were found to be 7 ft. 6 in. and 7 ft. 4 in. respectively, the former having 5 inflorescences and the latter 4. Counting the length of lateral branches, one of these

plants had a total vegetative growth of about 10 feet. Air shoots and Rhizoids were well developed in these plants, but both were entirely absent from all plants at East Ruston or at Foulden where they were not entirely submerged.

U. minor was also found in flower at East Ruston, Foulden, and Uigate Common, but not at Sutton Broad, where it survived the summer in a thriving condition at the edge of the Broad.

U. intermedia remained without flowers at East Ruston, Uigate, and Foulden, but at Roydon Common near Lynn on June 17th three of the plants found had flower spikes. These three plants were growing at the edges of pools, nearly out of water. The sentimental interest attaching to a rare flower may perhaps add a glamour which is not fully deserved, but my impression at the time was that the beauty of this flower rising from the water excelled that of any other water plant known to me.

Unfortunately, although showing no trace of fading or withering of the petals, these flowers all dropped at a mere touch, so that it is evident that the flowering season was exceptionally early. This was also the case with *U. minor* and with *U. vulgaris* in shallow water, but at Sutton Broad, where the latter species grows in deep water, the flowers were not fully open till late in July. The flowering plants of *U. intermedia* showed no trace of the "rhizoids" which are described by Glück as being produced in this species as in *U. vulgaris* at the point where the inflorescence springs from the stem. It seems that these rhizoids, whatever their function may be, are not developed except in plants growing fully submerged.

It is evident that the conditions in 1921 were specially favourable for the production of flowers, as they were also in 1910, 1912, and 1913 (W. G. Clarke, Trans. N. & N. Nat. Soc. XI., 1921, p. 135), and it may be of some interest to attempt to determine what these influences were.

One fact seems to be of great importance in this connection. On investigating plants of *U. minor* taken at East Ruston early in April it was noticed that the majority of them had minute bud-like structures springing from the axils of certain of the

leaves, in all cases at a point at which the stem branched. A dissection of these structures showed that they were rudimentary flower spikes, and it is therefore clear that, whatever the cause may be which induces flowering in *U. minor*, it must operate quite early in the year and long before the flowers themselves become noticeable.

Now the winter buds had certainly not begun to grow in February, and probably did not so do until March, though those kept in aquaria started into growth early in February.* If therefore the cause which determines flowering be light or heat it is only necessary to consider the conditions during the single month of March.

Taking the weekly weather reports for 1921, we find that the winter was one of unusual warmth, but of deficient sunshine. The spring (reckoned from February 27th to May 22nd) was one of very exceptional warmth, but, on the whole, of moderate sunshine. The critical period seems to have been about the last two weeks in March, and for these and neighbouring weeks the reports are as follows :—

		Warmth.		Sunshine.
March 13—19	..	very unusual	..	abundant
„ 20—26	..	unusual	..	moderate
„ 27—Apr. 3		unusual	..	abundant
April 4—9	..	unusual	..	very abundant

The conditions were therefore exceptionally favourable to plant growth exactly at the time when the turios were germinating, and it was no doubt due to the extra warmth at this time rather than to the heat of the summer that flowers were produced.

U. minor seems to flower habitually in most of its continental stations, though in eastern England flowering is exceptional, and it seems probable that the difference in habit must be due to a difference in time in the onset of spring and to the amount and incidence of the spring increase in temperature. I have not been able to obtain meteorological reports for Switzerland, where both *U. minor* and *U. intermedia* seem to flower regularly,

*Germination began in the first week of April in 1920.

but, through the kindness of the Secretary of the Royal Meteorological Society, I have seen reports from Austria and from Holland. It is very difficult to discover from these figures any differences which can reasonably be assumed to have a "florific" influence, though the accompanying table will show such differences as exist.

It is characteristic of stations removed from the stabilising influence of the sea that they should have a considerably colder winter and warmer summer than those situated nearer to the coast, and, comparing mean temperature records of such stations with those of Great Yarmouth, it is found that in March or April the mean temperature of a "continental" station rises above that of East Norfolk, and the difference in May can amount to 9 degrees (Maastricht). The temperature gradient in spring must therefore be a much steeper one at a continental station, and the winter buds would be delayed in germination, but exposed to a much higher temperature so soon as germination began.

In 1921 the mean daily minimum temperature at Yarmouth exceeded the normal mean for the month during the 2nd and 3rd weeks; the mean daily maximum was 53° and 56° respectively, the mean for both during the whole month being 45° or 4 degrees in excess of normal. The temperature during March was therefore fully up to the temperature characteristic of a "continental" station.

On the other hand a comparison of the spring temperatures in 1910, which was also a very good flower year, does not seem to support a conclusion that a high temperature during March is a determining factor, though it is true that March in that year was somewhat warmer than usual. But without some knowledge of the approximate date at which germination began or flower rudiments were first formed such a comparison loses much of its force.

The problem would seem to be by no means a simple one. The influence of the autumn conditions on the production of turios and of the winter and early spring conditions on their germination no doubt have their part in determining whether

flowers will be produced or not, and no solution can be expected without in each "flower year" knowing the date of germination and the date of the first appearance of flower buds.

	Vienna	Helder	Groningen	Maastricht	Norfolk 1921	Norfolk mean
Jan.	30	37	35	37	45	37
Feb.	32	37	35	39	41	38
Mar.	39	41	41	44	45	41
Apr.	49	46	48	50	45	46
May	57	53	55	59	52	50

Temperature in degrees Fahrenheit.

Norfolk figures are for Great Yarmouth.

VI.

NORFOLK LAKES AND MERES

BY W. G. CLARKE, F.G.S.

ALTHOUGH much has been written concerning the Norfolk Broads, with a few noteworthy exceptions, such as Scoulton, there is a remarkable dearth of information as to the lakes and meres of the county. So far as I know, not even a list has been compiled, though many of them are of considerable interest to the botanist, ornithologist, and ichthyologist. Such information as I desired was not to be obtained from casual visits, and I have therefore sought the help of those with long experience of the lakes and meres. In most instances this has been generously given, and in all cases has, I hope, been acknowledged. That the details are incomplete must be regretfully admitted—botanical notes were so meagre that I have omitted them entirely—but this preliminary survey may draw attention to a field of operations which has been unaccountably overlooked.

Apart from the Broads there appear to be seventeen natural sheets of water in the county, with an approximate area of 141 $\frac{1}{4}$ acres. Traces of pile-dwellings have been found in Saham Mere; in Mickle Mere, Wretham, when it was pumped dry and deepened in 1856; and in Wretham West Mere when it was drained in 1851. In the last-named there were also bones of the red deer and long-faced ox. Remains of comparatively recent specimens of the European freshwater tortoise (*Emys lutaria*) were found for the first time in the British Islands in one of the Wretham Park Meres, in 1862. Old Buckenham Mere, Quidenham Mere, Saham Mere, and Mickle Mere, West Wretham, were marked on Morden's map of Norfolk in 1695, and all the natural sheets of water, with the exception of Croxton Punch Bowl, on Faden's map in 1797.

There is evidence that the area of water in the county a century or two ago was greater than at present. Excluding the decoys in Broadland and the Fleggs, Besthorpe was abandoned about 1815; Dersingham dried up about 1870; Feltwell

is only marked by a depression in the fens ; Hilgay (Woodhall) was given up about 1860 and all traces are gone ; Holkham may still be traced on the marshes half a mile north of the church ; Longham is quite gone ; and Methwold was abandoned in 1872. Of Stow Bardolph decoy, Sir T. L. Hare tells me that " there was a natural marsh of perhaps 200 or 300 acres of land, possibly more, before that bit of country was affected by the drainage schemes carried out in the 17th and 18th centuries. Before these works it must have been almost all marsh. I have seen it stated that about 200 years ago the decoy was let by the Hare of that day to someone for an annual rent of £500. If that is correct the decoy must have produced a prodigious number of ducks." It has not been used since about 1826. Of Wolterton decoy there are remains in the south-west corner of the park, and Wormegay was last used in 1838.

Some of the lakes and meres which formerly existed in the county have been drained ; others have grown up ; and on the whole the tendency is undoubtedly for the area of water to decrease.

One of the Antingham ponds has dried up ; one of the four Hempstead ponds is now grass, and another reeds. The meres at Old Buckenham, Quidenham, and Stow Bedon have only a small area of open water left. Dealing with the parish of Quidenham, Blomefield said : " Redemere or Reedmere lies on the right hand of the road to Kenninghall, and is now quite grown up, there being no remains of it but a reedy swamp." " Attleborough Meer " was marked in Ogilby's " Britannia " (1675) as a large area each side of the road between Attleborough and Wymondham, but nearer the former place, though it was probably more a swamp than a sheet of water. Hockham Mere was marked in Morden's map (1695) as almost the same size as Old Buckenham and Quidenham meres, with a tributary flowing from it in an easterly direction to the Thet at Shropham. It was a separate water of the lord of the manor who had a fish house there, is said to have contained 280 acres, and was 4,245 yards in circumference. The common and Cranberry Fen were enclosed in 1795, when this was drained. Its site is now a swamp

with great quantities of *Osmunda* and *Sphagnum*. Mannington Mere, which originated from a subsidence of the ground in 1717, is also dry. Rockland Mere, which was a mile north of Rockland St. Peter Church, has been drained; Wicklewood Mere was two miles north-east of Semere, Hingham, and along the course of the same stream, but has been filled up with silt and vegetation. Oxburgh Lake was shown on Faden's map, but has since been drained, and a sheet of water was also shown between the Hall and the river at West Harling, but Mr. W. Kerridge informs me that there is now only a small pool, no doubt part of the old moat.

There are at least 50 lakes and meres in the county which are wholly or partly artificial, made by damming small streams, or by digging out a portion of the valley bottom of a rivulet. They have an approximate area of 686 acres. That the following were constructed before 1797 is proved by the fact that they are shown on Faden's map of that date:—Antingham, Aylsham, Barningham, Beeston St. Lawrence, Blickling, Cockley Cley, Ditchingham, Gunton Great Water and Pond, Haverland, Hemblington, Heydon, Hillington, Holkham, Hoveton St. Peter, Kimberley, Melton Constable, North Elmham, Raynham, Scottow, Scoulton, West Tofts, Westwick, Wolterton, and Worstead. It is a somewhat remarkable fact that in only two instances have I been able to obtain definite evidence as to the date when these lakes were constructed, though a number of the park lakes seem to have been made contemporaneously with the unmoated mansions in the 16th, 17th, and 18th centuries, during the development of landscape gardening.

Those not marked by Faden, but which appear on Bryant's map in 1826, are Brooke, Didlington, Hempstead, Honingham, Mannington, Stradsett, and Stratton Strawless.

Water-loving birds naturally find sanctuary on and around these pools. They are the haunts of coot, moorhen, and little grebe; the dash of the kingfisher and his characteristic call are both familiar; and the herons fish in the shallows. Some of our finest Norfolk heronries are associated with the park

lakes at Didlington, Gunton, Holkham, Kimberley, Melton Constable, and Narford.

The largest mere is Mickle Mere, West Wretham, with an area of $29\frac{1}{4}$ acres, and the largest lakes Didlington with an area of 60 acres and Narford with an area of 56 acres.

Thirteen of these lakes are associated with the Bure, 6 with the Wissey, 5 with the Wensum, 3 with the Yare, 3 with the Ant, 2 with the Nar, and one each with the Waveney, Glaven, Tud, Thet, and Babingley River.

In the following brief account I have sought to give data as to the approximate area and depth of the lakes and meres, as to whether they are natural or artificial, the chief species of breeding and visiting birds, and the species of fish.

A.—NATURAL

CROXTON DEVIL'S PUNCH BOWL. Situated on the northern boundary of Croxton, just south of the "Drove" road, and south-west of Fowlmere, the southern half of which is in Croxton. A description of it appears in our "Transactions" (Vol. VII., pp. 508-09). When fairly full the mere has an area of about an acre. It was quite dry in 1905 and 1909, extremely full in 1913 and 1919, and very low in 1921.

DISS MERE. Mr. F. J. Bennett (quoted in "The Water Supply of Norfolk") says:—"This expanse of water, which is oval in shape, is bounded on the north by steep shelving banks, while at one point on the south the margin is nearly level and has a communication with the Waveney, which, however, I believe to be an artificial one. The water is derived chiefly from springs in the chalk, for although the mere lies in the glacial sands, these sands are not very thick, so that its bottom, which lies deep down, must be on the chalk." A survey of 1835 makes the area 5a. 1r. $11\frac{1}{2}$ p. The report of the Medical Officer of Health for 1912 states that there are five springs in the centre of the mere. Measured in 1885 it was found to have an area of 5a. 2r. 15p., and to average in depth $17\frac{1}{2}$ feet, the greatest depth being $19\frac{1}{2}$ feet. The nesting birds (I am informed by Mr. H. F. Whitrod) are coot, moorhen, little grebe, kingfisher,

and reed warbler ; and the visitors, swans, wild geese, mallard, wigeon, pochard, teal, sheld-duck, great crested grebe, black-headed gull (during stormy weather in spring), and water rail. A pair of eared grebes were killed on the mere about 1860. Pike are rare, and golden and Prussian carp, tench, and eels are found. Sticklebacks were very numerous a few years ago, but have decreased in numbers. Mr. Whitrod also states that the muddy bottom is abundantly stored with eels, and every summer the sun warming the water helps, or starts, fermentation, when the mere is popularly said to be " sick." The gases generated affect the fish, causing them to come to the surface, where they float in a dazed condition, and many are found dead. The scum which accompanies the phenomenon passes off after a week or more, and the water resumes its former condition. During the " sick " time a large quantity of eels are easily caught with home-made nippers made of wood with nails for teeth, and are eaten. No case of illness has ever been known to arise from their consumption ; indeed, they are much extolled for their quality and flavour.

HINGHAM SEMERE. Faden described this as " Sea Meer." It is one mile south-east of Hingham Church, receives two small streams, and has an outlet by the stream flowing to Hackford. Its north bank is very steep, and it is surrounded by a thick spread of boulder clay. Lieut.-Col. Dudley Buckle informs me that it is almost circular, with an area of about 20 acres, with a depth of 10 to 12 feet at the sides, and 17 feet in the middle. The fish are pike, perch, rudd, tench, bream, and eels. Six pairs of great crested grebe arrive in February and all nest, but in 1920 only three nestlings lived to leave the mere. They depart in November. Mallard visit the mere, and four pairs of duck nested in 1921. Pochard, scaup, and tufted duck also visit the pool, and coots and moorhens nest. Black-headed gulls are frequent visitors. The Hingham Yacht Club uses the mere for racing in the summer.

HOUGHTON WASHMERE AND ST. JAMES' POND. Mr. Alexander H. Munro informs me that the Washmere extends to just over 5 acres, and St. James' Pond, quite near, is rather over 2 acres.

In a north-westerly direction there was formerly a series of meres, which were connected with the two now existing, but the former are now dry and grown up with willows and underwood. A strong spring rises at the edge of the Washmere. Maps 200 years old show the whole series of five meres. The average depth of water in the two meres is 5 feet, but one part of the Washmere is deeper. Moorhens nest, and teal, wigeon, shovellers, and herons are visitors. There are now three white swans, two black swans, and a few Canadian geese, which are fed by the keeper. The fish comprise pike, roach, carp, perch, and eels, but pike predominate.

OLD BUCKENHAM MERE. Sir Hugh Beevor informs me that there is one acre of water, but the septagonal ditched boundary encloses an area of eight acres. Blomefield refers to it as old manorial property, and on the division of the manor it was attached to Old Buckenham Leys Manor. Locally the enclosure is always called "the manor." Morden in 1695 showed a tributary flowing from the mere, by Fettle Bridge, into the Thet. There are very few birds on the mere, or fish in it.

QUIDENHAM MERE. Morden in 1695 showed a westerly tributary flowing from the mere to the Thet. It is a small, oval sheet of water, at one time of seven acres, but much grown up of late years. Blomefield stated that "The Meer called Semere belongs to this manor, two-thirds of which is in this parish, and the rest in the parish of Kenninghall; it contains about 14 acres of water, and had a decoy formerly." A great northern diver was shot here in 1838.

SAHAM MERE. This is 13 acres in extent, in the chalk area, but boulder clay touches it on the east and south. On the west there is an inlier of chalk. It has an outlet to a tributary of the Wissey, but this is an artificial one, and made for taking the overflow water. It is almost circular, and except on the south side is bordered by trees--alder, ash, beech, birch, elm, horse chestnut, Scotch pine, spruce, and willow. It receives the drainage of the surrounding slopes, but is also fed by springs, and has never been known to become dry. In an average year the depth of water at the deepest part is about 8 feet. Coarse

fish breed abundantly, the northern shore providing a hard, gravelly bottom, while on the southern shore there is more mud. Pike, bream, roach, carp, and tench occur, and eels attain a weight of 8 lbs. In September, 1919, four anglers captured 200 carp in eight days, the total weight being 250 lbs. The largest recorded carp is 6 $\frac{3}{4}$ lbs. Black bass were formerly bred here, but appear to have become extinct. Great crested grebes, moorhens, coots, water-rails, reed warblers, and sedge warblers nest every year; the boom of the bittern and the call of the little bittern have been heard. Mallard, shovellers, tufted duck, pochard, teal, and gadwall also breed; scaup, golden eye, and long-tailed duck have been caught in the winter; and brent geese, white-fronted geese, bernacle geese, wigeon, golden eye, and sheld-duck have been pinioned and kept on the mere.

STOW BEDON MERE. This is a mere on the boulder clay, but appears to be fed by chalk springs, though it has a distinct outlet. It is gradually growing up, and of the five acres within the banks there is only (I am informed by Mr. F. Pearce) about one acre of clear water. There is about 3 feet of water, and the mud is at least 15 feet in depth. Mallard, teal, and shovellers are the chief birds, and tench, perch, and eels the chief fish. A colony of the Italian variety of the edible frog has been known here for a number of years.

EAST WRETHAM LANGMERE. This mere is on the heathland, and when of average depth has an area of 12 acres. A description of it appears in our "Transactions" (Vol. VII., pp. 503-05), and of the bird-life of this mere, with Ringmere and Fowlmere, in Vol. VIII., pp. 747-54. A smew was seen here on January 6th, 1916, by Dr. S. H. Long. In addition to the fluctuations in water-level previously recorded, the mere was dry till the autumn of 1903, full in August, 1904, and quite dry throughout 1905. In February, 1906, it again contained water, and fluctuated till August, 1908, when it was full, but was again quite dry throughout 1909. It contained water in March, 1910, was full in April, 1911, nearly dry at Christmas, full in April, 1912, and so remained until 1920. It was low in March, 1921, and quite dry in October.

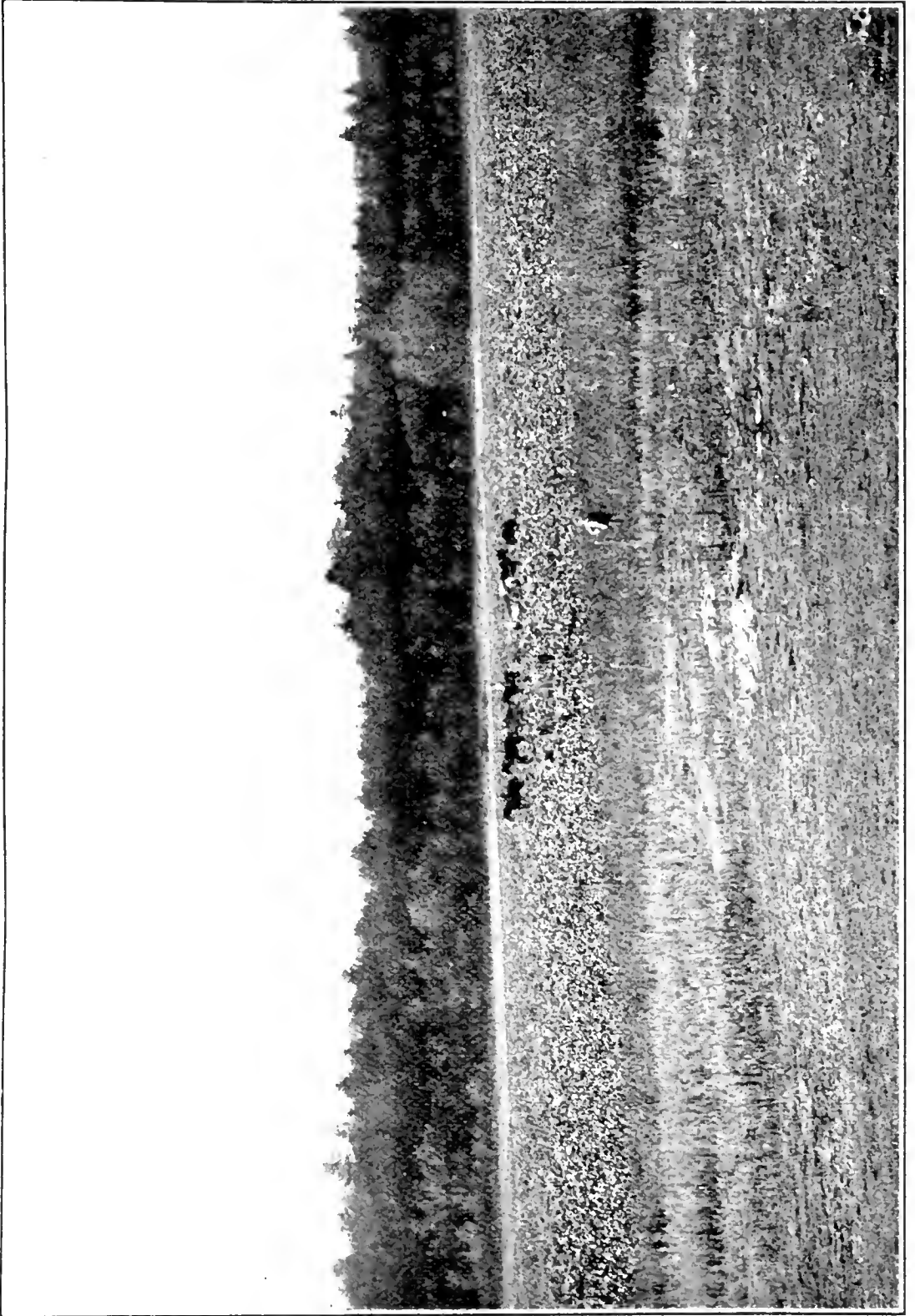
EAST WRETHAM RINGMERE. A description of this mere appears in our "Transactions" (Vol. VII. pp. 500-2). It has an area of $6\frac{3}{4}$ acres. Ringmere remained dry until October, 1903, was full in April, 1904, and dry at Christmas, 1905. It again contained water in February, 1906, and remained fairly full until April, 1909, but was again dry at Christmas. It contained water in 1910, was dry at Christmas, fairly full in February, 1911, and so remained till 1920, but in March, 1921, was low, and during the year became greatly reduced in size.

WEST WRETHAM FOWLMERE. This mere has an area of 18 acres, and the southern half is in Croxton. It is described in our "Transactions" (Vol. VII., pp. 505-08). It was dry until August, 1903, and fluctuated almost year by year, the increase in the height of the water killing most of the alders planted on the south-eastern shore, and it did not again go dry, not even in 1921. When full there is a depth of 18 ft. of water at the northern end, and it gradually becomes shallower to the south. For some years past crossbills have nested on the Scotch pines and spruce near the mere. In May, 1912, two reeves were seen here. Tench up to 3 lbs. and perch are abundant, and in 1897 an angler caught over 1 cwt. of fish in one day.

WEST WRETHAM HILL MERE. This has an area of $8\frac{3}{4}$ acres, and is situated in Wretham Park.

WEST WRETHAM HOME MERE. This is situated on Thorpe Heath, west of the Thorpe Belt, and has an area of $4\frac{1}{2}$ acres. It is bordered on the north and west by a line of Scotch pines, and is the resort of ducks of the same species as the other Wretham Meres.

WEST WRETHAM MICKLE MERE. This has an area of $29\frac{1}{4}$ acres, and a small stream which flows from it eastward beneath the "Stone Brig" ultimately joins the river Thet. About 1836 it was made into a decoy for Mr. Wyrley Birch, with ten pipes, one of them left-handed. A white-tailed eagle was shot here in January, 1890, and a white stork in 1838. Mr. Sydney Morris informs me that most of the meres are very deep, but the deepest part of Mickle Mere is not more than 20 feet. There are



The bed of Fowlmere as cultivated for Roots, September, 1902

BRITISH
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great quantities of fish, shoals of carp up to 10 lbs. in weight, large rudd, roach, bream, perch, pike (the largest caught by Mr. Morris being 29 lbs.), and eels. Mr. Morris adds:—"I have seen otters and badgers there and their young ones. When sitting in a punt one day I saw an osprey dive down and take a fish and sit on a tree with it close to me." Boulder clay touches the mere on the north and loam on the south; but chalk is seen here and there around it and it lies in a chalk area. Cormorant, smew, and goosander have been shot; and most of the species of duck which breed on the heathland meres also nest here, as well as the great crested grebe.

WEST WRETHAM RUSH MERE. This has an area of $4\frac{1}{4}$ acres, and is situated in Wretham Park.

WEST WRETHAM WEST MERE. This has an area of $2\frac{1}{4}$ acres, and is situated in Wretham Park.

B.—WHOLLY OR PARTLY ARTIFICIAL

ANTINGHAM PONDS. From information supplied by Mr. C. W. Barritt and Mr. E. D. Horsfield it appears that originally two ponds were made by damming the river Ant, which rises in the parish of Thorpe Market, in order to work a mill which still stands below the ponds. The northern or Southrepps Pond was 5a. 2r. 33p. in extent, but was drained about twenty years ago, and its bed is now an osier carr. The southern, or North Walsham Pond, was 5a. 3r. in extent, but has been growing up for many years. This pond has an artificial dam on the south. The average depth of water is now about $2\frac{1}{2}$ feet, with a maximum depth of 4 feet. Mallard and snipe nest near the ponds, and teal, swans, great crested grebe, curlews, and goosanders are among the visiting species noted. The fish include pike, carp, bream, tench, roach, perch, rudd, and eels. Early in March, 1922, a $29\frac{1}{2}$ lb. pike was caught in this pond.

AYLSHAM WOODGATE LAKE. Mr. T. W. Purdy tells me that the area of this lake is 2.220 acres. Before 1870 there was a small pond, probably of about 20 rods, fed by a spring. This was enlarged to about an acre by the late Mr. R. J. W. Purdy about 1870, and to its present size in 1884. The average depth is

3 feet. The nesting birds are coot, moorhen, and little grebe, and the visitors mallard, teal, pochard, wigeon, tufted duck, great crested grebe, common sandpiper, green sandpiper, heron, Canadian goose, Egyptian goose, herring gull, black-headed gull, yellow wagtail, and kingfisher. The fish are perch, roach, and eels. Tench and gudgeon were all killed by an application of weed-killer to the garden paths just before a thunderstorm. Close to the lake and fed by the spring is an old brick bath about 4 feet deep.

BARNINGHAM LAKE. Situated in the park near Barningham Hall. Mr. E. M. Hansell informs me that it is just over 5 acres in area. Originally there was a small stream, a tributary of the Bure, which had its source about 500 yards from the north end of the present lake in a small pond with a spring. The lake was made about 1807, at the time of the alterations to the Hall and garden by Mr. Repton, the architect. At the south end the lake is considerably wider, and reaches a depth of 12 feet, becoming shallower to the north. There is a wall on the south with a sluice. Duck, tame swans, and grebe come to the lake in winter. Mallard have been known to breed in the lake, but the young ones, as is the case with young moorhens, often fall a prey to the pike. Coarse fish are found, and Mr. J. S. Mott, the owner, has caught a pike of 34 lbs., and another angler caught one of 26 lbs.

BEESTON ST. LAWRENCE LAKE. Sir Edward Preston informs me that the area of this lake, which is in the park near Beeston Hall, is just under 10 acres. It was formed from a stream which runs through the lake and empties itself in Barton Broad. It is also fed by three excellent springs which kept the lake full and running over during the summer of 1921. The depth is 1 to 6 feet, with an average of 3 feet. Gulls are always present in large or small numbers; herons from the heronry at Catfield fish regularly; mallard and teal are regular visitors, and snipe occasional. In November, December, and February flying duck appear in large numbers. Canadian geese and swans are also visitors, and mallard, moorhens, and coot nesting

birds. There are some large pike and tench, besides roach, perch, rudd, bream, and eels.

BLICKING LAKE. Mr. C. R. Birkbeck informs me that the lake, which is situated in the park near Blickling Hall, is about 26 acres in extent, and appears to have been dug before the present Hall was built in 1626. The "Norfolk Tour" states that "The lake, which is of a crescent shape, the bow of which extends a mile and the string half a one, the extreme width being about 400 yards, is one of the finest in the kingdom. The colour is very bright, but what renders it uncommonly beautiful is the noble accompaniment of wood. The hills rise from the edge in a various manner." Mr. A. E. Powell tells me that the lake is fed by a stream which flows under the Hall from the direction of Oulton, and that at the side of the lake are wells into which the water can be diverted. The lake is shallow in the middle, and in 1868 was quite dry there. Mr. Birkbeck states that the average depth is about 3 feet, deepening at the bottom end to 4 or 5 feet. Ducks of various species, coot, and grebe are the common birds. The fish include pike, tench, carp, perch, roach, dace, and eels.

BROOKE LAKES AND MERES. The "Geology of Norwich" states that "The Brooke Meres were excavated in the boulder clay. They may have been dug out for the marl, and are now serviceable as holding a water supply, unfit however for human consumption." Major T. E. Bussell informs me that there are in Brooke a lake of 5.105 acres, natural but enlarged in 1830, a small lake of 1.258 acres, probably natural, a mere and island 1.194 acres, and a mere (Lord Canterbury's) about one-third of an acre. The average depth of the lakes is about 6 feet and of the meres about 3 feet. Mallard, moorhen, little grebe, and kingfisher are nesting species, and the teal a visiting species. Brown and rainbow trout are found in the lakes, and golden carp, eels, dace, and pike in the meres, until the summer of 1921, when the meres dried up and the fish died.

CAWSTON POND. A decoy in Bluestone Hall Plantation was demolished early in the 19th century, when the pond was

cleaned and the water enlarged, and now has an area of about 20 acres, though vegetation has encroached on the open water.

COCKLEY CLEY LAKE. The lake is in the park near the Hall, and Mr. F. Allen informs me that it is about $3\frac{1}{2}$ acres in area, and was formed by a dam across a small valley. There are springs in it, and in many places near it. The "Geological Memoir" says that "A tributary of the Wissey rises in a powerful spring some way above Cockley Cley Hall; it deposits much tufa, and is not known to run dry." The lake has an average depth of three feet, and was made between 1720 and 1797, as Mr. Allen has a map of the former date on which it is not shown, and it appears on Faden's map issued in the latter year. It was cleaned out in 1921, when the bottom was found to be hard and sound. It was dry for some months in that year, but began to fill again early in 1922. Mallard, tufted duck, gadwall, snipe, and redshank frequent it; and trout, roach, and eels are the common fish.

DIDLINGTON LAKE. The Hon. Margaret Amherst sends me the following interesting account of the lake, which is in the park near the Hall. "The lake, which now extends for about 60 acres, has been enlarged at various times from what was evidently a small natural mere, probably the remains of the old river-bed. In a painting by James Stark about 1820 the lake is seen in front of the house with the lime avenues and trees on its banks, much as that part is now. In 1856 it was enlarged, and at the north-west corner a terrace raised with arches for boats underneath. The eastern end was increased in the sixties and seventies, and the further lake, which was developed out of a mere, a marsh, and some streams, was also made during these years. The further lake is on a lower level, and is connected by a lock. In the upper lake there is one large island and eight smaller ones, and in the lower, one large and one small, and a large expanse of sedge and reed between the large island and the bank which divides the river Wissey from the lake. The lakes are fed by a stream which rises in Ickburgh, joined close to Didlington Hall by a stream rising in the covert where there is a duck decoy. For the most part the lake is shallow, but in

some places attains a depth of 10 feet. In parts the bed is muddy, and in others sandy. When the boathouses were built, and again when they were rebuilt, the lake being drained for the purpose, remains of mammoth, *Bos longifrons*, and other animals were found. The lake is a haunt of wild fowl. Pintail, golden-eye, pochard, teal, mallard, tufted duck, garganey, shovellers, and wigeon are regularly seen. Ospreys, goosanders, and mergansers have been seen, and a bittern was present for about three years not long ago. Black-headed gulls are visitors, and during the immigrations of sand grouse they used to be seen flying from High Ash heath (about two miles off) to drink in the lake. It is well stocked with coarse fish—roach, dace, perch, minnows, and pike—some of the last-named scaling over 20 lbs. There were till recently a few carp in the old part. Trout have been put in from time to time, but as a rule soon disappear, being caught by herons and otters, of both of which there used to be a great many. The water runs out of the lake (1) by a turbine which pumps up the supply to the tanks in the tower of the hall; (2) over a waterfall, and (3) through the sluice from the lower lake. These three streams join and fall into the Wissey about a mile lower down." The decoy, about $1\frac{1}{4}$ acre in extent, was made by the Rev. John Fountaine in 1865. It has four pipes. The Didlington heronry was formerly well known.

DITCHINGHAM LAKE. This is situated in the park near the Hall, and Mr. Wm. Carr informs me that it ought to be about 8 acres in extent, but is getting badly silted up. It is an enlargement of a small tributary of the Waveney, and was constructed by "Capability" Brown. It is a favourite haunt of duck, and teal breed there. There used to be a rookery, but the rooks were driven away by the herons, who built two nests there one year, but were in their turn driven away by the rooks, who, however, did not go back. The fish are pike, perch, roach, tench, and a pair of otters have bred there.

FELTHORPE FISH POND. Mr. Reginald Laurence tells me that two small pieces of water in the park near the Hall were dredged and formed into one about 20 years ago, making a sheet of water of about 3 acres. It is chiefly fed by springs in the pond and

springs near by, and by a small stream, and one end is artificially banked. The depth is very variable, there being some deep pools, although a portion is quite shallow. It is visited by wild duck, and coots, moorhens, and little grebe nest. Mr. Laurence has stocked it with trout; the rainbow disappear after two or three years, but the fario have been fairly successful.

GUNTON GREAT WATER AND POND. These are sheets of water in Gunton Park. A tributary of the Bure starts north-west of Roughton, and flows through the village, through Great Water and on to the Bure nearly a mile distant. Mr. W. E. Paul tells me that Great Water contains about 38 acres and is nearly silted up. At the top end is an island where herons have nested for a great number of years. The Pond is about 16 acres in extent, and is connected with the Great Water by a stream. In severe weather a great number of wild fowl frequent the waters, and some species, including Canadian geese, remain to nest. Both lakes are artificial, and were probably constructed about 150 years ago. In places they are quite shallow, and in others 7 to 10 feet in depth. There are plenty of coarse fish—pike, perch, and roach—some of the pike attaining a large size. The "Birds of Norfolk" states that goosanders were formerly regular visitors, as many as twenty having been seen at one time.

HAVERLAND LAKES. I am informed by Mr. G. Gooch that the area of the big lake is 17 acres, and of the small one adjoining 3 acres. They are artificial, and the average depth is about 4 feet. The lakes were formed by damming a tributary of the Wensum, and the water is used for the Hall. The chief water-fowl are mallard, teal, moorhens, and coots, and the chief fish, pike, bream, and roach.

HEMBLINGTON PEDDAM. This picturesque sheet of water was formed by damming a small tributary of the Bure which flows into South Walsham Broad, presumably in connection with Petty Mill, which is marked on Faden's map (1797). Mr. Godfrey W. Weston tells me that it is still sometimes called "Petty-mill-dam," though nobody now recollects the mill. He also states that the pool is about 8 acres in extent, and the dam

is thickly planted with rhododendrons. The deepest part (about 8 to 10 feet) runs from the waterfall to the inlet at the far end and about 30 yards from the east bank, and was no doubt the bed of the stream before the dam was raised. To the west it gradually slopes off to quite shallow water. The present owner let out all the water in order to remove the fish, chiefly bream and pike, and stocked it with trout. Various species of duck are common. The "Norfolk Directory" (1845) described this as "a fine lake or dam, with beautiful waterfall, ornamented with grottoes, arches, piles of stones, and clumps of trees, arranged in the most fantastic manner," but little trace of these remains.

HEMPSTEAD SELBIGG POND. Mr. J. H. Gurney, F.Z.S., tells me that the estate was originally purchased by his great-grandfather, and that the pond was then in existence. It is undoubtedly artificial, and until the year 1845 there was a very productive decoy, 1000 teal being taken in the winter of 1834-35. Mr. E. Cole adds that it is about an acre and a half in area, with an average depth of about 6 feet. Wild duck frequent it, and pike and perch are also found.

HEYDON LAKE. Mr. A. C. Beck informs me that this is an enlargement of a small tributary of the Wensum which passes through the park, and has an area of 1a. 3r. 35p. It is frequented by wild fowl, and contains coarse fish.

HOLKHAM LAKE. The lake fills the bottom of a narrow valley, which is well wooded, except at the south end, and contains a small wooded island. It is fed by springs at the south end, and has a length of 1056 yards. The "Norfolk Tour" says that "the shore is a very bold one, all covered with wood to a great height; and on the top stands the church." In 1884-85 it was calculated that as many as 10,000 wigeon rested on its surface every day. Prior to 1854 only mallard and a few stray teal resorted to the lake, but at times the surface of the water has in some years been almost covered with wild-fowl. A small party of smews—5 to 7—used to frequent the lake annually. Teal and great crested grebes are regular visitors, and tufted duck and wigeon appear in winter. There is a heronry near by, and in 1920 there were 26 nests, not more than five on any

one tree. The Earl of Leicester informs me that the lake was presumably an arm of the sea, cut off by a dam with sluice and culvert about 200 years ago, but the exact date is not known. The area is about 36 acres, the deepest part 16 feet, and the southern end quite shallow. A large variety of wild fowl resort to it in winter, including some thousands of duck, teal, and wigeon. Large numbers of Canadian geese and Egyptian geese make it their home, and with mallard and great crested grebe nest regularly.

HOLME BROAD WATER. Mr. Thomas Nelson informs me that the area is 20.542 acres, and that it was a creek until the sea was excluded by a bank made on the east under powers conferred by the Holme Common Inclosure Award of 1860. It is fed by the river Hun, which rises in Hunstanton Park. It has become much more shallow since the gale of November 29th, 1897, washed the sea defences away on the north side and carried débris into part of the broad. Dr. B. G. Sumpter adds that the nesting birds are 9 or 10 pairs of mallard, 3 or 4 pairs of shovellers, about half a dozen pairs of sheld-duck which remain on the broad with their young until August, teal, gadwall, and snipe occasionally, and coots, moorhens, and little grebe in the reed-beds. Other visitors are gulls, cormorants, herons, red-headed pochard, golden eye, and garganey, and scaup are fairly frequent in hard winters. "When the water is low, leaving bare mud" (continues Dr. Sumpter), "I have seen reeves and ruffs (occasionally), dunlin, ringed plover, greenshank (a flock of 18 one year), godwit, little stint, common sandpiper, green sandpiper, and a few years ago quite a big lot of curlew, sandpiper, and occasionally grey phalarope. I have records of a spoonbill and red-throated diver being shot there, and several years in April have seen a pair of black tern. One April I saw on a cultivated field a little way from the broad a flash of five dotterel. Often a small flock of pink-footed geese will make their headquarters there, and I have seen wild swans once or twice. (There are many tame ones.) The total bag for 1918 was 24 hares, 61 rabbits, 51 mallard, 30 teal, 11 shovellers, 3 wigeon, 8 red-headed pochards, 1 golden eye, 1 scaup, 8 lapwings, 2 golden

plover, 65 snipe, 4 woodcock, 2 curlews, 2 greenshank, 3 redshank, 3 reeves, 1 ruff, 9 coot, 46 partridges, 5 pheasants, 5 pigeons, 5 stint, 1 little stint, 1 green sandpiper, and 1 ringed plover." The fish are flat fish and eels, a few trout, and roach.

HONINGHAM LAKE. This lake is in the Park near Honingham Hall, and Mr. Francis Rowbottom informs me that it has an area of 7 acres, and was made about the year 1800. It is kept well supplied by springs which rise within a mile on the west, and during 1921 a continuous supply was maintained. From the lake the water flows into the river Tud. Mallards, coot, moorhens, and swans nest on the banks, and teal, herons, gulls, and geese are frequent visitors, as are also otters. The lake is well stocked with pike, perch, and roach.

HOVETON ST. PETER LAKE. This is in the park near Hoveton Hall. Mr. G. F. Buxton states that it is about a quarter-mile long and 40 yards wide, and contains about 4 acres. It was made by throwing a dam across a small stream which flows from west to east. The average depth is about 3 feet. Mr. Buxton adds:—"A good many ducks come, and I have seen besides mallard, shovellers, tufted duck, pochard, and teal, also herons and kingfishers. Mallard and teal nest there. There are plenty of pike, bream, and other coarse fish."

KETTERINGHAM LAKES. Lieut.-Colonel Raymond F. Boileau informs me that the upper lake is 420 yards long and has an area of 3a. 2r. 18p., and the lower lake is 220 yards long with an area of 2a. 3r. Both are supplied by many springs. Water from the upper lake descends about 8 ft. into the lower. The history of the lower lake is unknown. About 100 years ago the upper lake was a series of fish-ponds on a stream which had its source in springs close by and flowed through the ponds to the lower lake. The ponds were united to form a lake of about 3 acres, and about 1840 another half-acre was added up-stream. About 1875 the down-stream end of the upper lake had a depth of about 10 feet, and of the lower about 12 feet, but both are now greatly silted up. The average depth in the two lakes is now about $4\frac{1}{2}$ to 5 feet. The nesting birds are mallard, coot, moorhen, and kingfisher. Visitors include pochard (23 on Feb. 17, 1922),

little auk (Feb. 6, 1922), sandpipers, snipe, little grebe, red-necked grebe, Canadian geese, tufted duck, teal, black-headed gull, tern, heron, and swans (3 mute in Jan., 1922). The fish are pike, tench, roach, rudd, perch, and eels. A pike of 34 lbs., the largest at the Norwich Fisheries Exhibition, was caught in the summer with an artificial bait about 1870. Another, preserved at Ketteringham Hall, weighed 28½ lbs., and was gorging a tench 18 inches long when it took the bait in 1898. Others have been taken of 27, 25, 24, 22, and 21 lbs., and some very large eels. There were no perch until 1895, when 18 about 5 inches long were placed in the upper lake. They are now plentiful in both lakes, and reach two pounds or more. Years ago there were large carp, but they are believed to be extinct. Otters visit the lakes at times. A stream flows from the lower lake and joins the Yare by Cringleford.

KIMBERLEY LAKE. This is an artificial sheet of water constructed about 200 years ago in Kimberley Park. The "Norfolk Tour" states that "The piece of water which lies in this parish and there said to contain about 12 or 14 acres is now extended into a noble lake of about 28 acres, which seems to environ a large wood or carr on its west side, rendering its appearance to the house much more grand and delightful. The rivulet that ran on its east side is now made a serpentine river, laid out in a neat manner." Mr. R. E. Parker tells me that the area of the lake is 27 acres, and the island 1½ a. There is no greater depth of water than 4½ feet, and about 10 to 14 feet of mud. Its most important feature is the heronry, which has an average of about 30-36 nests per annum. Mr. Parker has counted over 60 herons standing in the park opposite the island on an early morning in July. He also saw a spoonbill in July, 1910. In summer there are few birds—about three pairs of coots, two pairs great crested grebe, and numerous moorhens. About 20 pairs of Canadian geese breed on the island and get their young into the river as quickly as they can. In 1852 a gadwall was shot on the lake. In 1884 there were fourteen goosanders in February and thirteen in December. In winter there are quantities of teal and wigeon, smaller flocks of

golden eye, pochard, and tufted duck, coots, mergansers, and goosanders. Mr. Parker has seen a peregrine stoop at a duck. The fish are pike, brèam, roach, rudd, dace, tench, perch (up to 2½ lbs), and an occasional trout. Otters frequent the island.

MANNINGTON LAKES. The area of the larger of the lakes in the park is 1.357 acres, and of the smaller .758 acre. In "Mannington Hall and its Owners," Sir Charles Tomes states that a map of 1565 shows that a set of springs that rise to the west flowed into the fish-pond, about 2 acres in extent. By 1742 the upper end had silted up and was apparently a marsh. However, it was again cleared out, and is still a sheet of water, though shallower than the rest. The large pond is no doubt artificial, the lower end showing indications of having been in the first instance a dam. Sir Charles informs me that both lakes are regular oblongs, and are fed from springs distant three-quarters of a mile. Where the principal springs arise there are traces of an extensive dam, probably for a mill. The average depth of water in the lakes is four feet. The resident birds are a few mallard, many moorhens, and a pair of kingfishers. The visitors are mallard, teal, coot, and tufted ducks. The fish are pike, roach, perch, and a few eels, and a few large carp. At different times an otter has killed four or five large carp—about four or five pounds. The lakes were obviously made as fish-ponds for the house, which was built in 1460. The overflow passes into the Bure at Itteringham.

MARSHAM BOLWICK LAKE. Mr. Walter L. Buxton informs me that the lake near Bolwick Hall was artificially made by diverting the stream about half a mile up the valley, through a cutting, at some time about the beginning of last century, the chief purpose being to provide enough fall to work the mill. It covers between three and four acres, and is of very irregular shape and depth. Where the stream enters it is almost silted up, but at each end there is a depth of about 10 feet. On January 28th, 1922, there were 30 mallard, 6 tufted duck, 1 pochard, 1 coot, 4 little grebe, and 30 to 40 moorhens on it. Mr. Buxton has also seen a shoveller, pintail, teal, wigeon, and gulls, common and green sandpipers, common and jack snipe,

heron, and (in 1915) a greenshank. The nesting birds are mallard, moorhen, little grebe, kingfisher, and reed warbler. The lake contains trout, tench, a few pike, and eels.

MELTON CONSTABLE LAKE. The "Norfolk Tour" states that "The park . . . has lately been judiciously ornamented and the great canal made with uncommon difficulty and much judgment, which when properly united with wood will have a fine effect." Mr. R. Owen Goddard tells me that the area of the lake is 17.522 acres. The exact date of its construction is unknown, but it was certainly before 1750. The northern half averages three feet in depth, and the southern half from ten to twenty feet. There is an old-established heronry of some twenty nests. In 1914 a pair of cormorants nested in a tree on the island in a heron's nest. Mallard and grebe nest, and visitors are teal, gadwall, pochard, great crested grebe, white-fronted and pink-footed geese. It abounds in pike and all other kinds of coarse fish.

NARFORD LAKE. In the park near Narford Hall. Mr. J. F. Attwood informs me that it was constructed in 1840, when its area was 27 acres, but was subsequently enlarged, and has now an extent of 56 acres. It is fed by springs which rise underneath the Hall, and the flow from these abated very little during the drought of 1921. The average depth is 5 to 6 feet, although in places a depth of 15 feet is attained. In the Decoy Wood on the south side there is a heronry of 10 to 15 nests. A Narford gentleman who has known the lake for twenty years tells me that there are always a few pairs of gadwall to be seen, and they also breed. The Norfolk stock of nesting gadwalls appear to have originated from a pair caught in Southacre Decoy, pinioned and released in 1850 by the Rev. John Fountaine on Narford Lake. In 1877 several wigeon remained on this lake all the summer. The breeding birds are mallard, tufted duck, pochard, teal, shoveller, great crested grebe, and little grebe. Wigeon and pintail frequent the lake in hard weather, and a pair of golden-eye were once seen. Wild swans have been observed on several occasions; twelve years ago an osprey frequented the lake for

some days ; and a bittern was observed about ten years ago. Mr. Attwood adds that the fish are chiefly trout and carp. In 1921 a trout was caught weighing $3\frac{1}{2}$ lbs. When the lake was cleaned out about twenty years ago the water was run off, and the fish carted on to the land in tumbril loads. In 1843 two decoy pipes were made on the lake by the Rev. J. Fountaine, and in one season he obtained 1,000 fowl.

NORTH ELMHAM LAKE. In the park near the Hall. Mr. G. Mace tells me that the lake has an approximate area of seven acres, and is certainly artificial. The sides at the east end are bricked. There is little doubt that it was made when the present Hall was built by Richard Warner in 1720. It is fed by a brook which flows in at the west end, where it is very shallow. In the deepest parts there are 9 or 10 feet of water, the average being probably 5 or 6 feet. Coots, moorhens, and swans nest, and mallard and herons are visitors. Pike, eels, and tench abound.

RACKHEATH SPRINGS. This sheet of water is on the west side of the Norwich-Wroxham highway in Rackheath. Sir E. Stracey, Bart., informs me that its area is 6.7 acres, and it was formed by impounding the water flowing from some seven springs which are the head waters of a stream known as Dobb's Beck, which flows into the Bure. The dam was originally made about 1860 by the late Sir Henry Stracey for operating a hydraulic ram which drives the water through to Rackheath Hall. The depth is not more than four or five feet except immediately over the springs. Mallard, shovellers, and teal nest there, and coots, moorhens, water-rails, black-headed gulls, tufted duck, gadwall, wigeon, sheld-duck, pintail, and garganey are visitors, while goosander, red-breasted merganser, and great northern diver have been shot. Pike, roach, rudd, perch, gudgeon, bream, tench, and eels are plentiful. A previous tenant of the Hall turned in a thousand rainbow trout, but they all disappeared within eighteen months or less.

RAYNHAM LAKE. This is situated in Raynham Park, and an iron-stained spring issues from the lower end. The "Norfolk Tour" says :—"The park and woods . . . are beautiful, and the lake below particularly striking." Mr. L. V. C. Jones informs

me that the area of the lake is 27 acres. It is fed by springs, and was excavated in 1630 by Mr. Kent. Mallard, teal, moorhens, and coot nest, and in addition shovellers, snipe, and woodcock are not infrequent. The bittern is a rare visitor. Pike, roach, and dace are found in the lake.

SANDRINGHAM PONDS. Mr. A. C. Beck informs me that there are three fish ponds of under two acres each in the neighbourhood of Sandringham House, York Cottage, and in the Park. These are all artificial waters, fed by springs, and were made between 1860 and 1870, in the early days of the purchase of the estate for the Prince of Wales (afterwards King Edward VII.). The ponds are visited by mallard, teal, pintail, and golden eye, and contain coarse fish.

SCOTTOW PONDS. Mr. A. E. Powell tells me that the area is 25 acres. The east end is shallow, but the water shelves to a depth of 15 feet opposite the boat-house. There was a stream here, and towards the end of the 18th century one of the Durrants carted the soil to the land adjoining and made the ponds. The outlet is into the Bure by King's Beck. The ponds are surrounded by trees, and are a favourite resort for mallard, teal, wigeon, and herons. A red-necked grebe was seen here in 1848, and a common scoter in June, 1856. The fish include pike, tench, roach, and perch. The largest recorded Norfolk pike was a 37 lb. fish taken here in 1854, and a 20 lb. pike was caught early in 1922. Wooden models of many fine fish caught in the ponds are preserved at Scottow Hall.

SCOULTON MERE. This fine mere is by the side of the road between Norwich and Hingham, is surrounded by narrow belts of woodland, planted at the Enclosure between 1805 and 1807, and is about one and three-quarter mile in circumference. The mere itself is about 30 acres in extent, and the island, on which large numbers of black-headed gulls breed, is about 40 acres. Originally it appears to have been a swampy area near the source of a small stream which flows intermittently from Wood Rising into the mere. A considerable portion appears to have been dug out and a firm bank made all round about 1805, dividing the waters of the mere from those of two ditches

which almost encircle it. The junction of these with the overflow from the mere sluice makes the beginning of a tributary of the Wissey. Mr. George Broke tells me that he believes the mere is supplied by springs, as the little stream from the direction of the Hall provides only a small quantity of water. The "Geology of Attleborough" says that the mere "is wholly in the boulder clay," but Mr. W. Whitaker ("Water Supply of Norfolk") considers it is on the gravel. The average depth of water (Mr. Geo. Garwood tells me) does not exceed four feet. It was quite dry in the late summer of 1921, when the expanses of mud were covered with large specimens of the freshwater mussel, from which the molluscs had been extracted, presumably by herons. In October much of the bed of the mere was covered with a thick coating of vegetation, the bare mud being intersected by wide and deep cracks. The water then covered about a fourth of the area to a depth of a few inches. The black-headed gulls arrive about March 18th, and depart in July. Other nesting birds are mallard, teal, gadwall, shoveller, pochard, little grebe, coot, snipe, sedge warblers, and reed warblers. On May 23rd, 1918, an osprey visited the mere and was seen by Dr. S. H. Long. The fish are pike, roach, perch, carp, rudd, and eels. In 1864 a number of half-pound pike were placed in the mere, and ten years later they had grown to 18 lbs., and had destroyed all the little grebe. Mr. Christopher Davies records that 23 pike were taken on Scoulton Mere on one day by trimmers, five of them weighing over 20 lbs each.

SHADWELL LAKE. This lake was formed in Shadwell Park by widening a branch of the river Thet, and is about 3 acres in extent. Sir Robert Buxton's "Household Book" records that in 1790 5s. was paid to Mr. T. Holt's keeper "for bringing three Canada geese," and a guinea in 1805 to "Lord Wodehouse's keeper for the Canada geese." The average depth is about 3 feet, but it is deeper in the old river channel, and especially near the sluice which conveys the surplus water to the river. Eight species of duck have been recorded; a young bittern was killed by a warrener's dog in the reeds by the sluice in 1903; wild geese, swans, great crested grebe, moorhens, coots, herons,

and kingfishers have been noted ; and a peregrine has been seen chasing the ducks. Otters have also been caught. The fish are pike, roach, rudd, tench, lake bream, and white bream. Pike have been caught up to 23 lbs. in weight, and many over 18 lbs.

SOUTHACRE DECOY. This is near the river Nar and was made for the Rev. John Fountaine in 1843 by George Skelton the younger, and consisted of $1\frac{1}{2}$ acre of water with four pipes. Mallard, teal, pintail, wigeon, and gadwall were taken and shovellers seen.

STANFORD WATER. Lord Walsingham informs me that this sheet of water was made by his father about 1847, and is approximately 40 acres in extent, with an average depth of not more than 3 feet. It is in the valley of a tributary of the Wissey, which was dammed below a marshy flat, and as it is fed by springs remained full in 1921. It is in the chalk tract. In 1873 Professor Alfred Newton visited it with Lord Walsingham and said that "About a month before the Maharajah Dulceep Singh went shooting ducks there, and wading lost a diamond said to be worth between £2,000 and £3,000 from a ring, and this he wants to find. Accordingly they have let the waters off to lay dry the line he took, and the soil is to be taken up, stacked like peat, and sifted." There was an earlier Stanford Mere on the heathland where black-headed gulls were found breeding in 1836 by J. D. Salmon, F.L.S., who also recorded that shovellers nested there in 1826 and pochard in 1836. Other nesting birds are mallard, tufted duck, gadwall, teal, and great crested grebe, Pinioned females of wigeon and pintail were turned down to induce the wild males to remain with them, and the experiment was partly successful. The Badminton volume on "Shooting" records some fine bags at Stanford, often including scaup, smew, goosander, pintail, wigeon, goldeneye, coots, moorhens, wild geese, and shovellers, in addition to more common kinds. In November, 1878, the late Lord Walsingham in one day killed 134 head of different species of duck. When first made, the lake held some fine trout, and two years after it was constructed they were taken up to 9 lbs. in weight.

Pike have been taken up to 19 lbs. in weight, and other fish are perch, tench, rudd, and eels.

STRADSETT LAKE. Sir A. W. F. Bagge, Bart., informs me that this sheet of water in Stradsett Park is about 21 acres in extent, including the islands. The stream was artificially extended by Thomas Philip Bagge during the Peninsular War, and the deepest part is about 16 feet. Teal, mallard, herons, and grebe visit it, and swans and moorhens nest. The fish are pike, eels, tench, perch, roach, rudd, and bream. Mr. H. L. Bradfer-Lawrence tells me that the lake was constructed in 1807-09 at a cost of £7,000.

STRATTON STRAWLESS POND. Mr. A. E. Powell informs me that the area is just under five acres, and the depth 2 to 3 feet, but 5 feet if the mud were cleaned out. It was made by Robert Marsham about 1820. He built the bridge on dry land, and then excavated a channel to it, his intention being to take the water through Reedhouse Grove, across the Aylsham turnpike to the stream that runs from Horsford, but he came on sand and gave up the project. This was done largely to provide work for the unemployed of that day. It is visited by coot, mallard, great crested grebe, herons, and wigeon. Fine pike—some over 20 lbs in weight—were formerly caught, as well as tench and roach, but most of the fish were killed during the severe winter of 1893, and had to be removed after the thaw, owing to their putrefaction.

THOMPSON WATER. Lord Walsingham informs me that this pool of about 40 acres was made by his father, who dammed a tributary of the Wissey about 1847. Its normal depth is 4 to 6 feet, but in 1921 it became practically dry, and most of the fish died. Mr. W. Whitaker, F.R.S., says that the stream rises in the drift tract around Thompson, and at Thompson Water enters a small chalk-area on the southern side. A decoy pipe was constructed here in 1886 by G. Skelton. The nesting birds include mallard, shovellers, gadwall, pochard, tufted duck, teal, garganey, great crested grebe. A great northern diver was shot in 1875, and pintail and bittern have been noted. On October 23rd, 1921, when nearly half the bed of the mere

was bare mud, Dr. S. H. Long and I saw about 100 teal, 23 herons, many gulls, a kingfisher, one white-fronted goose, one grey-lag goose, and half a dozen swan-geese. A pike of 29½ lbs. was caught about 1879, and on February 3rd, 1905, Mr. J. G. Brown caught 92 lbs. of pike, the largest fish being 24½ lbs. The late Lord Walsingham has caught over 100 perch in a day; bream disappeared many years ago; golden tench were introduced; and tench, rudd, and eels also occur.

WEST TOFTS MERE. This mere was constructed by throwing a big clay dam across a valley, about half a mile from the source of a tributary of the Wissey which rises in powerful chalk springs near Mouse Hall, forming a sheet of water about 4 acres in extent. In addition to some fine beech trees growing on the dam, there is on the southern end a poplar with a girth of 17½ feet five feet from the ground. The dam is broad and high and steep, and a sluice gate carries off the superfluous water from the mere. It is surrounded by trees, and its secluded waters are beloved by wildfowl. Mr. T. Huggan informs me that mallard, teal, wigeon, red-throated divers, coot, moorhens, and kingfishers have been noted, and I have seen shovellers, tufted duck, herons, great crested grebe, and little grebe. In 1921 the fish were attacked by some disease which practically destroyed them all, but pike, roach, and most coarse fish have been caught. A pair of otters frequented the mere in 1920, and the same year the keeper shot a magpie, while in 1921 he caught one alive in a vermin trap.

WESTWICK LAKES. Miss C. Basilia Duff informs me that the lakes here are the Perch Lake with an acreage of 9.60, Little Perch Lake with 1.647, Mill Pond 5.266, Captain's Pond 5.177, Lodge Pond, 6.444, and Church Pond 3.916. They were probably constructed between 1790 and 1800. The "Norfolk Tour" states that "The hills and inequality of the ground all planted to the water's edge have a most beautiful effect round a lake of between 30 and 40 acres (*sic*). There is also a large piece of water near the house, which from the elevated situation of the place and the nature of the soil it was long thought impracticable to obtain, but that difficulty is at last fully surmounted by Mr. Petre's having made an aqueduct from the

large lake above-mentioned." Mr. Robert Gurney states that in order to make the Perch Lake a dam was built across the valley about 1819. There was no pond or stream previously, and it is fed by springs and surface water. Colonel Petre informs me that it is over 20 feet deep in most places, and in the last five years the depth of water has increased by certainly 6 feet. The two ponds at the sides of the Norwich—North Walsham road have also very considerably deepened in that period. The two ponds in the park, which were puddled and filled by a pumping engine, are nearly empty, the horses from the camp at the park having destroyed the puddling. The decoy at the end of the Perch Lake, constructed about 1826, has not been used for 20 years. Mallard, teal, wigeon, and pintail were caught there.

WOLTERTON LAKE. Lord Orford says: "The lake is 14 acres in extent. It is an old lake. At the further end from the house my grandfather excavated about six acres more, but it was unfinished at his death in 1860, and so remains, and a small extent has no water in it. Beyond this again in old days there was a decoy in what is still called the "Decoy Wood." It was drained, and then used for fish stews, but is now planted with trees. Canada geese fly backwards and forwards between the lake here and those at Blickling and Gunton, and breed on an island in the lake. There are many mallard, pintail, golden eye, teal, etc., and a ruff was shot by mistake a few years ago. Crested grebe are here in some quantities. A few years ago a stormy petrel was found on the lake and is preserved here. Herons are generally to be seen. All kinds of coarse fish are in the lake, including very large carp. Pike of 29 lbs. and 26 lbs. have been caught of late years. The lake is shallow at the end towards the house, but in the deepest part is 14 feet. It is fed by springs and water is led from springs 200 and 300 yards away."

WORSTEAD LAKE. Mr. Wm. Chettleburgh informs me that there are two lakes, the upper with an area of 1 acre, and the lower with an area of 8 acres, with a causeway between on which is the carriage drive. They are supplied by a small stream,

which was widened over 130 years ago. The average depth is 5 to 6 feet, and the deepest part 8 feet. The upper lake is headed by a small wood of evergreens and contains a small island, while there are two islands, one at each end, in the lower lake, the head of which is surrounded by a wood. The drought of 1921, although lowering the water, did not cause the lakes to become quite dry, but by January, 1922, they were again full, the mud having been cleaned out during the previous summer. Mallard and moorhens nest, and visiting birds include herons, gulls, wild swans and geese, and various species of duck. In the upper lake there are tench, perch, and roach, and in the lower lake pike, carp, roach, bream, etc.

VII.

NATURAL AND ARTIFICIAL FLIGHT

BY J. D. NORTH, F.R.AE.S., F.R.MET.SOC.

SUMMARY.

IN all surviving literature we find traces of man's interest in and envy of the flying animals. Numerous attempts at human flight have been made from time to time from the beginning of the Christian Era to the commencement of the 19th century, but all had the common feature that the apparatus was modelled on the superficial characteristics of a bird. When we consider that the materials have always been available with which an apparatus capable of at least one kind of flight could have been made, it is remarkable that more definite success was not obtained.

Flight may be separated into three classes: static flight, such as that of an airship, and the two forms of dynamic flight—soaring or gliding flight, for which the energy is supplied from an external source, and flight under power, in which the energy is derived internally from a motor or animal mechanism.

As man's animal mechanism is inadequate for the latter form of flight, he is compelled to make use of a mechanical prime mover ; and until a suitable form of prime mover made its appearance in the latter part of last century, the development of human flight was necessarily slow.

The record of the rocks contains much interesting information concerning the development of animal flight. The remains of one of the earliest forms of flying creatures—the paleodictyoptera—have been taken from the Carboniferous strata. The wings of this creature consisted of a double membrane interconnected by numerous air-tubes, and were apparently developed from the external tracheal gills which have been found in many species intermediate between the fishes and the reptiles. Among the flying reptiles, the earliest of which was the *Dimorphodon*, we find the *Pterodactyl*, which was the largest flying creature which has so far been discovered. It had a wing span of about 20 feet, and its weight has been estimated at no more than 30 pounds. Its structure was very delicate—the main bones of the wings, though over two inches in diameter, were no thicker than a visiting card.

Here it is interesting to note the fact which limits the size of a flying structure. If we consider a definite form of structure whose dimensions are increased all round in the same ratio, the supporting surface will be increased as the square of the dimensions, and the weight of the structure as the cube of the dimensions. It will thus be seen that the weight increases at a greater rate than the surface, which means that with increase in size we must either have a heavier loading per unit area of surface or else better and more economical structural methods. This influence of size on wing loading is well seen in a comparison of various insects and birds. To take a few examples, the gnat has 49 square feet of wing surface per lb. of its weight ; in the rhinoceros beetle this figure falls to 3.14 ; the sparrowhawk 2.05 ; the flamingo 0.55 ; the modern aeroplane 0.1. It appears that in the *Pterodactyl* nature reached its limit in size, at any rate for the type of wing structure employed.

From the flying reptiles we pass on to the development of the bird proper, characterised by a gradual forward movement of the centre of gravity of the body and the appearance of feathers, which were merely a mammalian development designed to conserve the high degree of thermal efficiency necessary. The earliest known bird was discovered in the Solenhofen Lithographic Slate (Upper Jurassic) and is known as the *Archæopteryx*, of which two fairly complete specimens are preserved, in the South Kensington Museum and at Berlin.

The modern bird flies in two ways: by gliding or soaring, and by flapping. A bird or an aeroplane, if released from a height in still air with its wings or planes rigidly extended, will reach a state of steady motion, known as gliding, in which it advances from 5 to 10 feet horizontally for each foot it descends. Its efficiency on the glide is represented by the ratio of horizontal distance to loss of height, and from this it is easy to calculate the work done and power expended. It is, however, difficult to obtain any consistent data as to the value of this ratio by direct observation of birds in flight, owing to the complexity of movements in the air. It has been estimated by various observers, whose figures range from about 5 to 1 to about 8 to 1. An alternative method of measuring this ratio has been developed in the Wind Channel, an apparatus in which a steady stream of air of known velocity is caused to flow past an object mounted on a sensitive balance. Various birds have been tested in wind channels, and the results so far obtained would tend to show that bird forms are not as efficient aerodynamically as that of the aeroplane. The best Lift-Drag ratio found in a bird (a teal) in the wind channel is approximately 5.3, whereas a complete model aeroplane of similar size, tested under the same conditions gave a ratio of 7.5: in the full scale aeroplane this difference would be still greater.

In order to maintain equilibrium and prevent loss of height, it is necessary to apply a force along the line of flight equal to the air resistance. The power which a bird is capable of expending may be considered to depend on the weight and size of its muscles—comparable to the size of an aeroplane motor,

and the amount of food energy stored in food calories---comparable to the fuel supply of the aeroplane. Various authorities have estimated, from observations of bird flight, the amount of power necessary to sustain them in the air. In comparing these figures with the weight of the birds' muscles, the estimates vary from 22.5 to 68.8 foot-lbs. per second per pound weight of muscle, so that it is difficult to attempt to make any definite conclusions as to their efficiency as an engine. Houghton has estimated the power of human muscles as about 5.4 foot-lbs. per second per pound weight, and the large discrepancy between this figure and the lowest quoted for a bird still awaits explanation. It signifies that either human muscles are very much less efficient than those of birds, from the standpoint of strength for weight, or there is some special feature of bird flight which has not yet been appreciated.

It must be remembered that in flight power is continually being expended, and must from time to time be replenished in the form of food or fuel. In the face of this fact it is obvious that there is no truth in the commonly accepted idea that birds when migrating can fly thousands of miles at a stretch. It would be interesting to weigh a bird both before and after a long flight, and thus try to estimate the actual amount of work done in flying. Another common fallacy connected with the migration of birds is that they fly at very great heights. There is no reason to believe that birds fly above about 5,000 feet except on very rare occasions. One reason why they should not be expected to do so is difficulty in breathing, as the air becomes less dense, and so contains less oxygen per unit volume, as the height increases. It is for this reason that aviators have to take up supplies of oxygen to breathe if they wish to fly for any length of time at a greater height than about 15,000 feet. Another reason is that the temperature of the air decreases rapidly with height, and a low temperature would make it more difficult for the bird to conserve the heat energy upon which its flight depends.

The nature of flapping flight has been investigated by Marey and others, and various forms of flapping have been defined.

It is difficult to form an estimate of its efficiency as a mechanism for converting power into air thrust, but there is no reason to suppose that by imitating it mechanically it would be possible to produce a flying machine more efficient than the airscrew driven type. The nature of flap does not affect the above remarks concerning the relative merits of bird and human muscles, as 100% efficiency of the flapping mechanism has been assumed.

The problem of soaring flight is one which has long attracted the attention of scientists and others, and since the War fresh interest in it has been evidenced by the numerous experiments with various types of gliders in Germany. The simplest explanation of soaring flight is that it is merely another form of gliding in which, while losing height relative to the air in which it glides, the bird or machine remains at a constant height relative to the ground, owing to the fact that the air itself is rising. Rising currents in the atmosphere are due to a variety of causes—contour of the ground over which it is moving, differences in temperature between different parts of the atmosphere, etc. It is by taking advantage of these rising currents whenever they are encountered that birds such as seagulls are able to soar for long distances without expenditure of power. At the present time soaring is still the subject of controversy, and there are many who are loth to admit this simple explanation. Dr. Hankin, one of the greatest authorities on bird flight, states that soaring is accomplished otherwise than by utilising rising currents; but, while we must give deference to the accuracy of his observations, there is reason to believe that his conclusions drawn therefrom may be faulty. It has been shown to be possible for men in gliders to soar in this way for upwards of twenty minutes at a time; but whether any further valuable results will accrue from this form of experiment remains to be seen. It was while experimenting with this form of flight that the Wright brothers invented the forms of control which made the aeroplane a practical proposition, and it was by adding an engine to one of their gliders that they made the aeroplane an accomplished fact. With this successful achievement of

artificial flight, the study of bird flight has lost the greatest prospect of reward which it had to offer, but it is by no means improbable that substantial advances might be made by further research in this direction.

VIII.

INFLUX OF THE RED-NECKED GREBE
(*COLYMBUS GRISEIGENA*)

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

Although the Great Crested Grebe is a familiar denizen of our Broads, the other smaller species are, with the exception of the Dabchick, never common in Norfolk. Occasionally it happens that there is an influx of *Colymbus griseigena* and *C. auritus*, but there is always something to account for it.

In reality it depends on the weather, which, if very severe, drives these diving birds from lakes directly they become frozen to southern and more open waters. In the present instance it seems to have been a gale and the frost combined which were accountable for their presence, the storm was from the west, and was strong on the night of February 3rd and early morning of the 4th, with snow. These conditions naturally affected all kinds of wild-fowl, and in addition to a rush of Ducks and Geese, it brought more Grebes to Hickling and Barton Broads than Mr. Vincent had ever seen there, about twenty Slavonian and five Red-necked Grebes (*C. auritus* and *C. griseigena*) being viewed at the former place. Others probably were riding at sea, as the washed-up remains of a Black-necked Grebe were subsequently picked up by Mr. Buxton on the shore.

It appears that Grebes were equally abundant at Cley about a week earlier, for under date of January 27th Mr. Pashley writes: "A great many Grebes about, especially Red-necked Grebes, which I consider the rarest species on this coast. I

have seen eighteen or twenty, but not one of them had a sign of rufous on the neck. They varied much in size, the smallest one being three inches less than the largest. I have also seen a good many Slavonian Grebes, but only one Black-necked so far."

On February 4th he again writes of more Grebes having turned up, all four species being now represented, viz., the Great Crested, Red-necked, Black-necked, and Slavonian.

In the neighbourhood of Yarmouth, Grebes also showed up in rather unusual numbers; a few being sent to Mr. Saunders for preservation (*see* "British Birds," XV., 295), and several to Mr. Gunn of Norwich. Mr. Gunn had altogether five Slavonian Grebes, one Black-necked, four Great Crested, three Red-necked, and one or two Dabchicks, all of them in winter plumage.

This invasion of Grebes was by no means confined to Norfolk and Suffolk, but extended north along the coast-line of Lincolnshire, Yorkshire, and as far as Northumberland, where Mr. Abel Chapman says it was marked by an influx of all four species. (A.C. *in litt.*) Where they all came from is a mystery which one would like to solve, the more so because sometimes a sharp winter brings none at all.

It is probable that to Scotland we owe these migrants, for great gatherings of Grebes have been occasionally noted on Scottish lochs, as in Wigtown Bay on December 4th, 1920, "after a great gale." ("Scottish Naturalist," 1921, p. 152.)

There does not seem to have been any such migration of Red-necked Grebes to Norfolk or Suffolk since February, 1865. There was a smaller rush of that species in 1891, but the invasion spent itself chiefly on the Yorkshire coast, and again in 1897 Norfolk had a good many, and at that time Slavonian Grebes were equally abundant (*see* "Zoologist," 1898, p. 108).

IX.

WILD BIRD PROTECTION IN NORFOLK IN 1922

REPORT OF THE COMMITTEE

In presenting its first report on the protection of wild birds in the county of Norfolk the new Committee, appointed for this purpose at the last annual meeting of the Society, must first record its appreciation of the harmonious amalgamation that has taken place between the various Wild Bird Protection Societies that previously existed in the county; and in the second place of the wide-spread support it has received from members and others, whether resident or non-resident in Norfolk. The total number of subscribers to the central fund is 106, producing, with donations, an aggregate sum of £158 11s. 11d. In this connection special reference must be made to the sum of £8 11s. 10d. collected by the watcher (R. J. Pinchen) from visitors to Blakeney Point. It is impossible to give, before the end of the year, a statement of the expenditure and liabilities of the Committee, but such statement will be issued in the next report.

To enumerate the results of the season's work on the different coastal areas it will be best to take these separately.

1. BREYDON WATER

George Jary is the watcher, a position he has held for twenty years. He is familiar with the different species of birds that visit this estuary and has a knowledge of most of the local gunners. He was on duty for five months, from the beginning of April to the end of August, living in the Society's house-boat moored in the Ship-Drain. It was necessary to renew the boat this year, as the old boat (second-hand when purchased twenty years ago) could no longer be rendered watertight.

The usual large number of ducks and waders made use of these mudflats as a halting feeding-ground during the spring migration, but only once, on July 6th, did a Spoonbill put in an appearance this year. For some years past there has been a suspicion that Sheld-Ducks have nested on the high ground

in the neighbourhood of Burgh Castle, and the fact that on June 16th of this year two pairs of these birds, each with a brood of young ones, nine and five respectively, were present on Breydon practically confirms this opinion.

It was reported to the Secretary that indiscriminate shooting from the walls of Breydon had been going on during the month of August, especially in the early morning on Sundays. It is therefore satisfactory to record that at the Great Yarmouth police-court on September 11th the Society successfully prosecuted one of these gunners for shooting a Ringed Plover on Sunday, August 27th. With the present state of the law which allows of Snipe, Teal, and all species of duck being shot after July 31st, whereas other wildfowl, except those with an all-the-year-round protection, are protected up to August 31st, there may be confusion in the minds of some as to the closed period for different species. On this account the Committee did not press for the maximum penalty, and felt that by inflicting a fine of five shillings, with the same amount as costs, the Bench had done all that was required in making an example of the case. It is very difficult on a wide area like Breydon to get in touch with these law-breakers, and the watcher is to be congratulated upon his success on this occasion.

2. HORSEY

Some twenty to thirty pairs of Little Terns arrived on this area again this year, but some of them seemed to move on to other nesting sites. The part-time services of a keeper from an adjoining beat were secured for watching the nests, of which there were from fifteen to twenty. A few clutches hatched off, but two high tides in July swept away many of the nests. The area was visited on several occasions during the nesting season, and it is satisfactory to report that there was no evidence of eggging—except by Rooks. The local fishermen are in no sense hostile to the birds. A few pairs of Ringed Plover nest on the beach. On Horsey Warren a pair of Stone-Curlews nested this year.



Photo

Nest and Eggs of Little Tern
Blakeney Point, June 10th, 1922

R. Gaze



Photo

Nest and Eggs of Common Tern
Blakeney Point, July 25th, 1922

R. Gaze

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3. SALTHOUSE BROAD

It augurs well for the future success of our efforts at bird protection that Nature should have come to our assistance, as she has done, on this part of the coast-line. Within the course of a single night (December 31st, 1921) the sea, which man for generations has been striving to keep at bay, by shattering a concrete wall has once again placed under natural conditions acres of reclaimed marshland in this district, which have thus reverted to the ideal breeding-ground they once were when the Avocet, Ruff, and numerous species of sea-birds resorted to them as a nesting area. (It may here be parenthetically explained that the surplus water in Salthouse Broad normally drains away to the Cley Channel, through the Cley marshes. This Channel has become blocked by landward-creeping shingle; hence, at the present time there is no natural exit for the water in either of these two large inundated areas.)

Such a sight as was witnessed here during this past summer could surely not have been equalled elsewhere in the British Isles. With numerous small islands dotted about on a shallow inland sea, or Broad, as it is locally termed, separated by a bank only from the Cley marshes similarly flooded, here indeed was a spot such as many birds must have been on the look-out for on their return spring journey to the north. And it was obviously appreciated; because with the advent of spring it very soon became alive with a winged population.

In 1920 a few Common Terns (about twenty pairs) nested on Salthouse Broad, and although the nests and young suffered considerable molestation at the hands of boys and others, the birds returned to breed in considerably increased numbers in 1921. This year, on one of the islands, it is estimated that there were from 500 to 600 nests of the Common Tern. On a very small patch of this same island there were also ninety nests of the Sandwich Tern, the nests being closely packed, as has been observed before in other colonies (see Bickerton "The Home-life of the Terns," p. 18). In only about a dozen of these

nests was more than one egg laid, and in no instance were more than two eggs found in a nest. Black-headed Gulls, Redshanks, and Ringed Plover were also found nesting on this island. On the shingle ridge separating the Broad from the sea were numerous nests of the Ringed Plover and a few of the Little Tern.

It is a matter of considerable interest that the Sandwich Tern should have started breeding on the coast of Norfolk, because hitherto there has been no record of this species breeding on the east side of England, south of the Farne Islands.

One of the most interesting sights on the Broad were the several pairs of Sheld-Ducks with their young. There are suitable nesting places near-by, where doubtless these were hatched, and it was instructive to see how skilfully the young ducklings dived in the presence of danger, or in response to an alarm-note from their parents.

From the beginning of April to well into July a pair of Scaup Ducks were to be seen daily on the Broad, but there is no evidence of their having nested.

On the adjoining partially-inundated Cley marshes there was also evidence of much bird life throughout the summer: Coots, Moorhens, Lapwings, and various species of waders were to be seen here at all times, and doubtless some of them nested.

Early in June a pair of Black Terns appeared on the scene, and were present throughout the breeding season; there is a presumption that this pair nested, though no nest^s was discovered. Miss Logan Home, who visited the marsh on several occasions during the summer, found, on July 31st, four Black Terns hawking over that part of the marsh where the pair had usually been seen, "two of them being much paler than the others."

4. BLAKENEY POINT

In addition to our own observations on this delightful reserve we are indebted to the watcher, R. J. Pinchen, and others for many interesting facts about the birds nesting here.



Photo

R. Gaze

Nest and Eggs of Roseate Tern
Blakeney Point, June 10th, 1922



Photo

R. Gaze

Nest and Eggs of Arctic Tern
Blakeney Point, June 10th, 1922

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On April 22nd the first Ringed Plover's nest, with three eggs, was found; later, several other nests of this species were discovered, and the birds generally had a successful hatching.

On April 24th the first of the terns, a Little Tern, was seen, and six days later this was followed by a few more of the same species, together with a few Common Terns; and on the night of May 3rd there was a large influx of terns of both species, and a few Sandwich Terns also came in.

On May 4th the first Oyster-catcher's nest, with one egg, was found; five days later a second nest, with two eggs, was discovered. In all, six nests of this bird were found on the Point this year, and all hatched off successfully. This is eminently satisfactory, because only a few years ago *one* nest on this area was quite an event. Two Redshanks' nests, with eggs, were found on May 19th.

The first nests, containing eggs, of the Common and Little Terns were discovered on May 17th, and from this date onwards the number of nests of both species increased rapidly.

Three nests of the Sandwich Tern, each containing one egg, were found on May 24th, and subsequently six more were discovered. In no instance was more than one egg laid in a nest. On this same date the first Roseate Tern was identified, and two days later a nest, containing three eggs, was found; these eventually hatched.

On May 29th young Sheld-Ducks were first seen swimming in the harbour. Between the rabbit holes on the Point and the gravel hills in the neighbourhood of Salthouse some thirty to forty pairs of Sheld-Ducks must have nested this year.

On June 7th the watcher found a nest, with two eggs, of the Arctic Tern, and verified his identification by watching the old bird go on to the nest. This bird was seen and identified by several other competent observers.

There were two main colonies of terns on the Point this year; the one on the extreme western end, the other in the neighbourhood of Great Sandy Low, where many of the nests were scattered among the dunes: on the intervening shingle beach most of the nests of the Little Terns were situated. It is

proverbially difficult to estimate with accuracy the number of nests in any colony, when these are "all over the place," as Pinchen very aptly described them ; but it is not an exaggeration to say that there were 1000 nests in each of the colonies. Of these, by far the greatest number were Common Terns' nests, but there were also nine nests of the Sandwich Tern, one of the Arctic, and one (or possibly more) of the Roseate Tern. The call-notes of these different species are easily recognisable, and in the case of the Arctic Tern there were many opportunities for observing the parent bird at close quarters. By the courtesy of Mr. Nash we are able to reproduce photographs of a nest of each of these species taken by him on Blakeney Point this year. In the opinion of the watcher the birds never hatched off better than they did this year, and there was fortunately no high tide to wash out the nests, as occurs sometimes.

5. WELLS

We visited this ternery with the watcher, Cringle, on June 8th, 1922. In walking down to "the hills" across the marshes the entire absence of terns diving over the creeks and pools was very noticeable. On the other hand, Redshanks were numerous, and by the behaviour of the old birds it was obvious that their young were not far distant. A few pairs of Black-headed Gulls were nesting on this marsh, but for some unknown reason the main part of the colony shifted this year to the Stiffkey and Morston marshes. For the past forty years to our own knowledge there has been a large colony of Common Terns on the meal marsh and adjacent sand-hills at Wells, and it is a little difficult to explain why, this year, the birds were reduced to, at the most, twenty pairs. An investigation of the area suggested the following as contributory causes for the birds forsaking this long-tenanted site and for moving eastward to Blakeney Point and Salthouse, for such would seem to be the explanation of the great increase in the size of the colonies at these latter places.

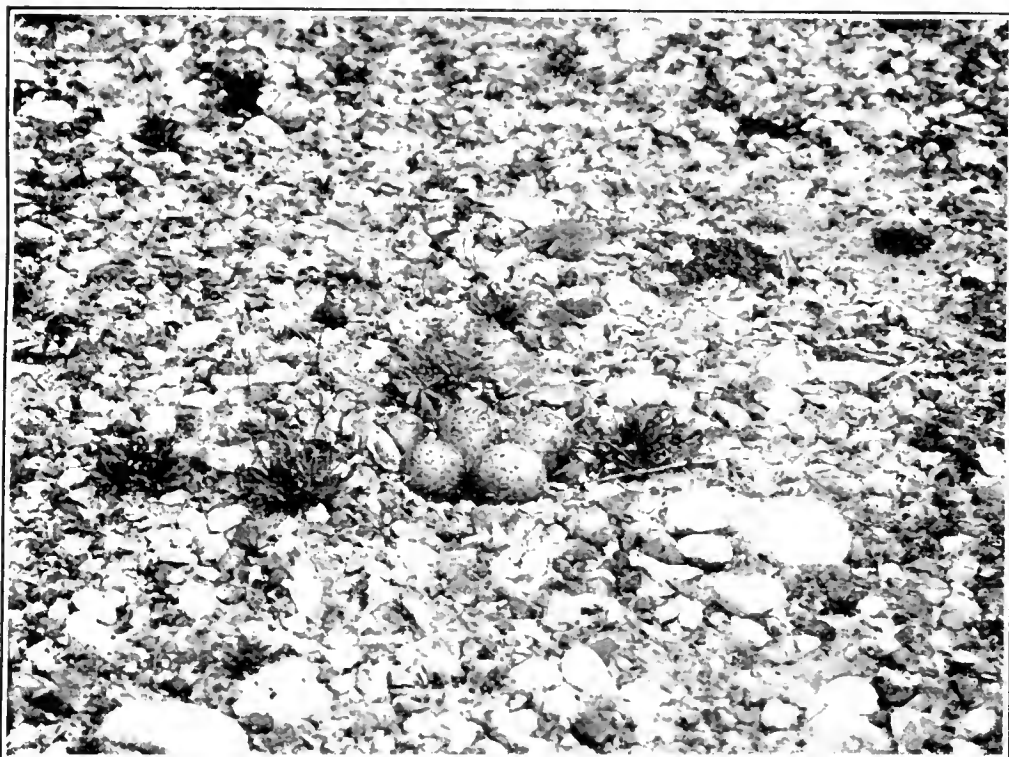
In August, 1921, an extensive fire occurred on the sand-hills forming the eastern limit of the area ; the marram was all burnt,



Photo

Nest and Egg of Sandwich Tern
Blakeney Point, June 10th, 1922

R. Gaze



Photo

Nest and Eggs of Oyster-Catcher
Blakeney Point, June 10th, 1922

R. Gaze

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and the gales of last winter, supplemented by the abnormally high tides at the end of the year, resulted in these dunes being swept away. The marram is already beginning to grow again in small islets, but over the whole of this area we could only find four nests, whereas formerly there were scores.

On the adjacent dunes, on the northern side of the breeding-ground, trees were planted some years ago, and these have now grown to a considerable size; it is not improbable that the presence of these trees has acted as a deterrent to the birds remaining here for nesting purposes.

As showing the age to which terns may live it may be recorded that for seventeen successive years there was a nest of the Common Tern on this ground containing very distinctive unspotted red eggs which were seen by several reliable ornithologists. The nest was always placed on the same site in the dunes, adjacent to a piece of old wreckage. In 1920 the bird was killed by a stoat, and the watcher found the latter, with the dead bird and the eggs, in a rabbit hole near by. He has not since found a nest containing similar eggs.

About six pairs of Oyster-catchers and from fifteen to twenty pairs of Sheld-Ducks nest in the Wells district. When topping the dunes in our return from the shore to the marshes we disturbed a Marsh-Harrier feeding on the ground about sixty yards away.

6. BRANCASTER

On what is locally known as "Bird Island" in this district, *i.e.*, that area of the coast-line containing Scolt's Head which lies between the mouth of Overy harbour on the east and of Brancaster harbour on the west, with Norton Creek as its southern limit, there has, for some years, been a colony of nesting terns. The area is difficult of access, and when we visited it on June 2nd, 1922, we counted seventeen nests, with eggs, of the Common Tern and nine of the Little Tern. Sheld-Ducks also undoubtedly nest hereabouts, and we saw fifteen of these birds on one mud-flat. The area has so far received no

supervision during the nesting season, and next year it will be the business of the Committee to settle whether or not it is necessary to have a watcher here.

7. WOLFERTON

By an arrangement with the Head Keeper two of the keepers on the Sandringham estate have supervised this ternery for the committee during the past breeding season. The ground was visited by ourselves and on several occasions by Col. Cresswell. Keeper John Bland reports that there were forty nests of the Common Tern ; twenty of the Little Tern ; fifty-one of the Ringed Plover ; and forty of the Lapwing. He estimates that 90% of the eggs hatched off. The watcher's hut was re-painted at the close of the season.

8. THE HICKLING RESERVE

From the point of view of encouraging the return of those rare breeding species which are known to have nested in Broadland years ago, the importance of maintaining this large reserve as a non-disturbed area throughout the breeding season is fortunately recognised by the owners of the property ; and the fruits of the rigid protection to which this district has been subjected during the past few years are now becoming apparent. In 1911 the Bittern returned to nest in Norfolk, at Sutton Broad ; this year there were certainly four, and possibly five pairs of these birds at Sutton—a full complement for the district. The birds have gradually spread into the surrounding areas, and, without attempting to give a census of the nests in 1922, we can confidently say that the Bittern may once again be reckoned as a well-established breeding species in the county.

Of the Harriers we can also give encouraging reports. Several pairs of Montagu's Harrier regularly nest in the Broadland district, and occasionally, though not every year, a pair of Marsh-Harriers also nest with us. Ruffs pass through the Hickling district every spring, and a few years ago Miss Turner photographed a Reeve on its nest in this locality. It would therefore seem to be more than a wild hope that before many years have passed " Rush Hills " will once again justify its, to many, inappropriate name.

9. GENERAL

During the past few years there has certainly been an increase in the nesting population of the Black-headed Gulls in Norfolk. In addition to the well-known colony at Scoulton Mere, and those mentioned above, there has sprung up this year a colony of considerable size in the parish of Breccles, an offshoot, apparently, from Scoulton. As an indication of the rapidity with which such a colony can establish itself, it may be stated that it is not thought by the owner of the property that there were any nests last year, but during the past season (1922) over 1000 eggs were taken, and yet on July 10th "the place was swarming with young gulls." At Stoke Ferry there is another, now well-established, colony of these birds; and in the Broads district from 100 to 150 pairs have nested at Hoveton during the past few years. There would also appear to be an increase in the number of Herons nesting in the county. For example, Mr. H. E. S. Upcher informs us (*in litt*) that in Blackdyke Wood on his property at Hockwold herons began to build about 1880, and that "they have increased annually and now there are about forty nests." We know of other heronries where the nests are on the increase. As mentioned elsewhere in this number, the Wood-Warbler is now known to be an established breeding species in west Norfolk, and during the past year we have received encouraging reports about the Redstart returning to nest.

There are still a few pairs of Crossbills nesting in the Castle Rising district; we saw one nest this year (April 17th), and watched the parent birds feeding their young.

In "British Birds," Vol. 16, p. 86 (August, 1922) Capt. A. W. Boyd records the finding of a Ruff's nest in North Norfolk on June 11th, 1922. The nest contained four eggs.

Signed (on behalf of the Norfolk W.B.P.C.),

SYDNEY H. LONG, Hon. Sec.

LIST OF SUBSCRIPTIONS AND DONATIONS TO THE
NORFOLK WILD BIRDS' PROTECTION FUND

FOR THE YEAR 1922

	£	s.	d.			£	s.	d.
H.M. THE KING ...	3	3	0		Brought forward ...	83	6	4
H.R.H. The Prince of Wales. K.G. ...	2	2	0		Holmes H. N. ...	2	2	0
Andrews W. H. M. ...	1	1	0		Horsfall Mrs. F. E. ...	0	10	0
Anonymous ...	1	3	6		Howard H. J. ...	0	5	0
Barclay Col. H. G. ...	2	2	0		Howard R. J. ...	1	1	0
Barrett-Lennard Sir T., Bart. ...	1	1	0		Jacob Miss E. ...	0	10	0
Barton S. J., M.D. ...	1	1	0		Jones Sir L., Bart. ...	1	1	0
Bedford The Duke of, K.G. ...	3	0	0		Knight E. ...	0	10	6
Bell R. C. ...	0	10	0		Knowles R. ...	0	10	0
Bett S. H. I. ...	3	3	0		Larking C. ...	1	1	0
Bidwell E. ...	0	10	6		Lee Elliott Rev. D. L. ...	0	10	6
Bird Rev. M. C. H. ...	1	1	0		Lloyd W. ...	1	1	0
Blakeney Point (Watcher's Collecting-box) ...	8	11	10		Long S. H., M.D. ...	2	2	0
Boardman E. T. ...	0	10	0		Ditto, per Lectures ...	3	3	2
Boileau Lady ...	1	1	0		Mack H. P. ...	2	2	0
Boileau Sir M., Bart. ...	1	1	0		M'Kenna Mrs. Reginald ...	1	1	0
Brittain H. ...	0	10	6		Meade -Waldo E. G. B. ...	1	1	0
Brooks J. R. ...	1	0	0		Meadows Mrs. A. H. ...	0	10	0
Burton S. H., F.R.C.S. ...	2	2	0		Millett C. ...	1	0	0
Buxton E. G. ...	1	1	0		Milner Mrs. W. A. ...	0	10	0
Buxton G. F. ...	1	1	0		Moxey J. ...	1	1	0
Buxton Walter L. ...	1	1	0		Murton Mrs. ...	1	0	0
Byers J. ...	1	0	0		Norwich Sheriff of ...	2	2	0
Caton Rev. R. B. ...	0	2	6		Offord Miss ...	0	10	6
Chamberlin Sir G. M. ...	1	1	0		Oliver Prof. F.W., F.R.S. ...	2	2	0
Chapman E. H. ...	2	2	0		Pain Percy ...	0	11	0
Christie J. A. ...	1	1	0		Patteson Mrs. F. E. ...	1	1	0
Coe Mrs. A. E. ...	0	5	0		Pelham Rev. Canon Sidney... ...	2	2	0
Coller G. A. ...	1	1	0		Petre Mrs. ...	0	10	6
Colman Miss ...	1	1	0		Plowright Dr. C. T. Mc L. ...	1	1	0
Colman Miss H. C. ...	1	1	0		Pond H. J. ...	0	10	6
Colman Ralph ...	0	5	0		Pratt A., M.D. ...	1	1	0
Colman R. J. ...	1	1	0		Preston Sir E., Bart. ...	1	1	0
Cozens-Hardy A. ...	1	1	0		Ransome Mrs. ...	1	1	0
Cremer W. C. ...	0	10	6		Richmond H. W. ...	1	0	0
Cresswell Col. G., C.V.O. ...	2	2	0		Riviere B. B., F.R.C.S. ...	2	2	0
Deacon G. E. ...	1	1	0		Rothschild The Hon. N. Chas. ...	10	0	0
Doughty C. G. ...	1	1	0		Smith Col. H. F. ...	1	1	0
Edwards Maj. B. M. ...	1	0	0		Spalding Gerald ...	0	10	0
Ferrier Miss J. M. ...	0	10	6		Stimpson E. ...	0	10	0
Foster Miss C. ...	5	5	0		Strachan C. E. ...	1	1	0
Geldart Miss A. ...	0	5	0		Taylor Dr. Mark ...	1	1	0
Glyn The Hon. Mrs. ...	1	1	0		Thouless H. J. ...	0	10	6
Gossage Mrs. ...	2	2	0		Ticehurst Dr. C. B. ...	1	1	0
Green Rev. H. W. H. ...	1	1	0		Upcher H. E. S. ...	1	0	0
Gurney Sir Eustace ...	1	1	0		Walter Col. Cyril ...	1	1	0
Gurney Gerard H. ...	1	1	0		Washington Rev. Canon M. ...	1	1	0
Gurney J. H. ...	5	5	0		Willett W. L. ...	0	5	0
Gurney Robert ...	5	0	0		Wilson Mrs. Knyvet ...	0	5	0
Ditto, Lecture at Stalham	1	11	0		Winch Maj. S. B. ...	2	2	6
Gurney W. S. ...	1	1	0		Wolferton W. B. P. S. (balance) ...	12	2	5
Halls H. H. ...	1	1	0		Woolnough F. ...	0	5	0
Harding J. R. ...	0	5	0		Wright T. J. ...	1	1	0
Hare Sir R., Bart. ...	1	0	0		Wyllys H. J. M. ...	0	10	6
Harker W. ...	1	1	0		Wyllys W. E. ...	0	10	0
Haydon W. ...	0	2	6					

Carried forward ... £83 6 4

£158 11 11

X.

A NEW BRITISH PRAWN FOUND IN NORFOLK

BY ROBERT GURNEY, M.A., F.L.S.

IN my account of the Crustacea of the East Norfolk rivers published in these Transactions in 1907, I recorded the capture in Heigham Sounds of *Leander* (*Palæmon*) *squilla*, a Prawn which is characteristic of sea shores between tide marks. In later years the same species of prawn was taken from time to time in other parts of our rivers, but no attempt was made to verify the original identification. During 1921, however, on two visits to Breydon Water, a large number of these prawns were caught in the shrimp trawl of Jary, the bird watcher, and these were carefully examined and compared with the descriptions given of the European species of *Leander* in papers published of recent years by Stanley Kemp and De Man. The result was somewhat of a surprise, since it became quite clear that the Norfolk prawn was not only not *L. squilla*, but was actually a species *L. longirostris* M.Edw., which had not before been found in Britain. It is a species which has been found in the Mediterranean, in certain estuaries of the west coast of France, and is now known to be common in estuarine regions in Holland, where also it had previously been recorded under the name of *L. squilla*.

In Norfolk it is abundant in Oulton Broad, and in Breydon Water at certain times. Mr. Patterson has kindly sent me specimens taken in the Waveney, and I have no doubt that it also inhabits the Yare. In the Bure it appears to be common at least as far up as Acle. Oulton and Breydon fishermen know it as the Jack Shrimp or White Prawn. Mr. Patterson refers to this prawn in his "Nature in East Norfolk," p. 334, under the name of White Prawn (*P. squilla*).

It is evident that this is an estuarine and river species, while *L. squilla*, on the other hand, inhabits the sea shore between tide marks and it is quite common on the Norfolk Coast. I have found it at Hunstanton, Thornham, Wells, Blakeney and Cley,

and have seen specimens taken in Lowestoft Harbour. A small specimen of it was taken this year at Acle, but its occurrence there must be regarded as exceptional and due to the remarkable penetration of salt waters up our rivers during the summer of 1921.

In life the two species are quite easily distinguished by colour alone. *L. longirostris* is almost colourless, or banded inconspicuously with grey or purplish markings on thorax and abdomen. *L. squilla*, on the other hand, has very conspicuous stripes of purplish colour and also has bright yellow bands on the legs and a beautiful blue colour on the claws of the second pair of legs. Also, whereas *L. longirostris* rapidly turns an opaque white when dead, *L. squilla* retains its colours for a long time after death and even when preserved in formol.

When the colour is lost, as it rapidly is in spirit, the two species can be separated by the number of teeth on the rostrum and by the much greater length of the claw of the second leg in *L. longirostris*. The rostrum of *L. squilla* bears usually eight or nine spines above, of which three are behind the eye, while that of *L. longirostris* has generally seven or eight, of which two lie behind the eye.

Another prawn which might readily be confused with the "Jack Shrimp" is *L. adspersus* (*Palæmon leachi* Bell), which is a rare British species which I have not myself found in Norfolk, though it is quite probable that it occurs. It should be looked out for, and can be easily recognised by the dark red patch on the lower side of the rostrum.

I have searched for *L. longirostris* in all the estuaries of the East Coast without success, and it may be that it is confined in Britain to our Norfolk rivers. If this is so it would be a fact rather difficult to explain, since the larvæ are carried out to sea and so distributed far and wide. Perhaps it is a relic of the time when our rivers were tributaries of the Rhine, and the larvæ have the instinct to return here just as the migrating bird is able to find its way to its winter quarters.

XI.

POTAMOGETON PANORMITANUS B. BERNARDI
IN NORFOLK

BY ARTHUR BENNETT, A.L.S.

Read 30th November, 1920

- BIVONI BERNARDI in *Nuove piante inedite del barone Ant. B. Bernardi pubblicate del figlio Andrea.* p. 6. 1838.
P. gracilis Fries. Nov. Fl. Suec. p. 50. 1828.
P. Noltei Ar. Benn. Nomenclature of Potamogeton, in Jour. Botany. p. 300. 1890.

In August, 1919, Mr. F. Robinson sent me a dried sheet of a Potamogeton he had gathered in that month, which after examination proved to belong to the above species. Because the Italian botanists made it merely a synonym of *pusillus*, it had been passed over. It was incidentally mentioned by Prof. Babington in the Journal of Botany, 1881, by myself in the same place, and by Dr. Moring in the United States in 1883. In 1916, Dr. Hagström, in his "Critical Remarks on Potamogeton," gave a full account of it, and showed it must be treated as a species. From *pusillus* it differs in that the ligules (stipules of our books) are connate (not split as in *pusillus*), the turios (winter-buds or gemmæ) are very slender, and the growth and colour are different. Unfortunately I have not been able to see the original description, although I have had the help of Dr. Daydon Jackson, of the Linnean Society, and Mr. Lacita; but neither the Linnean, Royal, Kew, nor British Museum library contains the Memoir. But I hope to get it from Italy.

Dr. Hagström considers that *P. gracilis* of Fries, though not exactly the same, yet must come under it. I named Fries' *gracilis*, *P. Noltei*, as there was a previous *gracilis* of Wolfgang. After many years Dr. Kihlman, of Helsingfors, published the fact that their Herbarium contained two specimens named by Wolfgang; as I had never before been able to find a specimen in any European herbarium.

“ In a ditch between Dereham and Holt, 8 miles from Dereham. August, 1919.”—F. Robinson.

It will be necessary to examine all our specimens of *P. pusillus* to see how far these have been mixed. It occurs in many stations in Europe, and in Surrey, Salop, Sussex, Carnarvon, Cambridge, Anglesea, Cardigan, Kirkcudbright, Inverness, Caithness, and Wexford. They are easy to separate when in the living state, but somewhat difficult when dried.

XII.

THE HERRING FISHERY OF 1921

BY ARTHUR H. PATTERSON

The herring fishery of 1921 was a disastrous failure, the falling off in the catches being unprecedented, and the quality of the fish being the worst ever known. The herrings were practically starved; they were thin, utterly devoid of their characteristic oiliness, and maintained this poor quality from the beginning to the finish of the voyage. As might be expected, much speculation was rife as to the cause, or combination of causes, of the comparative scarcity; tunnies, sharks, and cetaceans were emphatically blamed by some, whilst others ventured to suggest explanations of an equally pointless nature. So far no satisfactory scientific explanation has been offered.

The season's catch is stated to have been valued at £351,791, as against that of the previous year's £1,292,529. Prices varied remarkably, from £7 15s. 0d. per cran (equal to £77 15s. 0d. per last) to two shillings and sixpence per cran—"stuff" only fit for manure. The best catch grossed £2,180; the lowest boat only £300. Many boats were ruinously "fished," 90% failing to clear expenses, and very few fishermen had anything to take at the end of the voyage.

There were 716 Scotch boats and 433 local boats fishing out of Yarmouth, and of these 172 were motor-driven and the

remainder were steamers. Not a sailing drifter now floats in the harbour. The vessels fishing from Lowestoft may be taken usually at two-thirds of the number working from Yarmouth.

Few fresh herrings were exposed for sale in shops or about the streets, fewer people ate them. I myself sampled a warp (four), but they were not even palatable.

Of the fish captured about 50% were pickled (gutted and barrelled in brine); 20% were taken by Mediterranean curers; 22% were handled by kipperers and suppliers of "freshers" (boxed with ice or tubbed with a sprinkling of dry salt) for the home markets. Some of the boats landed fresh herrings to the number of several thousand crans at Ostend, Ymuiden, Scheveningen, and Vlaardingen.

The personnel of the Yarmouth herring fishery consists of about 20,000 persons, who are distributed as follows:—Fishermen, 8,500; picklers, 642 men, 3,138 women; Mediterranean curers, 400 men, 1,000 women; kipperers, 500 men, 1,800 women; shore-workers, 1,000 men; staff, clerical, etc., 750 men, 50 women; miscellaneous establishments, canning, etc., 700 men, 1,200 women.

The failure of the fishing led to a quick break-up of the year's industry, placing Scotch girls and other workers in distressful circumstances, which led to early return. The fishermen were not only in sorry plight at the "making-up," but, being share-fishermen, they were disqualified from subsequently participating in unemployment benefit.

The Greek poet Oppian does not exactly tell us that the fisher folk in his day were subject to a failure of their fishings, but he crisply describes one side of the fishermen's arduous life:

"The Fishers labour not on certain Ground,

But in a leaky Boat are tost around.

Here fierce succeeding Waves disturb the careful Wight,

Now black'ning Clouds, and gath'ring Storms affright."



XIII.

METEOROLOGICAL NOTES, 1921

(From observations taken at Norwich)

BY ARTHUR W. PRESTON, F.R.MET SOC.

JANUARY

This month was noted for its extreme mildness. The mean temperature (45.1 deg.) was as much as 7.5 deg. above the normal, and was even 0.6 deg. higher than in the warm January of 1916. The thermometer exceeded 50 deg. on fifteen days, and there were only two nights on which frost was recorded in the screen. The rainfall was .18 in. above the average. There was no snow. Winds were almost constantly from between south and west, gales occurring on the 10th and 18th, that on the latter date having been accompanied by a rapid fall of the barometer from 30.50 ins. on the morning of the 16th to 29.22 ins. on the morning of the 18th. Sunshine exceeded the average by about five hours, and vegetation made an early start.

FEBRUARY

There was a falling off in temperature compared with January, but it was nevertheless a mild month; about 2 deg. above the average. There were ground frosts on many nights, but at no time of great severity. The most remarkable feature of the month was its extreme dryness, only a third of an inch of rain being measured here, and there was no snow. On only one day did the rainfall amount to a tenth of an inch. There was but little wind, and pressure was remarkably high throughout the month, the barometer not once falling below 30 ins. after the fourth day. On the 26th it attained 30.77 ins., the highest point observed since 1907.

MARCH

Abnormal mildness marked the weather of this month, and the mean temperature was only two-tenths of a degree lower than that of the previous March, which held the record of having been the warmest since 1859. The thermometer exceeded 50 deg. on twenty-five days, and 60 deg. on three days, the highest having been 66 deg. on the 24th, or similar to that of the previous March. There were only two nights with frost in the screen, although there were slight ground frosts on seventeen nights. Rainfall was about three-quarters of an inch deficient. There were only three sunless days, and the total record of sunshine amounted to 151 hours. This was 27 hours above the average, and exceeded that of the previous warm March by four hours. As in the previous year, vegetation was remarkably forward. Winds were chiefly from the s.w. quarter.

APRIL

Although there were great fluctuations of temperature, the mean of the month was 1.5 deg. above the normal. Rainfall was in exact agreement with the average, the heaviest falls having been .55 ins. on the 13th, .28 ins. (snow) on the 15th, and .42 ins. on the 23rd. Snow fell on the 14th, 15th, and 16th, and on the last-named day was accompanied by thunder and lightning. The cold, drying winds, coupled with the want of moisture in February and March, had a very parching effect on the soil. Sunshine was 50 hours in excess of the average, and vegetation kept remarkably forward. It is not often that such a profusion of leafage is to be seen in April as at the close of this month. The solar eclipse on the 8th was well seen at Norwich, Venus and Vega being readily detected during the period of greatest obscuration.

MAY

Mean temperature was 2.6 degs. above the average, and it was the sixth abnormally warm May in succession. Winds

were very variable and constantly changing in direction, and on a few days in the latter part of the month were rather strong from the N.E. The month's total rainfall was .66 ins. deficient, and from the 11th to 25th it was absolutely rainless, the drought being much felt. A thunderstorm on the afternoon of the 26th gave .20 ins. of rain, and the following two days .38 ins. and .19 ins. respectively, which was a welcome supply. This thunderstorm was much more severe in North Norfolk than in Norwich. At Sheringham an inch of rain fell in an hour. Total sunshine for the month was 251 hours, or 45 hours in excess of the average. Many days were practically cloudless, and the sunshine was most brilliant. There was a fine display of aurora borealis on the evening of the 13th.

JUNE

The drought which had prevailed during the greater part of May, and which was temporarily broken by the showers above mentioned in the latter part of that month, continued practically throughout June, the only break being on the evening of the 17th during a thunderstorm of about a quarter of an hour's duration, the total for the entire month being only .55 ins. Temperature fluctuated much, and there were some remarkable changes from heat to cold and the reverse. On June the 17th the shade temperature rose to 82.3 degs. Two days later the maximum was only 59.7 degs., and by night the exposed thermometer fell below the freezing-point, doing much damage. On the 21st the maximum was only 56 degs., or the same as on January 9th. On the 25th it soared again into the eighties. There was a great prevalence of north-easterly wind, and a deficiency of sunshine.

JULY

It is a somewhat remarkable fact that this month, which was the hottest month ever recorded in London, and was the warmest July registered here since 1884, commenced with a short spell of abnormally cool weather. On the 4th the thermometer did not rise above 56 deg. all day (as on June 21st),

which was, as above mentioned, the same maximum as recorded on the 9th of the previous January. On the 5th a change occurred, and to August 2nd a period of intense heat, such as experienced only in very exceptional summers, ensued. During the month the screened thermometer rose to 80 deg. and above on 12 days, a circumstance which had not occurred in any one month since August, 1884, and on many other days the temperature approached that level. On the 10th, 90.2 deg. was reached, and on the following day 89.5 deg. The night temperature in the screen failed to fall below 66.5 deg. on the 23rd, which was higher than in any night back to 1881. The mean temperature of the month was 65.8 deg., or 4.2 deg. above the average. The heat was accompanied by a violent drought, the total rainfall being exactly half-an-inch, falling on five days only, the combined rainfall of June and July being only 1.05 inches. The month's sunshine was 61 hours above the normal. The results of the constant sunshine, heat and drought, were very marked, the whole countryside being in a terribly parched condition, shrubs and large trees dying for want of moisture. Wheat harvest commenced generally in this neighbourhood about the third week.

AUGUST

On August 1st the shaded thermometer reached 84 deg., and on the 2nd 80 deg. After that date it did not again reach 80 deg. during the month, although it attained 79.5 deg. on the 18th and 77.2 deg. on the 27th. There were several very warm nights, which were a marked feature of the summer. Rain was again deficient, but there were showers on several days, and the month's total was 1.52 inches. Bright sunshine was about equal to the average, but on many days was very intermittent. Thunder occurred on six days. Altogether it was a very fine, pleasant holiday month, and the harvest was brought to an early close.

SEPTEMBER

On the 7th, 8th, and 9th the thermometer once again ascended into the "eighties," touching 83.8 degs. on the last-

named day. The drought which had been so persistent was temporarily broken on the 11th, when .68 in. fell, succeeded by .45 in. on the following day. This was a welcome supply ; but yet another dry period followed, and the total month's fall was only 1.31 in. Sunshine was 60 hours in excess of the average and there was not one sunless day throughout the month.

OCTOBER

This was another remarkable month, forming as it did the fourth month of 1921 in which the mean temperature was largely in excess of the normal. The day temperatures on many days during the first fortnight were exceptionally high, rising to 70 degs. or over on as many as ten occasions, whereas an October with even one day of 70 degs. is the exception rather than the rule. On the 6th it reached 77 degs., on the 9th 76.7 degs., on the 10th 75.2 degs., and even as late as the 18th 71.7 degs. In London maxima of 80 degs. were attained on two days, and were stated to be the highest maxima ever registered in October, and although our maximum of 77 degs. was beaten in 1908, when 78.4 degs. was reached, the number of hot days recorded in this October appear to have been without precedent. The nights also were exceptionally warm in the earlier part of the month, minima of 57 degs. and upwards being noted on several nights. There was no frost throughout the month in the screen, and only one frost on the grass. The mean temperature of the month was 55.8 degs., 6 degs. above the average, and the highest of any October since these observations were begun in 1883, but it appears to have been equalled in 1861, 1831, and 1811. A thunderstorm occurred on the morning of the 11th. Winds were variable, N.W. predominating, and sunshine was 30 hours above the average.

NOVEMBER

The most noteworthy episode during this month was a very violent gale which sprang up suddenly on Sunday morning, the 6th, and was the most severe wind observed here for some

years. At Gorleston the most violent gusts registered equalled 78 miles an hour, and much damage was done in many parts of the county as well as at sea. During the gale the barometer fell to 29.05 ins., which was the lowest reading during the year. The month was generally a cold one, nearly as cold as in 1919. On the 7th and 8th snow fell, remaining on the ground for a week, and on the 27th the screened thermometer fell to 23 deg. A further deficiency of .72 ins. occurred in the month's rainfall, notwithstanding the rather wet fortnight with which the month commenced, but from the 13th to the 29th there was another absolute drought. The foliage remained on the trees to an unusually late date.

DECEMBER

With the exception of a few cold days at the beginning, this was a very mild month, and the latter part exceedingly stormy. The mean temperature (43.2 deg.) was 4.3 deg. above the normal, and, with the exception of 1918, 1912, 1900, and 1898 it was the mildest December since 1876. On the 27th the thermometer rose to 58 deg. by night, being the highest temperature in December since 1856. This reading was 2 deg. warmer than the day temperatures on June 21st and July 4th last. There were heavy gales in the last week, especially on the 28th and 31st, although their highest velocity did not equal that of the November gale. The month was very dry down to the 22nd, and although the latter part of the month was somewhat wet, the total of the month's rainfall was .65 in. deficient. There was some snow on the 23rd and 24th only. There was considerable cloud on many days, and the total month's sunshine was 4 hrs. deficient.

THE SEASONS

Tables of Mean Temperature and Rainfall of the four seasons of 1921, together with those of the five previous years, and compared with the average (including December, 1920, but excluding December, 1921).

TEMPERATURE								
Seasons	1916.	1917.	1918.	1919.	1920.	1921.	Average	Departure of 1921 from average.
	degrees	degrees	degrees	degrees	degrees	degrees	degrees	degrees
Winter -	41'7	35'4	38'7	38'7	41'2	41'7	38'4	+ 3'3
Spring -	47'6	44'9	47'5	46'9	50'0	49'6	46'7	+ 2'9
Summer -	58'8	62'2	60'0	58'9	58'9	62'1	60'2	+ 1'9
Autumn -	50'6	50'0	48'6	46'8	50'2	51'3	50'1	+ 1'2
Year - Jan. to Dec.	49'3	48'0	49'4	47'6	50'0	51'5	48'8	+ 2'7

RAINFALL								
Seasons	1916.	1917.	1918.	1919.	1920.	1921.	Average	Departure of 1921 from average.
	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.
Winter -	10'41	6'55	5'63	10'29	8'12	5'58	6'21	-0'63
Spring -	8'20	6'27	5'10	4'98	6'61	4'17	5'55	-1'38
Summer -	7'63	8'61	6'03	6'15	7'34	2'57	6'89	-4'32
Autumn -	7'39	8'03	9'62	7'49	3'76	4'65	7'83	-3'18
Year - Jan. to Dec.	32'68	27'82	28'88	29'99	24'00	15'71	26'48	-10'77

The mean temperature of each of the seasons was above the average, the winter (December to February) having been warmer than any since 1916, and the spring fell very little short of the previous one, which was exceptionally warm. Although July was so hot, the mean temperature of the three summer months was kept down by the somewhat cool June, and the autumn, which comprised one of the hottest Octobers on record, had its temperature reduced by the cold November. Each season had a deficient rainfall, that with the greatest deficiency having been the summer, which had less than half the average amount and was the driest since 1885, which yielded a similar amount

of rain. The autumn, though dry, was less so than the previous one.

THE YEAR

From a meteorological point of view the year may be called an "annus mirabilis." The mean temperature of the year was 51.5 deg., or 2.6 deg. above the average, higher than that of any year since 1868, and even 1 deg. higher than that of the hot year 1911. Nearly every month gave a mean temperature above the normal, that of January, March, July, and October most extraordinarily so. The only month that could be called cold was November, where the falling off of about 4 deg. was compensated for by a similar excess in December. Although the highest summer temperature of 90.2 deg. on July 10th failed to reach the level attained in August, 1911, there were as many as 19 days on which 80 deg. was reached or exceeded, and 75 days on which 70 deg. was reached or exceeded. With the exception of 1911, when these results were 25 and 77 days respectively, we have to go back to 1884 for so large a number. But even more remarkable than the heat was the persistent dryness, which prevailed from January onwards throughout the year. Although April gave an average rainfall, each month from February to December inclusive, with that exception, were deficient in moisture, February, June, and July being greatly so, the total rainfall for these three months being respectively .33 in., .50 in., and .55 in. The total at Norwich was only 15.71 ins., or nearly 4 ins. less than in 1893, the previous driest year since these observations were commenced in 1883, and as much as 10.77 ins. below the average. In some places it is stated to have been the driest year on record, but "Symons's British Rainfall" discloses that in 1864 the small amount of 14.02 ins. was gauged in Norwich by Mr. W. Brooke. (A Norwich directory for that year mentions a Mr. W. Brooke at 2, Upper Surrey Street.) This was, however, measured at the height of 31 feet above the ground, and by his ground-gauge he recorded 17.79 ins. At Costessey the same authority reports a total of 14.48 ins., at Honingham 14.62 ins., at Fakenham

(Egmere) 14.16 ins., at Holkham 14.50 ins., and at Hunstanton 12.08 ins. These were all in 1864, and compare with some of the smallest falls in the County for 1921, viz.:—14.77 ins. at Downham, 14.91 ins. at Thetford, 14.67 ins. at Hingham, 14.77 ins. at Thuxton, 14.81 ins. at Sprowston, 13.70 ins. at Hunstanton, 12.40 ins. at Denton, and 12.01 ins. at Geldeston. As can be imagined, after such a shortage of rain the dearth of water in all directions was most serious. Numbers of wells were dry, and in many places drinking water was at a premium. Sunshine was more than 200 hours in excess of the average amount, and it was the sunniest year since 1911, which still holds the record with nearly 100 hours over 1921. Best thanks are due to Mr. J. H. Willis for continuing to supply so regularly, month by month, the results of the readings from his excellent Campbell-Stokes recorder.

MR. PRESTON'S METEOROLOGICAL RECORDS FOR 1921

MONTH. 1921.	BAROMETER.				THERMOMETER.				HYGRO-METER. Mean Relative Humidity 9 a.m. %	SUN-SHINE. Hours.	RAINFALL.		WIND.								
	Highest.	Date.	Lowest.	Date.	Highest.	Date.	Lowest.	Date.			Mean.	No. of Days.	Inches.	Direction and Days.	N	NE	E	SE	S	SW	W	NW	Mean altitude
JAN.	30.50	16	29.21	12, 31	56.0	9	28.6	16	45.1	56.9	2.03	23	2	0	0	2	6	7	10	4	3.6
FEB.	30.77	26	29.52	1	57.5	24	26.2	2	40.4	76.6	0.33	9	2	6	4	5	3	0	5	3	2.1
MARCH	30.32	1	29.34	29	66.0	24	28.5	8	46.1	151.3	1.19	13	2	0	0	0	4	14	5	6	3.5
APRIL	30.45	7	29.39	17	68.2	13	31.5	15	47.8	210.5	1.71	11	7	8	7	1	1	0	3	3	2.9
MAY	30.30	21	29.43	8	77.7	13	32.7	5	54.8	251.2	1.27	12	5	3	6	3	6	3	3	2	3.2
JUNE	30.42	16	29.79	9	82.3	17	39.2	19	57.8	182.8	0.55	7	6	9	3	0	2	1	4	5	3.4
JULY	30.28	9	29.33	29	90.2	10	42.3	3	65.8	271.9	0.50	5	7	3	8	1	4	1	3	4	2.6
AUG.	30.18	31	29.54	11	84.0	1	41.0	31	62.7	185.8	1.52	14	3	1	3	0	4	5	8	7	3.1
SEPT.	30.43	27	29.70	10	83.8	9	38.6	29	59.1	165.8	1.31	8	2	3	8	2	3	4	2	6	2.7
OCT.	30.53	15	29.44	22	77.0	6	38.3	25	55.8	135.0	1.50	13	3	0	6	1	5	1	4	11	2.1
NOV.	30.58	10	29.05	6	53.2	4	23.0	27	39.2	72.0	1.84	12	3	2	5	12	1	2	1	4	2.0
DEC.	30.35	12	29.36	30	58.0	27	25.0	5	43.2	39.1	1.96	15	3	1	2	1	1	7	11	5	3.7
MEANS					30.036				51.5												2.9
EXTREMES & TOTALS	30.77	Feb. 26	29.05	Nov. 6	90.2	July 10	23.0	Nov. 27		1798.9	15.71	142	45	36	52	28	40	45	59	60	

XIV.

NOTES ON SOME NEW NORFOLK PLANTS

BY FRED ROBINSON

Read November, 1921

The following notes refer to plants which may be added to the Norfolk list since the publication of "A Flora of Norfolk" in 1914.

CUCUBALUS BACCIFER L.—This is a most beautiful plant, not unlike the bladder campion, for which I know no popular name. Its long stems creep through the blackberry and other shrubs amongst which it grows, and I have seen them six feet or more in length. The foliage is a bright green, and the fruit, when ripe, a large black berry, very like that of the deadly nightshade. I have made very careful enquiries with a view of ascertaining whether this plant was introduced, but none of the residents of the parish can account for it; I have therefore come to the conclusion that it is indigenous. Its occurrence on the Continent in similar situations confirms this view. At one time it was found on the Isle of Dogs, but has long been extinct there.

LYSIMACHIA PUNCTATA L. ("Loosestrife.")—I found this plant some years ago on the bank surrounding Scoulton Mere, amongst other beautiful and rare plants, its brilliant flowers being noticeable for a long distance. It was reported in Nicholson's "Flora of Norfolk" for Hingham, on the authority of Babington (*Man. Brit. Bot.*); and as Hingham is the adjoining parish to Scoulton, and the mere is next to the Hingham boundary on the Scoulton side, it is possible that this was the locality referred to.

VIOLA CURTISII Forster var. *PESNEAUI*.—This sweet violet grows on the highest parts of the sandy heathland from Santon to Thetford, and perhaps further. When I first observed it it was in abundance, a glorious sight, and in some places the plants

were very large, with fifty flowers, and scattered in small clumps all over the heath. It is apparently confined to the loose sands, and flowers in May. I gathered *Veronica verna* growing with it.

DEYEUXIA NEGLECTA Kunth.—I discovered this very rare grass in marshy land at Great Hockham seven or eight years ago. It grows abundantly over a sparsely wooded marsh (in a wet season almost inaccessible), and covers an area of forty or fifty acres. The marsh fern also grows abundantly here, as does *Carex paradoxa*, *Cicuta virosa*, *Mentha gentilis* var. *cardiaca*, and many other treasures. This plant presents two rather different aspects: for about a day it is spreading, and not unlike a robust *Agrostis alba*: after flowering, the branches are closely adpressed to the stem, giving it a spike-like appearance.

DEYEUXIA NEGLECTA Kunth. var. *Hookeri*.—I discovered this variety a year or two after the above, at Stow-Bedon, within about two miles of Hockham Station. It was named for me by Mr. Arthur Bennett, who has acted as my court of appeal from the commencement of my collecting. The difference between this plant and the preceding species is slight, and it is very difficult to discriminate between them. Both this and the Hockham localities are on private property, which fact may account for their not having been discovered before.

CERASTIUM ARVENSE var. *latifolium*.—This extraordinary plant, so named for me at the Botanical Exchange Club, bears little resemblance to the beautiful *Cerastium* so common in Norfolk. It is from eighteen inches to two feet in height in some cases, and has more the habit of *Cerastium vulgatum*. It grows at Rockland, near Attleborough, over a rather restricted area, and has done so for twelve years to my knowledge.

IMPATIENS PARVIFLORA DC.—This plant is now distributed in Norfolk, chiefly in woods, and I think has become permanently established. I have seen it at Hargham, Shropham, Blickling, Aylsham, and other places where the soil is suitable; it spreads very rapidly.

XV.

MISCELLANEOUS NOTES AND OBSERVATIONS

NEW NORFOLK "GULLERY."—During a week in Breckland at the end of June, 1922, I noticed black-headed gulls at points further west than those usually visited by members of the Scoulton colony. They seemed to increase in numbers near Hockham, with the result that I made enquiries and on July 1st saw a "gullery" over which I estimated that between 400 and 500 birds, young and old, were flying, and there were many more scattered in the neighbourhood. The site is in the parish of Breccles, adjoining Cranberry, Great Hockham, where until 1795 there was the largest natural mere in Norfolk, and it may be that this is merely a return to a situation favoured before the mere was drained. There is a number of small pools and a considerable area suitable for nesting, and I was informed that gulls usually visit the spot in the spring, but have not remained to nest until this year. The site is much more remote and inaccessible than Scoulton, and with the protection which will undoubtedly be afforded by the bird-loving owner of the estate, it is to be hoped that a permanent "gullery" has been added to those in Norfolk.—W. G. CLARKE.

WOOD-WARBLER IN NORFOLK.—It is many years since this species (*Phylloscopus sibilatrix*) has been reported as breeding in the county, though it is mentioned by Stevenson ("Birds of Norfolk," Vol. 1, p. 130) as "a regular summer visitant" to the breckland district. For the past two years it has been noted by Mr. N. Tracy at South Wootton, near King's Lynn, where on June the 8th of this year (1922) I was shown two nests by him, the one containing eggs, the other young birds. I had ample opportunity of watching the parent birds and of refreshing my memory with the song of the male and the call-note of the female, both very distinctive when once heard. Mr. Tracy located eight or nine pairs in the district this year.—S. H. LONG.

WIGEON NESTING IN WEST NORFOLK.—With reference to Dr. Long's record of a pair of wigeon (*Mareca penelope*) believed to have bred at Burnt Fen in 1919 (Trans. N. & N. Nat. Soc., Vol. 11, p. 101), Mr. R. S. Smith informs me that in 1918 he met with two wigeons' nests at Southery, near Hilgay Fen, on the borders of the flood area. They were only twenty yards apart, and each contained six eggs, which he considers to have been sufficiently identified. Unfortunately they were robbed by crows, but, nothing daunted, one of the ducks laid again, and was afterwards seen by the gamekeeper with young ones following her.—J. H. GURNEY.

GREAT WILLOW-HERB (*Epilobium hirsutum* L.)—Some fine specimens of this plant, with white flowers, were found by Capt. S. V. Green at Intwood, in July, 1921. The white-flowering variety has not been recorded for Norfolk previously, though it is mentioned as occurring in the Bristol area by Mr. J. W. White, in his "Flora of Bristol."—W. A. NICHOLSON.

GROUND BEETLE (*Carabus*, sp.) ATTACKING AN EARTHWORM.—On May 7th, 1922, my attention was drawn to a large worm, about five inches long, wriggling about on the surface of a field of winter oats at Bawdswell. On closer examination it was seen that this worm was being attacked by an animal which, on first inspection, looked rather like a very big wire-worm. This animal had seized the worm's neck and had such a strong hold on it that it could not be shaken off; in fact, it very much resembled a rabbit being attacked by a ferret. Both the worm and the *carabus* were put into a glass bottle, and the next morning it was found that the worm's head was completely severed from its body.—Q. E. GURNEY.

BOTANICAL RECORDS.—In 1922 I noted the following plants near Costessey Mill, but in the parish of Drayton. The eight marked with an asterisk are new to the county:—*Ranunculus*

arvensis, *Papaver hybridum*, *P. somniferum*, *Sisymbrium altissimum*, **Erysimum orientale*, **Lepidium perfoliatum*, *L. virginicum*, *Saponaria Vaccaria*, *Melilotus indica*, **Amsinckia lycopsioides*, *Centaurea Calcitrapa*, *C. solstitialis*, *Hyoscyamus niger*, *Chenopodium polyspermum*, *C. urbicum*, *Ambrosia trifida*, *Apera Spica-venti*, *Avena fatua*, **Cynosurus echinatus*, **Briza maxima*, **Bromus Schraderi* = *unioloides*, *Lolium temulentum*, *L. multiflorum*, **L. multiflorum* var. *muticum* DC.

Since the publication in 1919 (Vol. X., p. 504) of "Some Additions to the Flora of Norfolk" I have noted the following plants in the localities indicated:—*Thalictrum minus*, Mundford, Feltwell; *Papaver hybridum*, Feltwell, Brettenham; *Fumaria parviflora*, East Wretham; **Sisymbrium altissimum*, East Harling, Thetford (H. D. Hewitt, 1920), Norwich (1920), Narborough, Rushford, Costessey (1922); *Diplotaxis tenuifolia*, Mundesley; *Lepidium campestre*, Mundesley, Reedham; *L. Draba*, Runham-Vauxhall; *Helianthemum Chamæcistus*, North Pickenham; *Dianthus Armeria*, Wacton; *Silene conica*, Langford, Roudham; *Hypericum hirsutum*, Foxley; *Linum perenne*, Aylmerton; *Medicago falcata*, East Harling, Larling, Langford, East and West Wretham, Markshall, Mundesley; *M. denticulata*, Morston; *M. minima*, Brettenham, West Tofts; *Trifolium subterraneum*, Beeston Regis; *T. ochroleucon*, Bedingham, Burston, Earsham, Gissing, Hempnall, Moulton St. Michael, Necton, Shimpling, Strumpshaw, Thelveton, Thwaite, Tibenham, Tivetshall St. Margaret, Tivetshall St. Mary, Topcroft, Wacton; *T. scabrum*, West Harling; *Melilotus officinalis*, Langford, Rushford, Foulden; *M. alba*, Thetford; *Sedum album*, Litcham, Wighton; *S. rupestre*, Attlebridge, Colby, East Carleton, Drayton, Felmingham, Ingworth; *Galium anglicum*, Feltwell, Hockwold, Northwold; *Kentranthus ruber*, Thetford; *Matricaria suaveolens* (54 parishes); *Senecio palustris*, Thet valley (Sir H. Beevor, August, 1922); *Picris Echioides*, Foxley, Horsey, Sall; *Centaurea solstitialis*, Hethersett (F. W. Myhill); *Tragopogon minus*, Cranwich (1st record for division 4); *Campanula latifolia*, Sall; *Pyrola minor*, Thorpe St. Andrew; *Hyoscyamus niger*, Cranwich,

Catton; *Verbascum Blattaria*, Felthorpe, Brettenham; *Veronica spicata* (near Thetford, 1922, H.D. Hewitt); *Melampyrum pratense*, Bedingham; *Orobanche purpurea*, Mundesley, Trunch, Sidestrand; *O. minor*, variant growing on *Artemisia campestris*, Northwold, 1922; *Mentha rotundifolia*, Honing; *Rumex maritimus*, Thetford, Old Buckenham; *Ornithogalum umbellatum*, Cranwich, South Walsham; *Spiranthes spiralis*, Ormesby St. Michael (Mrs. C. Copeman); *Allium vineale c. compactum*, Thetford; *Lemna gibba*, Acle, Buckenham; *Scirpus maritimus*, Watlington; *Carex paradoxa*, Horning, Hasingham; *C. pallescens*, Foxley; *C. sylvatica*, Foxley, Fritton, Bedingham; *Phleum phleoides*, Cranwich, Feltwell; *Calamagrostis epigeios*, Foxley; *C. canescens*, Woodbastwick, Foxley, Bedingham; *Apera Spica-venti*, Bodney; *Avena pratensis*, Brettenham, Thetford, Narborough; *Cynosurus echinatus*, Thetford; *Melica nutans* L., Foxley, Bedingham; *Osmunda regalis*, Woodbastwick.—W. G. CLARKE.

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1922—23

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 1901 *Campbell Donald F., F.G.S., 119, Adelaide Road, London, N.W.
 1909 Campbell-Taylor J. E., Mavisthorpe, High Street, Southover,
 Lewes
 1909 Cann Miss F. A., Norfolk and Norwich Hospital, Norwich
 1923 Cater Capt. A. Parker, Norfolk Club, Norwich
 1907 Caton Rev. R. B., Great Fakenham Rectory, Thetford
 1902 Cator John, Woodbastwick Hall, Norfolk
 1922 Cator Miss Diana, Happisburgh, Norfolk
 1911 Chamberlin Rev. C. M., Witton Rectory, Norwich
 1881 Chase R. W., Herne's Nest, Bewdley, Worcestershire
 1919 *Chasen F. N., The Raffles Museum, Singapore
 1907 Christie J. A., Framingham Manor, Norwich
 1923 Claridge Mrs., St. Giles' Plain, Norwich
 1894 Clarke W. G., F.G.S., 12, St. Philip's Road, Norwich
 1923 Clayton J.
 1911 Cleather Rev. W. S., Barningham Rectory, Norfolk
 1923 Clodd Mrs., Strafford House, Aldeburgh, Suffolk
 1887 *Cocks A. H., M.A., F.Z.S., Poynetts, Skirmett, Henley-on-Thames
 1909 Coke Right Hon. Viscount, Holkham, Norfolk
 1923 Cole Lowry A. C., The Lodge, Sprowston
 1923 Cole Mrs. Lowry, The Lodge, Sprowston
 1921 Colman Capt. Geoffrey, Bixley Lodge, Norwich
 1903 *Colman Miss, Carrow Abbey, Norwich
 1903 *Colman Miss H. C., Carrow Abbey, Norwich
 1881 Colman Russell J., *President*, Crown Point, Norwich
 1923 Collin J. F., 419, Unthank Road, Norwich
 1919 Copeman W. O., 5, Claremont Road, Norwich
 1906 Corder John, London Street, Norwich
 1923 Coward T. A., M.Sc., Brentwood, Bowdon, Cheshire
 1921 Cozens-Hardy A., Oak Lodge, Sprowston, Norwich
 1912 Cremer W. C., Beeston Regis Hall, Norfolk
 1871 Cresswell Col. George, C.V.O., The Garden House, Hunstanton
 1886 Cross J. M., Acle
 1923 Crosse H. W., 7, Aylsham Road, Norwich
 1919 Currie Lt.-Col. J. W., Old Catton

D

- Elected.*
 1910 Dalby Rev. Alan, M.A., The Vicarage, Leamington-Hastings,
 Rugby
 1922 Dallas Chas. C., Eastley Wootton, New Milton, Hants.
 1920 Davey Guy, Aldborough, Norwich
 1914 Davies H. C., Old Lakenham, Norwich
 1923 Daukes Maj. A. H., 22, Egerton Terrace, London, S.W. 2
 1901 Day Donald D., F.R.C.S., Surrey Street, Norwich
 1917 Deacon G. E., Hethersett, Norwich
 1891 Digby A., Cley-next-the-Sea.
 1918 Donnison H., Boston, Lincolnshire
 1916 Doughty Chester G., 7, Upper Cliff Road, Gorleston-on-Sea
 1889 *Duleep Singh H.H. Prince Frederick, F.S.A., Blo' Norton Hall,
 Norfolk

E

- 1911 Easter W. C., 99, City Road, Norwich
 1877 Edwards J., F.E.S., *Hon. Mem.*, Colesborne, Cheltenham
 1923 Evans A. H., 9, Harvey Road, Cambridge
 1897 Evans H. Muir, M.D., Turret House, South Lowestoft
 1919 Evans-Lombe Major E., Marlingford Hall, Norwich

F

- 1885 Falcon Michael, Horstead, Norfolk
 1922 Ferrier Miss J. M., Hemsby Hall, Norfolk
 1922 Ferrier R. F. E., F.S.A., Hemsby Hall, Norfolk
 1923 Finch Alfred, The Red House, Old Catton
 1922 Fitzgerald Mrs W. H., Framingham Earl, Norwich
 1923 Fisher Sidney, Oaklands, St. Clement's Hill, Norwich
 1880 *Fletcher W. H. B., Aldwick Manse, Bognor
 1922 Fonnereau Miss Hilda, The Old Farm, Walcot-on-Sea, Norfolk
 1883 Forrester J. B., Thorpe Road, Norwich
 1922 Frere Sir Bartle H. T., South Walsham Hall, Norfolk
 1877 Fryer H. F., The Priory, Chatteris

G

- 1887 *Gainsborough The Right Hon, the Earl of, Exton Park, Rutland
 1902 Garstang Walter, D.Sc., The University, Leeds
 1922 Gaze R., 105, Earlham Road, Norwich
 1903 Geldart Miss Alice M., Cotman Road, Norwich
 1908 Gilbert R. T. E., Ashby Hall, Norfolk
 1923 Gill S. T., Rupert Street, Norwich
 1921 Glover Miss, Cliff House, Norwich
 1921 Glover T., Cliff House, Norwich
 1909 Goodchild Herbert, The Chestnuts, Unthank Road, Norwich
 1922 Gossage Mrs., Leet Hill, Kirby Cane, Norfolk
 1922 Gossage W. W., Leet Hill, Kirby Cane, Norfolk
 1901 Goose A. W., 10, Sandringham Road, Norwich
 1921 Graves Mrs., Oulton Lodge, Aylsham, Norfolk
 1919 Greatorex H. A., Witton, Norwich
 1921 Green Capt. S. V., Sutton Lodge, Ipswich Road, Norwich
 1922 Greene, Dr. A., 4, Theatre Street, Norwich
 1918 Gresham School The, Holt, Norwich
 1913 *Grey of Fallodon, The Rt. Hon. Viscount, K.G., Fallodon,
 Lestbury, Northumberland

Elected.

- 1920 Gudgin S. H., "Homeland," Cley Road, Swaffham, Norfolk
 1918 Gurney Major C., Berry Hall, Walsingham
 1902 *Gurney Miss Cicely, Keswick Hall, Norwich
 1896 *Gurney Sir Eustace, M.A., F.Z.S. V.P., Walsingham Abbey,
 Norfolk
 1893 *Gurney Gerard H., F.Z.S., Keswick Hall, Norwich
 1901 Gurney Q. E., Bawdeswell Hall, Norfolk
 1894 *Gurney Robert, M.A., F.L.S., F.Z.S., *Hon. Treasurer*, Ingham
 Old Hall, Norfolk
 1918 Gurney Mrs. Robert, Ingham Old Hall, Norfolk

H

- 1892 *Haigh G. H. Caton, Grainsby Hall, Great Grimsby
 1905 Halls H. H., 130, Hall Road, Norwich
 1908 Hamond Licut.-Com. C.E., R.N., 40, Lyndhurst Road, Lowestoft
 1906 *Hamond Major Philip, D.S.O., Morston, Holt, Norfolk
 1923 Hankin E. H., Sc.D., The Manor House, Ingham, Norfolk
 1923 Harbord Miss P., Mouschold House, Norwich
 1919 Harker Miss Sylvia, Blofield Hall, Norwich
 1908 Harker William, Blofield Hall, Norwich,
 1881 *Harmer Sir Sidney, K.B.E., F.R.S., 20, Courtfield Gardens,
 London, S.W. 5
 1906 Harris Rev G. H., St. Paul's Vicarage, 47, Trafalgar Road,
 Moseley, Birmingham
 1923 Hibberd Rev. H., Burnham Thorpe Rectory, King's Lynn
 1893 *Hill Alexander, M.D., F.R.S., Highfield Hall, Southampton
 1919 Hinde Dr. E. B., Gurney Court, Magdalen Street, Norwich
 1891 Hinde F. C., *Hon. Librarian*, 4, Quebec Road, Norwich
 1923 Hines E. S., 10, Parker Road, Norwich
 1915 Hitchcock Arthur, Tamworth House, Tennyson Road, King's
 Lynn
 1921 Hoar Miss Marjorie, 17, Camberley Road, Norwich
 1922 Home Miss H. M. Logan, Runton Hill, West Runton
 1919 Horsfall Charles, Stody Lodge, Melton Constable, Norfolk
 1923 Hoskins Maj. Gen. Sir Reginald, Army and Navy Club, London
 1919 Howard Miss D. D., West Parade, Norwich
 1919 Howard H. J., 6, College Road, Norwich
 1887 Howard R. J., M.B.O.U., Shear Bank, Blackburn
 1923 Hunter Miss E. M., Mattishall Hall, East Dereham
 1923 Hunter H. M., Mattishall Hall, East Dereham
 1899 Hurrell H., 25, Regent Street, Gt. Yarmouth
 1915 Hutchinson Donald, M.D., 2, Gordon Road, Lowestoft

I

- 1922 Ivcs R. D., Erpingham Grange, near Norwich .

J

- 1921 Jarrold T. H. C., Pine Banks, Thorpe St. Andrew
 1891 Jarrold W. T. F., Thorpe St. Andrew, Norwich
 1923 Jay H. H., 28, High Road, Southtown, Great Yarmouth
 1896 *Jodrell Sir Alfred, Bart., Bayfield Hall, Norfolk
 1909 Jickling Colonel C. M., Smallburgh Hall, Norfolk
 1921 Johnson J. Barham, Cathedral Close, Norwich
 1923 Jolly T. L., Church Farm, Aylmerton, Norfolk
 1885 Jones Sir Lawrence, Bart., 39, Harrington Gardens, London,
 S.W., 7.

K

Elected.

- 1897 Kerrison Colonel E. R. A., C.M.G., Burgh Hall, Aylsham,
Norfolk
1904 Kinder Rev. E. H., Kirby Bedon Rectory, Norfolk
1898 Knight Edward, Keswick Old Hall, Norwich
1921 Knight John, East Walton, King's Lynn

L

- 1914 Laffan Major de Courcy, Little Acton, Wrexham, N. Wales
1918 Lascelles Miss Susan, Swanton Novers, Norfolk
1915 Laurence H. L. B., King's Lynn
1869 o.m. Laurence Rev. J. A., Dilham Rectory, Norwich
1921 Le Strange C., Hunstanton Hall
1889 Lee Warner Henry, Swaffham
1909 Leicester The Right Hon. the Earl of, G.C.V.O., C.M.G., *V.P.*,
Holkham
1899 Leney F., Castle Museum, Norwich
1923 Lipscomb R., Hannington House, Fakenham
1923 Lipscomb Mrs., Hannington House, Fakenham
1922 Livesay Mrs., Norfolk Mental Hospital, Thorpe St. Andrew
1922 Lloyd Capt. L., Taverham Mill, Norwich
1881 Long F., The Close, Norwich
1899 Long S. H., M.D., F.Z.S., M.B.O.U., *Hon. Sec.*, 31, Surrey Street,
Norwich
1907 Long Mrs. S. H., 31, Surrey Street, Norwich
1919 *Long Miss E. M., 31, Surrey Street, Norwich
1923 Long G. S. B., St. Giles Plain, Norwich
1921 Lucas The Baroness, Hickling, Norfolk

M

- 1923 Mann Miss, Thelveton Hall, Scole, Norfolk
1905 Mann Sir Edward, Bart., Thelveton Hall Norfolk
1909 Manning Rev. C. U., M.A., 20, Fonnereau Road, Ipswich
1906 Marriott F. W. P., 11, Queen Street, Norwich
1892 Marsham Major H. S., Rippon Hall, Marsham, Norfolk
1912 Mason A., Bank Plain, Norwich
1922 Massingham H. J., 22, Westmoreland Road, Barnes, S.W. 13
1911 Master George, M.D., Bury St. Edmunds
1893 Mayfield A., F.L.S., Mendlesham, Stowmarket
1922 Mc Kenna Mrs. Reginald, 36, Smith Square, Westminster, S.W. 1.
1898 Meade-Waldo Edmund G. B., Hever Warren, Hever, Kent
1877 Miller Henry, Bosmere House, Norwich Road, Ipswich
1922 Miller Osborne, "Beeleigh," Fakenham, Norfolk
1923 Moppe Lewis E. van, Cliffside, Overstrand
1919 Morris S., Earham Hall, Norwich
1922 Mountfield Rev. D., Horsford Rectory, Norwich
1922 Mountfield Miss M., Horsford Rectory, Norwich
1921 Moxey J. G., Framingham Hall, Norwich
1919 Moxey Llewellyn, Framingham Hall, Norwich
1923 Moxham M. C., Aldborough, Norwich
1920 *Mullens Major W. H., Westfield Place, Battle, Sussex
1921 *Murton Mrs., Cranbrook Lodge, Kent
1920 Myhill Miss M., Church Farm, Hethel, Norwich

N

Elected.

- 1904 Napier A. J., *Hon Mem.*, Teviotdale, Netley Abbey, Hants.
 1910 Nash J. T. C., M.D., D.P.H., Shirehall, Norwich
 1922 Nevill Rev. R. W., Beighton Rectory, Norwich
 1911 Newman L. F., St. Catherine's College, Cambridge
 1893 Newton E. T., F.R.S., *Hon. Mem.*, H.M. Geological Survey
 Office, 28, Jermyn Street, London
 1913 Newton W. C. F., The Meadows, Saham Toney, Watton
 1889 Nicholson W. A., *Hon. Mem.*, 81, Surrey Street, Norwich
 1915 Nightingale S. R., Scratby Hall, Great Yarmouth
 1915 Norwich Public Library
 1919 Norgate Philip, Swanington, Norfolk

O

- 1921 Offord Miss Georgina, St. Giles' Plain, Norwich
 1914 Oliver Prof. F. W., F.R.S., *Hon. Mem.*, University College,
 London

P

- 1889 Page G. W., Fakenham, Norfolk
 1919 Pain Percy, Dersingham, King's Lynn
 1913 Paine Rev. N. W., Great Melton, Norfolk
 1919 *Palmer Mrs. P. Hurry, "Red Roofs," North Drive, Great
 Yarmouth
 1912 Parker H., 10, Aspland Road, Norwich
 1921 Parker R. E., Easton Hall, Norwich
 1883 *Parkin Thomas, M.A., F.Z.S., High Wickham, Hastings
 1873 Partridge Rev. W. H., M.A., St. Peter's, Sandown, I. of W.
 1923 Partridge F. H., St. Helier, Hunstanton
 1889 Patterson Arthur H., *Hon. Mem.*, 32, Lichfield Road, Great
 Yarmouth
 1920 Patteson Mrs. F. E., Great Hautbois House, Norfolk
 1901 *Paul J. J. Dawson, Eaton Grove, Norwich
 1911 *Payler Donald, Castle Museum, Norwich
 1920 Pelham Mrs. Sidney, 85, Newmarket Road, Norwich
 1903 Petre Col., Westwick Hall, Norfolk
 1921 Pigott Miss M., Sheringham
 1872 Pigott Sir T. Digby, C.B., F.R.G.S., Sheringham, Norfolk
 1923 Pope Dr. G. Steven, Heigham Hall, Norwich
 1880 Preston A. W., F.R.Met.Soc., Christ Church Lodge, Norwich
 1919 Preston Sir E., Bart., Beeston Hall, Norwich
 1900 Preston F., Thorpe Mansions, Norwich
 1913 Purdy T. W., Woodgate, Aylsham
 1887 Pycraft W. P., A.L.S., F.Z.S., British Museum (Natural History),
 London, S.W.

R

- 1911 Rising A. P., The Manor House, Ormesby, Great Yarmouth
 1908 Riviere B. B., F.R.C.S., M.B.O.U., St. Giles' Plain, Norwich
 1893 Roberts E. T., 34, Carlisle Road, Norwich
 1919 Robinson F., Watton, Norfolk
 1869 o.m. Robinson H. S., Eaton, Norwich
 1908 Rogers Commander F. S., R.N., Ingham New Hall, Norfolk
 1909 Rogers Rev. Henry, Clarendon, Lowestoft
 1884 *Rosebery The Right Hon. the Earl of, K.G., 38, Berkeley
 Square, W. 1.

Elected.

- 1908 *Rothermere Rt. Hon. Lord, Hemsted Park, Cranbrook, Kent
 1897 *Rothschild Rt. Hon. Lord, F.Z.S., Tring, Herts.
 1922 Rounce G. H., Chesterfield Villas, Cromer
 1879 Royal Microscopical Society, President of the, *Hon. Mem.*,
 20, Hanover Square, W.
 1918 Rudd A. J., F.Z.S., London Street, Norwich
 1906 Rumbelow P. E., 27, Rodney Road, Great Yarmouth
 1919 Russwurm Mrs., Scarning Grange, E. Dereham
 1901 Rye Walter, 66, Clarendon Road, Norwich

S

- 1922 Sargeaunt Miss K., Mulbarton Hall, Norwich
 1921 Sherlock A. F., 45, York Road, Great Yarmouth
 1922 Sheppard Dr. Samuel, Aylsham
 1921 Silcock Chas., 56, Southwark Bridge Road, London, S.E.1.
 1919 Simpson F. T., Sheringham, Norfolk
 1923 Sitters A, van, Broadlands, Wroxham
 1917 Smalley F. W., "Hawthorns," 193, Clapham Road, S.W. 9
 1919 Smith Col. H. F., Diddlington Hall, Norfolk
 1915 Smith Mrs., Ellingham Hall, Bungay
 1891 Smith W. R., Harleston, Norfolk
 1909 Snow T., The Craig, Windermere
 1921 Soman A. E., 37, St. Andrew's Street, Norwich
 1917 Sowels Miss, Thetford
 1911 Spurrell J. T., St. Faith's, Norfolk
 1923 Spurrell Miss M., Manor House, Newton St. Faiths, Norwich
 1923 Spurrell Miss P., Manor House, Newton St. Faiths, Norwich
 1922 Spalding G., 9, St. Stephen's Street, Norwich
 1921 Stimpson Edward, Sall Moor Hall, Reepham, Norfolk
 1922 Sumpter Dr. B. G., Brancaster Staithe, King's Lynn
 1919 Suffield Rt. Hon. Lord, Gunton Park, Norfolk
 1896 Sutton W. Lincolne, F.I.C., Eaton, Norwich

T

- 1921 Taylor Dr. Mark R., 49, Mount Pleasant, Norwich
 1921 Taylor Mrs. Mark, 49, Mount Pleasant, Norwich
 1878 Taylor Shepherd T., M.B., The Mount, Edgefield, Melton
 Constable
 1921 Thain D., West Somerton, Norfolk
 1921 Thomson Mrs. D. G., 16, Mount Pleasant, Norwich
 1886 Thouless H. J., "Corfe," College Road, Norwich
 1910 Ticehurst C. B., M.B.O.U., 46, London Road, N. Lowestoft
 1896 Tillett Wilfrid S., 2, Claremont Road, Norwich
 1920 Todd Lt.-Col. Eardley, Mundham House, Brooke
 1902 Todd R. A., B.Sc., Plymouth
 1913 Tomes Sir Chas., LL.D., F.K.S., Mannington Hall, Norfolk
 1923 Tomes Lady, Mannington Hall, Norfolk
 1923 Tothill W., Beck's Green, St. Andrews, Bungay
 1910 Tracy N., 3, King Street, King's Lynn
 1921 Troubridge Sir Thos. H., Bart., 48, Gt. Cumberland Place,
 London, W.
 1896 True F. W., *Hon. Mem.*, U.S. National Museum, Washington,
 U.S.A.
 1906 Turner Miss E. L., F.Z.S., H.M.B.O.U., Langton Close,
 Girton, Cambridge
 1923 Turner Miss, The Lodge, Postwick

U

Elected

- 1923 Upcher Rev. E. C. S., Great Dunham Rectory, Norfolk
 1921 Upcher H. E. S., The Gables, Upper Sheringham
 1869 o.m. Utting S. W., 212, Thorpe Road, Norwich

V

- 1880 Vaughan Matthew, The Limes, Marlborough
 1917 Vincent James, Hickling, Norfolk

W

- 1923 Waller Rev. H. W., Cathedral Close, Norwich
 1923 Waller Mrs., Cathedral Close, Norwich
 1921 Wallis Rev. M. C., The Vicarage, St. Faith's
 1875 Walter J. H., F.Z.S., Drayton Hall, Norwich
 1923 Walter Mrs., Cyril, Old House, Drayton, Norwich
 1921 Walton Miss, 17, Camberley Road, Norwich
 1923 Waterfield Mrs., Attlebridge, Norfolk
 1923 Waterfield Miss Penelope, Attlebridge, Norfolk
 1923 Waterfield Miss Phyllida, Attlebridge, Norfolk
 1923 Watson Miss Violet, "Miramar," Sheringham
 1923 Wenn Mrs., Ingham, Norfolk
 1923 Wenn Miss, Ingham, Norfolk
 1872 Wheeler F. D., M.A., LL.D., Hellesdon, Norwich
 1883 *Whitaker Joseph, F.Z.S., Rainworth Lodge, Mansfield
 1901 Wild Edward, The Hawthorns, Eaton, Norwich
 1922 Willett W. L., The Rosary, Metfield, Kent
 1913 Williams Miss Margaret, 28, The Close, Norwich
 1923 Wilson Gerald, The Thatch, Thorpe St. Andrew
 1923 Wilson Mrs., The Thatch, Thorpe St. Andrew
 1923 Wilson Miss Hazell, High House, Thorpe St. Andrew
 1909 Witherby H. F., M.B.E., F.Z.S., 326, High Holborn, W.C.
 1923 Woolsey G. E. W., Judge's Walk, Norwich
 1907 Wormald Hugh, M.B.O.U., Heathfield, East Dereham
 1922 Wortley Francis, "Congham," Sheringham
 1920 Wyllys Hugh, "Shrublands," Southtown, Great Yarmouth

Y

- 1923 Young Lieut.-Com. E. Hilton, D.S.O., M.P., 18, Abingdon
 Street, Westminster, S.W.1.
 1915 Yarmouth Free Library, The, Great Yarmouth

TOTAL

Honorary Members	...	...	9
Life	..	...	33
Ordinary	..	...	313
			<hr/>
			355
			<hr/>

The Treasurer in Account with the Norfolk and Norwich Naturalists' Society, Year Ending April, 1923

I. GENERAL ACCOUNT

	Dr.	£	s.	d.		Cr.	£	s.	d.
1922-23.									
To Balance, April, 1922—									
On Deposit	...	11	8	4					
On Current a/c	...	12	3	6					
		23	11	10					
Subscriptions	...	128	1	6			85	5	0
Sale of "Transactions"			8	5	0
Sale of "Flora of Norfolk"			3	16	0
Special Publication Fund			4	10	0
Payment by W. B. P. F. for printing Report					
Interest on Deposit a/c					
" from Life Membership Fund					
		2	16	4			101	16	0
							4	14	6
Printing notices, etc.			0	13	6
Fire Insurance			1	11	8
Bookbinding			5	0	0
Assistant Secretary			2	1	1
Assistant Secretary's Expenses			6	6	4
Hon. Secretary and Hon. Treasurer's Postages			3	15	11
Refreshments			0	12	6
Year Book of Societies			0	5	0
Cheque Book			1	6	6
Wreath			1	18	9
Members' Register Book			10	0	0
Donation to Scott Head Fund			146	7	9
							13	5	5
Balance—Deposit a/c							23	3	8
" Current a/c							36	9	1
							182	16	10

Examined and found correct,

W A NICHOLSON, Hon. Auditor

ROBERT GURNEY,

Hon. Treasurer

II. SPECIAL PUBLICATION FUND

	£	s.	d.		£	s.	d.
1922-23.							
To Donations—				Transferred to Current Account			
R. Gurney ...	1	12	6	...	...	...	...
Sir E. Gurney ...	1	1	0	...	...	...	...
Dr. S. H. Long ...	1	1	0	...	...	...	...
C. Silcock ...	1	0	0	...	...	...	...
E. T. Boardman ...	0	10	0	...	...	...	...
Col. O. Ames ...	0	10	0	...	...	...	...
R. T. E. Gilbert ...	0	10	0	...	...	...	...
Rev. M. C. Wallis ...	0	10	0	...	...	...	...
R. A. Todd ...	0	10	0	...	...	...	...
H. E. S. Upcher ...	0	10	0	...	...	...	...
S. Morris ...	0	10	0	...	...	...	...
Sir C. Toines ...	0	10	0	...	...	...	...
Mrs. Graves ...	0	5	0	...	...	...	...
H. Greatorex ...	0	2	6	...	...	...	...
Miss Barrow ...	0	2	6	...	...	...	...
Rev. W. H. Partridge ...	0	2	6	...	...	...	...
Col. E. Todd ...	0	2	6	...	...	...	...
	£	9	6		£	9	6

III. LIFE MEMBERSHIP FUND

	£	s.	d.		£	s.	d.	
1922-23.								
To Balance, April, 1922, at Savings Bank	23	2	11	By Interest Transferred to Current a/c	...	...	...
Interest on Bank a/c	0	11	6	" 64 War Savings Certificates	...	...	...
Dividend on War Loan	2	16	4	" 56 8s. 5d. 5% War Loan, 1929-47	...	...	...
64 War Savings Certificates at cost, 4.4.18	49	12	0	" Balance at Savings Bank, April, 1923	...	...	...
Interest accrued on above	14	8	0					
5% War Stock, 1929-47	50	0	0					
	£	140	10	9	£	140	10	9

Examined and found correct,
W. A. NICHOLSON, Hon. Auditor

ADDRESS

Read by the President, MR. RUSSELL J. COLMAN, to the Members of the Norfolk and Norwich Naturalists' Society, at their Fifty-fourth Annual Meeting, held at the Norwich Castle Museum, April 24th, 1923.

LADIES AND GENTLEMEN,

When this society elected me to the Presidency, the members knew that I had no claim to the title of naturalist. My election, therefore, I regarded as all the more of a compliment, especially when I looked through the list of my predecessors in office and found among them persons of national and even international importance in some branch of natural science. The financial statement of Mr. Robert Gurney is, to some extent, encouraging, but I am a little nervous as to whether the report to be presented in twelve months' time will be quite as satisfactory. A kind and generous friend has passed away in Mr. John Henry Gurney, who was a good supporter of the society, particularly in the matter of the publication fund, without which the "Transactions" could not have been published. The society will understand how important it is, as old friends are lost by death, to try to replace them with other subscribers. The life membership fund of the society has not been increased during the past year. By resignation and death the year has been marked by serious losses. We have lost heavily by the death of two such great men as Mr. J. H. Gurney and Mr. F. W. Harmer. Three members have resigned, and death has removed five more. Our present membership is 332, the largest on record, which is really very encouraging. The Society was started in 1869; it is therefore by no means a mushroom growth. Looking at the "Transactions," in Volume I, I find that the society then boasted 120 members. In this last year 35 members have been elected, an achievement which is largely due to the activity of Dr. Long.

Another matter which the members will be glad to hear about is that relating to Scolt Head. This is a place which will now be known to all members. A few months ago I should have had to say I had never heard of it. It will have been seen from the local paper during the last few weeks that quite a series of letters have been published over my signature setting forth the progress of the fund. It is most satisfactory for me to be able to report that the £600 for which I asked has now been subscribed. This has been done in a short period, the major part of the money having come in during the last few weeks. The credit for initiating a movement to obtain this wonderful place for the public belongs to Dr. Long. It was he who first moved in the matter and got the first £200 or more together. It had been intended as recently as yesterday to close down the fund, and I had already written a letter to the local paper to thank the subscribers for the £600 and to announce that the fund was closed. But late yesterday afternoon Dr. Long telephoned to me suggesting that that would be inadvisable and that there was a reason why some more money might be wanted. The sum of £500 was required for the land and £100 for the erection of some sort of hut shelter. For the erection and furnishing of a hut more than £100 will be required, and it has been suggested to me that as the months go by there will be visitors to places in the neighbourhood who may become interested in Scolt Head, and who, if the fund remains open, will be willing to contribute something. I am therefore inclined to leave the fund open. Almost all the money has been collected within the bounds of Norfolk. But some has come from outside, and one very interesting contribution was received from a gentleman whose letter-paper was headed "Army of the Rhine."

The Committee has decided that the opening day shall be Monday, June 11th, when the island will be handed over to representatives of the National Trust. That will be a great event in the annals of the Norfolk and Norwich Naturalists' Society. I understand that presidents are expected, on leaving office, to sing a sort of swan-song: but swans are not always vocal. There are mute swans. Another thing I ask the members to bear in mind is that they elected to the presidency one who

was not a naturalist. I shall not be letting the cat out of the bag if I warn any future president who happens not to be a naturalist that he will find himself in more or less of a blue funk all the rest of the twelve months. I early made up my mind that whatever else I talked about, it would not be natural history. There is only one thing that I am capable of talking about. I have been looking through a book of extracts from George Borrow, and have been struck by his sincere regrets that the Norfolk dialect was in all probability passing away. If I myself express the same regret, I am in good company. The thought has occurred to me that those who are naturalists, and many more who, without being naturalists, live the outdoor life, might have opportunities for doing something to keep the Norfolk dialect alive. Probably most Norfolk people have a touch of it in their speech, though they are not conscious of it, and people from a distance are better able to detect it. As far away as New Zealand I have been spotted as hailing from this best of all counties. If it is the fate of the Norfolk dialect to die out, there is, I hope, one thing to replace it, and that is good English.

[From this point Mr. Colman went on to discuss the characteristics of Norfolk speech by means of illustrative stories, drawn from his experience in the shooting-field and on the Norfolk waterways. These he told with a fidelity which, as a rule, is only possible to the Norfolk-born and is seldom, or never, acquired exactly by the stranger. So much of the effect of the stories depends on their characteristic tone as well as their phraseology, that it would be hopeless to reproduce them. There was one story, however, which must be preserved, because it related to no less a celebrity than George Borrow.]

Mr. Colman continued :

I desire to be numbered among those who have a sincere admiration for the writings of George Borrow. At the same time it would be idle to claim for the great man that he was faultless, and no doubt a hot temper was one of his weaknesses. I have always regretted that I lost the opportunity, some years ago, of having a little fun at the expense of a large gathering of ardent Borrowians. The occasion was the presentation of the house in which Borrow once lived to the city of Norwich by

Mr. A. M. Samuel, M.P. The individual associated with the following story still resides at Oulton Broad, a hale old man of some 83 years of age, and, until last year, able to work for his living. I will designate him as G.P., and perhaps you will suppose him to be present at such an (imaginary) meeting as I have referred to above.

THE CHAIRMAN: Is it true, sir, that you really had personal acquaintance with Mr. George Borrow?

G.P.: Personal acquaintance with Mr. George Borrow! I should think I had—and a greater old rascal and bully never walked the streets of Oulton Broad!

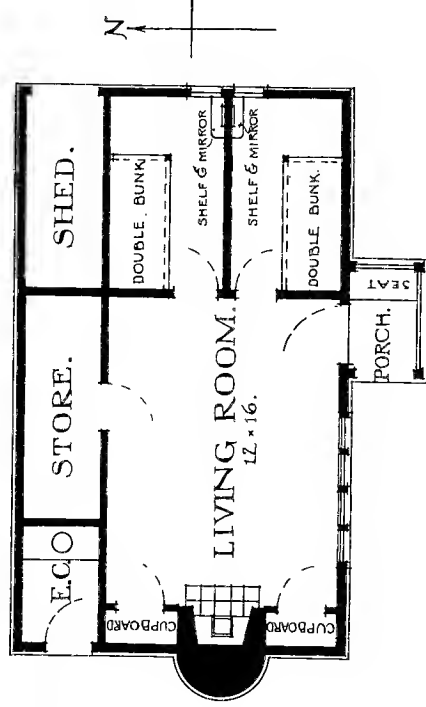
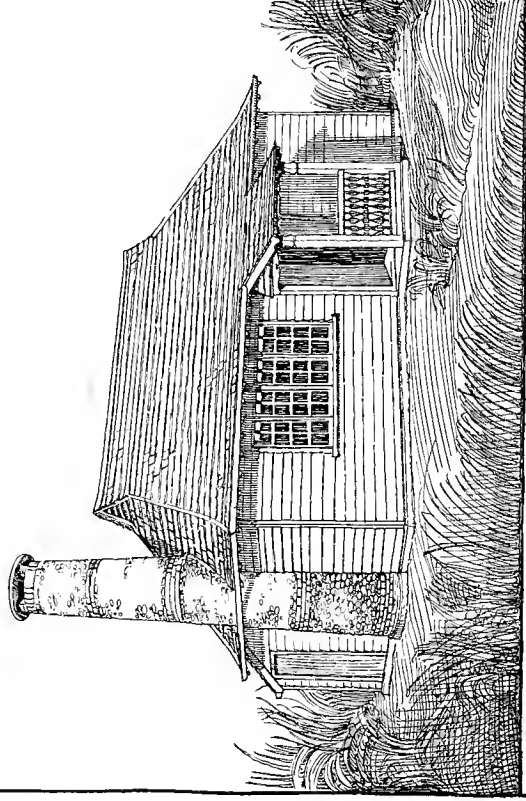
THE CHAIRMAN: Really, sir, I must protest. I demand that you either justify such language in association with the name of Borrow or that you instantly withdraw it.

G.P.: Justify it! I'll justify it right enough: you may make your mind easy about that. I worn't more'an a little boy at the time, and I was up a lane with a few other boys, when we see'd George Borrow come down the lane, on a great black hoss. One of the boys—'tworn't me—hulled a stone at the hoss and hollered so as to frighten him. Off go the hoss gallopin' down the lane, and we stood and larfed. Mr Borrow pulled up the hoss, turned him round, and galloped back faster than I ever see'd a hoss travel. We all runned for a gate. All the other boys got over and into the field, but Mr. Borrow knocked me off the gate with his great whip and I fell back into the lane. He got hold o' me and he give me a most unmerciful hiden—and I hadn't hulled no stones. I growed up, and I went to sea. Years afterwards I see'd Mr. Borrow in Oulton Broad Station. I went up to him and I says, "You'll excuse me, but ain't you Mr. George Borrow?" He says "Yes, I am." Then I says "You once give me a hiden for something I hadn't done when I was a little boy. I vowed then that some day I'd give you as good as you give me, and I'm now a goin' to do it."

At this juncture, to G.P.'s everlasting regret, the station-master and a porter appeared on the scene and prevented the episode proceeding further, and no second opportunity ever occurred.

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The HUT at SCOLT HEAD.



*Edw. Boardman & Son,
Architects Norwich.*

II

SCOLT HEAD ISLAND

A NEW NORFOLK NATURE RESERVE

BY THE EDITOR

The idea of acquiring Scolt Head Island as another Nature Reserve for Norfolk and of handing it over to the National Trust has been in the minds of one or two members of the Norfolk and Norwich Naturalists' Society for some years, but it was not until an undisputed right of ownership in the property had been legally settled that any practical steps towards the acquisition of the island could be made.

In 1922 the Earl of Leicester purchased the property, and when representations were made to him as to the desirability of retaining the area as a Reserve for all time, he immediately saw the importance of this and offered to sell the freehold of the Island for the sum of £500, reserving to himself an area of a few acres on its eastern extremity. Knowing this to be a very generous offer, and realising that there were many naturalists in the County who would be anxious to take advantage of it, the President of the Norfolk and Norwich Naturalists' Society, Mr. Russell J. Colman, in conjunction with Mr. Quintin E. Gurney, published the following appeal in the "Eastern Daily Press" on March 17th, 1923. Accompanying this appeal was a preliminary list of subscriptions amounting to just over £200.

"Between the mouth of Overy Harbour on the east and Brancaster Harbour on the west (a distance of three and a-half miles), with Norton Creek as its southern boundary, lies an island with an area of some 1,200 acres. It presents very great attractions, alike to the lover of beautiful scenery and to the naturalist. A magnificent range of sand dunes, culminating in Scolt Head, believed to be the highest sand dune in the British Isles, protects this area and the adjacent hinterland from the sea, the rest being salt marsh in various stages of development. We are told by Professor F. W. Oliver, F.R.S., of University College, London, that in its floristic glories the area is unique in the British Isles. To the bird-lover it is

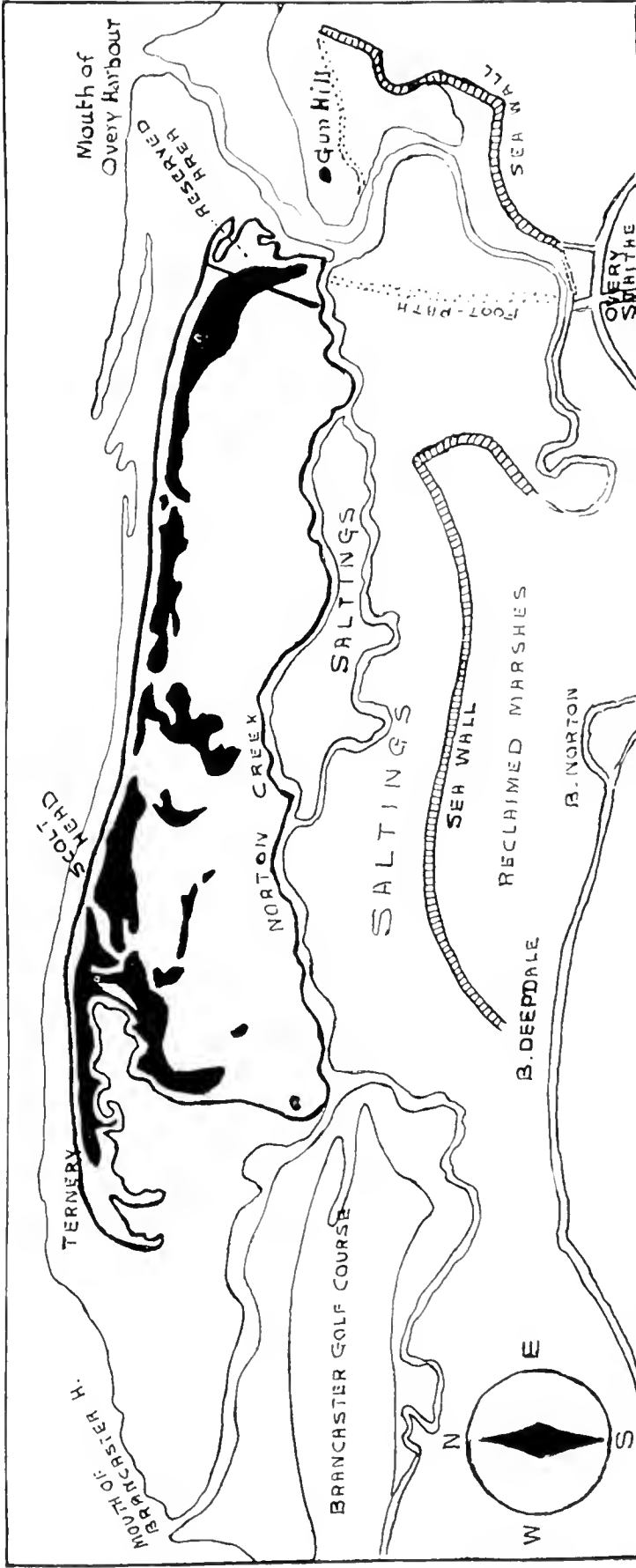
equally attractive, for here may be found in the breeding season terns and sheld-ducks nesting in large numbers, besides numerous other winged visitors.

“ To preserve this beautiful spot as a bird sanctuary, and to prevent its becoming ‘ developed,’ as will assuredly occur sooner or later if it is not rescued, we appeal with confidence to the people of Norfolk to subscribe the required sum of £600 for the purchase of the property, which it is then our intention to hand over to the ‘ National Trust ’ as a nature reserve for ever. This sum includes £500 to the owner for the freehold of the area, and £100 for the repair of an old hut for a watcher, and other incidental expenses. The Trust is prepared to take it over and to place its management in the hands of a local committee, as is done in the case of Blakeney Point. The owner of the property desires to retain from 200 to 300 yards of the dunes at the eastern end of the island, which he has offered to fence off ; the bird colonies are at the west end, and will therefore not be encroached upon by this reservation.”

Many letters followed the publication of the above, and of these one is here reproduced. It is from Dr. F. W. Oliver, F.R.S., Professor of Botany at University College, London, who wrote as follows :—

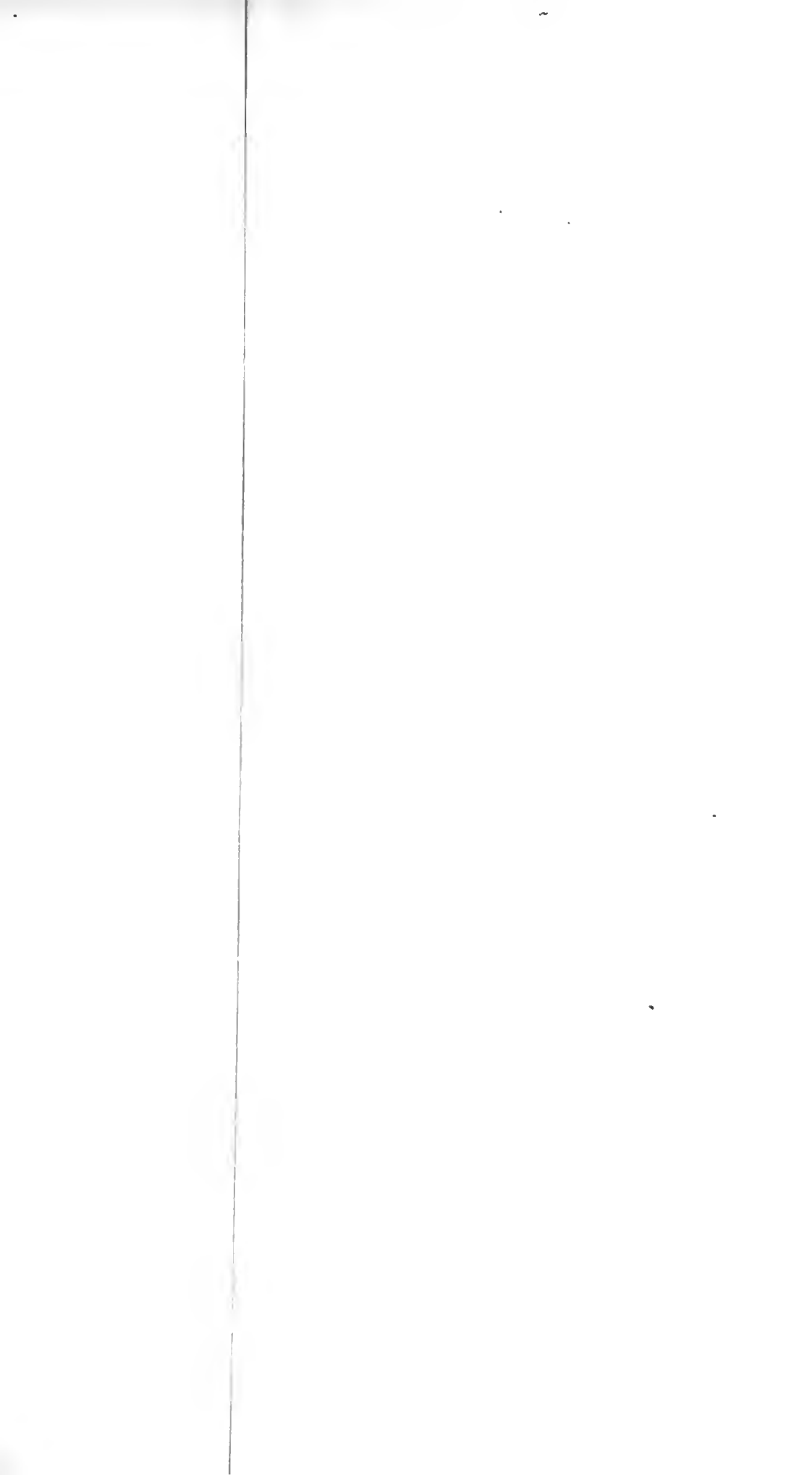
“ Having been familiar with the Scolt Head area for a number of years, I soon formed the opinion (which is strengthened whenever I re-visit it) that it is just one of those places that ought to be acquired as a national possession, safe from encroachment or “ development.” The present generous offer affords a most favourable opportunity for the realisation of this idea, and it is much to be hoped that the very moderate fund required for this purpose may be raised.

“ Not only is this an area of outstanding beauty as a natural landscape of sand hills, beach, and marshes, but it is likewise of the greatest interest from its physiographic construction and the vegetation and fauna which it bears. Taken in connection with Blakeney Point, one may say that Scolt Head is its complement. Each provides just those features in which the other is lacking ; the two together are far more than twice as valuable as either considered separately.



SCOLT HEAD ISLAND: Scale, 1 inch to 1 mile (approx.) The black areas represent sand dunes. The Southern Boundary of the island is Northern Creek, which connects Brancaster Harbour with Overy Harbour. The "Reserved Area" is the only part of the island not conveyed to the National Trust.

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F. W. Oliver

Photo

SCOLT HEAD ISLAND: MR. RUSSELL COLMAN HANDING OVER THE DEEDS OF THE PROPERTY TO LORD ULLSWATER
(AS REPRESENTING THE NATIONAL TRUST) ON JUNE 11TH, 1923

“ By securing Scolt Head for all time we shall be doing a thing not only satisfactory to ourselves but one likely to earn the gratitude of future generations of nature lovers, and especially of Norfolkians, with whom the love of their soil is a deep-rooted instinct. At various times I have visited pretty well the whole of the English and Welsh coast-line, and do not remember anything quite approaching the peculiar qualities of this particular gem.”

The following description of the island has been written by Mr. W. G. Clarke, F.G.S. :—

“ It is probable that very few Norfolk people have heard of Scolt Head, and that fewer still have seen it, but on all the 90 miles of coastal frontage which lie between Yarmouth and the Lincolnshire boundary, there is nothing else quite like it, and nothing quite so suitable for the formation of a sanctuary for wild life. Scolt Head itself is the north-west headland of an island which is bounded by Burnham Harbour on the east, Norton Creek on the south, and Brancaster Harbour on the west. Its most westerly point is due north of the staithe at Brancaster Staithe, and its most easterly due north of the inhabited portion of Burnham Overy Staithe. No bridge connects it with the mainland, and there is no wilder or more inaccessible spot round the Norfolk coast. At low tide there are almost impassable mud flats; at high tide it can be approached by boat from Burnham Overy Staithe or Brancaster Staithe, through long and tortuous channels. It is nature untouched, and largely uninfluenced by the handiwork of man. Along the three and a-half miles of coast fronting the North Sea there is a fine beach of sand and shingle. This is bordered by a wide and extensive series of sand dunes, which at Scolt Head itself are higher than anywhere else along the English coast. Between these and the southern boundary of the island at Norton Creek are extensive saltings or meal marshes, through which wander innumerable creeks in all stages of development, filled at high tide and mere muddy channels at low tide. The total area of the island is about 1,200 acres, of which 250 are sand dunes, and the only evidence of man on these two square miles is a roofless hut on the southern dune, a bungalow, and a navigation beacon at the east end of the sand dunes.

“Technically, the island is a ‘hooked spit,’ with numerous laterals on the landward side. In this respect it is similar to the other nature reserve at Blakeney Point, but it is on the whole in a younger phase of development, as most of the main beach and several of the laterals are still encumbered with sand dunes. To the east of Scolt Head itself and on many of the laterals (in whole or in part) the sand-hills have been blown or washed away, exposing the underlying framework of shingle. These denuded parts tend to become colonised with bushes of shrubby sea-blite (*Suaeda fruticosa*), an East Anglian specialty which here attains its maximum development. The series of marshes between all these hooks are remarkable for their beauty, and scientifically of great interest. As at Blakeney, they are arranged in order of age, the youngest being towards the west end. Numerically the flora is somewhat poorer than at Blakeney, because at the latter place the laterals, having been long ago denuded of their encumbering dunes, have been re-colonised by turf-forming plants, fairly rich in species. The laterals at Scolt Head are in a much earlier phase of re-colonisation, and it will probably take some centuries before they reach the condition now prevalent at Blakeney. Nevertheless, Scolt Head has on its dunes in the form of succulent fruited bushes, such as hawthorn, elder, privet, and gooseberry—doubtless brought by birds—an element lacking at Blakeney. The growth of the five species of sea lavender is perhaps the greatest floristic glory of the Scolt Head salt marshes. ‘In my experience,’ says Dr. F. W. Oliver, F.R.S., Professor of Botany at University College, London, ‘it is unique, that is the extent of the display and the variety of species in near compass. Taken as a whole, this area is complementary to Blakeney Point (and not just a duplicate), and each has a great value in elucidating the other. This fact is, I think, an additional reason for its preservation.

“From time immemorial the area has been the nesting site of many sea-birds, and is generally known locally as ‘Bird Island.’ There is a fairly large nesting colony of common and little terns, and these would doubtless increase but for the systematic eggging that goes on during the season. Ringed



Photo

A "BLOW-OUT" IN THE DUNES ON SCOLT HEAD ISLAND, AUGUST, 1923

F. W. Oliver

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plover also utilise the shingle areas for nesting purposes, and a considerable number of sheld-duck nest in the rabbit-holes in the dunes. Probably other species would be added if protection were afforded and competent observers were present during the nesting season. As it is, the island is almost a *terra incognita* to the naturalist. Should it be possible to raise the £600 needed to acquire this island and hand it over to the National Trust for preservation and the use of the public for ever, doubtless some means would be devised for protecting these birds during the nesting season. In addition to the wild life which forms such an attraction for the naturalist, the fine range of sand-dunes gives an element of picturesqueness to the island. Separated from the mainland by the untouched salt marshes between Norton and Trowland Creeks and also by the great reclaimed marshes north of Deepdale and Norton, the island gives a splendid sense of distance and remoteness, and a grandeur lacking at Blakeney Point. From the highest dune at Scolt Head there is one of the finest views round the Norfolk coast, ranging from Blakeney Point on the east, quite away to the Wash on the west, with all the low range of hills from Holkham, through the Burnhams, Brancaster, Titchwell, and Holme, almost to Hunstanton. Pictorially speaking, the system of dunes is the finest dune massive in the British Isles. It composes well and has a highest point around which the various ridges are properly subordinated.

“ It is perhaps possible to reconstruct to some extent the history of this island. Until at least the fourteenth century the great creek which gave its name to North and South Creak and on the shores of which the eight Burnhams were also situated, ran inland from the sea about eight miles, and was the most important harbour on the north coast of the county. Burnham was in those days an important port, and in 1322 and 1327, when it was spelt Brunham, found ships for the king. At the seaward end of this creek there appears to have been the lost village or port of Brunnenuith, which was important enough in 1301 to have ‘ bailiffs and goodmen,’ and was ordered to find a ship for the king. So long as the great sweep of flood-tide from the north came direct from the coast

of Lincolnshire on to the north-west coast of Norfolk there must have been constant erosion and the coast-line was driven further south. The formation of sand banks and the detritus from this wasting coast gradually drove the main flood-tide further eastward, and it now strikes the coast between Weybourne and Sheringham. Part of it then travels westward along the north coast of Norfolk. This gradual change doubtless resulted in the silting up of the Burnham Creek, partly by sand and shingle brought by the flood tide from the eastward. The little stream which flows through Burnham Harbour would always be cutting a way through this shingle bank, which would be more undisturbed on the westward, and there the beginnings of Bird Island would gradually rise above the waves. It would at once form a barrier to the mud brought from the westward by the ebb tide from the Wash, and sediment would also tend to settle when it met the ebbing waters from Burnham Harbour. These influences may have been in operation long before the 14th century, but during some hundreds of years, shingle, sand, and mud have made up Bird Island, which may yet develop further westward as it has in the past century. Faden's map of Norfolk in 1797 describes the headland as Scolts Head. At that time 'Burnham Meals' were shown on the seaward side of the dunes, and between the island and the mainland was a wide channel known as East Creek. At any rate, Nature has done her part. She has made the island, partly clothed it with vegetation, and rendered it suitable for the habitation of birds. Man has not spoiled it, and if the naturalists of Norfolk, those who like to provide enjoyment for their fellow men, and those who love birds and plants and all the creatures of the wild, will contribute £600, it will be possible to preserve this natural sanctuary in its primitive state, adding greatly to the attractions of the county and to the heritage of generations yet unborn."

It was at first thought that the old rabbitier's hut, situated on some low dunes about the middle of the island, could be repaired and made into a hut for a watcher whom the Norfolk Wild Birds Protection Committee had resolved to engage during the nesting season, but this plan was discarded in favour of a new hut in a more favourable position. As soon as this fact became known, Mr. Alfred Cushion, of Norwich,



Photo

F. W. Oliver

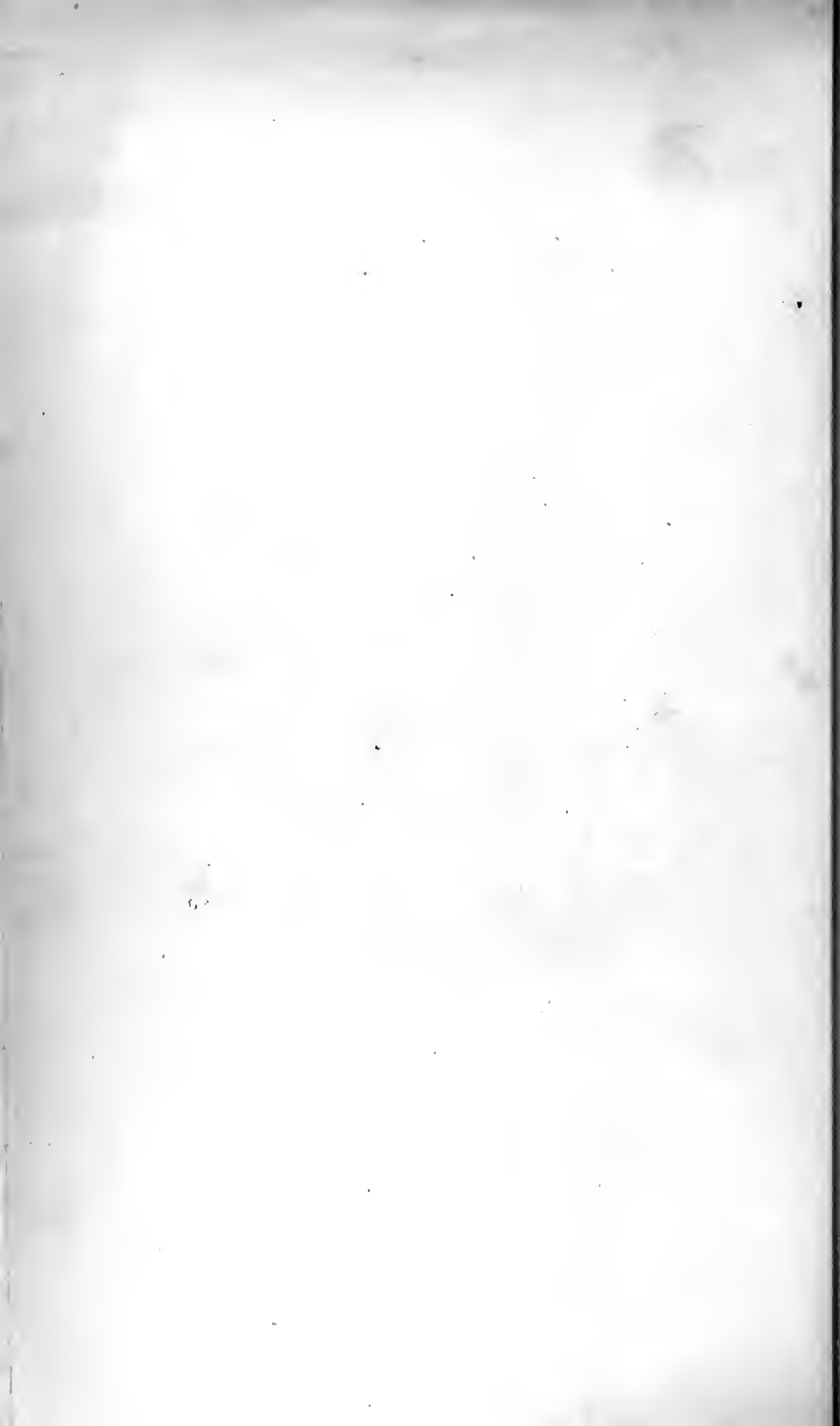
SCOLT HEAD: THE LIGHT HUMMOCKS IN THE FOREGROUND ARE *Statice reticulata* IN FLOWER, AUGUST 6TH, 1923



Photo

F. W. Oliver

SCOLT HEAD FROM THE WEST: THE ARROW POINTS TO A FICE STANDING ON THE PLATEAU ON WHICH THE HUT HAS BEEN ERECTED



generously offered to build such a hut of Norfolk-grown oak, which offer was gratefully accepted. The site finally selected is the sand plateau to the S.W. of Scolt Head.* In coming to this decision the question of a drinking water supply had to be considered, and the expectation of finding this in the dunes, near to the surface, as has been the experience on Blakeney Point, was realized. At a depth of about five feet, water containing only 26.7 grains of salt to the gallon was found. Mr. Lincolne Sutton, who kindly made the analysis, informs us that there are many drinking wells in the coast-line villages in Norfolk which contain water of not less than this salinity.

On Monday, June 11th, one of the most perfect days of the year, the official presentation of the island to the National Trust took place. The ceremony of handing over the deeds was performed in a sheltered amphitheatre in the dunes, and was attended by from 200 to 300 members of the Society with their friends. The presentation was made by Mr. Russell Colman to Lord Ullswater, who accepted the deeds on behalf of the National Trust. Others present included the Earl of Leicester, Sir Hugh Beevor, Bart. (President), Sir Laurence and Lady Jones, Sir Rickman and Lady Godlee, Sir Eustace and Lady Gurney, Major-General Sir Reginald Hoskins, Professor and Mrs. F. W. Oliver, Mr. Walter Derham, Mrs. Reginald McKenna, Mr. and Mrs. Holte Macpherson, the Honorary Treasurer (Mr. Robert Gurney) and the Honorary Secretary (Dr. S. H. Long). At the end of a most enjoyable day spent on the island, when many visited the breeding terns, tea was provided by Mr. Colman in an old malthouse in Overy Staithe, and, to mark the occasion, all the children in the village were similarly entertained by Mr. Colman, with a packet of sweets to each.

The management of the island has been placed by the Trust in the hands of a local committee, which held its first meeting at Brancaster on August 30th, 1923. The Members of this committee are :--

*It is hoped that this hut will be utilised for purposes of scientific observation. Applications for such use should be made to Dr. S. H. Long, the Secretary of the Scolt Head Committee of the National Trust.

Mr. Russell J. Colman, *Chairman*, Norwich.

Mr. W. G. Clarke, F.G.S., Norwich.

Mr. G. Arthur Coller, Brancaster.

Mr. Walter Derham, National Trust.

Col. E. S. Evans, C.B., Brancaster.

Mr. Robert Gurney, F.L.S., Ingham.

Rev. C. E. Hains, Burnham Sutton

Mr. Guy Hannaford, Brancaster.

Dr. Sydney H. Long, *Secretary*, Norwich.

Mr. E. Mennell, Burnham Overy.

Prof. F. W. Oliver, F.R.S., National Trust.

Mr. John Stoker, Overy Staithe.

Dr. B. G. Sumpter, Brancaster Staithe.

Mr. B. Knyvet Wilson, Brancaster.

Mr. W. A. Forsyth, 12, Stratford Place, W. 1.

Messrs. Colman, Clarke, and Long are members as representatives of the Norfolk and Norwich Naturalists' Society, and Messrs. Derham, Forsyth and Oliver are direct representatives of the National Trust. The surplus of the "Scolt Head Fund," amounting to £205 10s. 6d., after paying £500 as the purchase money for the island, has been handed over to the Committee.

III

THE BIRDS OF BLAKENEY POINT: A VISIT IN THE BREEDING SEASON

BY T. A. COWARD, M.Sc., F.Z.S.

Miss E. L. Turner, my wife and I arrived at the Point on June 21st and stopped until the end of the month. I made no attempt to take a census of the bird population, nor to measure and statistically examine eggs and young, as that work has been undertaken in previous years by more capable hands. Instead I tried to get some insight into the behaviour and habits of the birds, and to solve some problems which have presented themselves at other colonies in previous years.

In response to an invitation from Professor F. W. Oliver, F.R.S., Mr. Coward stayed on Blakeney Point from June 21st to the 30th, 1923, and on leaving, kindly offered to write a report on his observation. This was found of such general interest that Mr. Coward agreed to the publication as "Blakeney Point Publication, No. 21." We are pleased to give hospitality to the Report to this effect.—EDITOR.

Cold weather and strong winds had delayed the normal breeding season, but the various colonies or groups of Common Terns, extending from the shingle N. and N.E. of Great Sandy Low westward to the New Point, contained a considerable number of nesting pairs, as well as a fair number of birds which, from their behaviour, had either not nested or had lost eggs or young. Infant mortality is very high in all Tern colonies, and the causes naturally vary; at Blakeney the largest number of deaths during the short period of our visit took place between the 20th and 23rd, whilst the weather was still severe. The health of the young improved with the change in the weather. The young are undoubtedly sensitive to cold, and as soon as they can run take advantage of the shelter of large stones, outcrops of marram, or the screens which Pinchen scraped to windward of the nests.

Certain unnecessary causes of death might be avoided by stricter regulations, for unwary and often ignorant visitors, unaware of the crouching habits of the young or of the protective value of the colour of eggs and down, trample many young and eggs when crossing the nest areas. Visitors again will remain too long on the ground, keeping the parent birds away, and thus the young suffer from exposure and lack of food. This, unfortunately, is a fault of many who, in their enthusiasm, desire to photograph.

Failure of the fish supply, as noticed in previous years, may spell disaster, but during our visit there was little evidence of lack of fish, though the birds which were bringing in supplies did not always manage to get these to the expectant young, owing to their agitation at the presence of visitors. There are, in all Tern colonies that I have visited, numbers of birds which are ready to chase and strive to rob any incoming parent from whose bill a fish is dangling. When there were visitors on the nesting ground these fish-laden birds were so harassed by the would-be robbers that they usually swallowed the food themselves, and then, immediately, the chase ended. I never saw any young fed by regurgitation, and a number of the young birds which I picked up dead and opened had no food in the stomach.

VARIATION

The prevailing note in the domestic economy of the Common Tern is Variation. The remarkable variability has been noticed and investigated at Blakney in the colour, size and markings of the eggs, and in the site and construction of the nests, but variation extends considerably further than this, and there must be some explanation of why it is more marked in this than in any other other species of bird.

The watchers on every colony that I have visited have assured me that the dimorphic young agree with the eggs from which they emerged ; that is to say that a dark egg produces a dark downed young, and a light egg a light one. I am unconvinced. The few nests that I was able to be certain about provided different results. It is true that in one nest where the eggs were both dark the young were also of the dark phase, but I found a dark young one where the eggs were both light. Probably the colour of both eggs and young is influenced by heredity, but it by no means follows that the double characteristic would occur in the same bird in every case.

In the young bird the variation in the ground colour of the down, in the depth and size of the streaks and mottles, and in their pattern is nearly as marked as in the colour of the egg shell. In the parent bird there is very little variation noticeable, and certainly there is no appreciable difference which can influence such remarkable difference in eggs and young. True, there is variation, even in mature Common Terns, for the ratio of black and red on the bill is by no means constant. In the three red billed species—Roseate, Common and Arctic, we have in the breeding season a rough formula :—

ROSEATE—Bill mostly black (two-thirds or more), base red.

COMMON—Black (one-third, distal), mostly red.

ARCTIC—No black or merely tip black, rest red.

But between these average proportions are an endless variety, so much so that it is by no means easy to be sure of many Commons or Arctics when the birds are in flight. I look with the greatest respect upon the observer who can, with certainty, identify one bird or the other when the two are flying together.

The Common and Arctic Terns have certain characters which differ, and one can imagine that these are obvious in certain birds, but a change of attitude or a different point of vision will leave the observer in doubt, and the flying birds are full of restless activity, and constantly change the angle or plane of flight. The breast of the Arctic Tern is greyer than that of the Common, but in certain lights or in certain positions in relation to the light the Common looks grey. The bill of the flying bird with the light full upon it may look red, but with the light behind it almost black ; even when a bird is at rest a movement of its head may confuse us when we were sure that we had solved the problem. The comparative length of the "streamers" is very confusing unless the bird is in the hand, and the slight difference in the length of the tarsus is a matter for calipers, not for eyesight. The amount of grey on the primaries is a perfectly safe distinction in a bird in the hand, but fortunately at Blakeney there were no dead mature birds. In this way the colony seemed in a healthier condition than many I have visited ; the mortality amongst mature birds, often killed on the nest by Stoats and Rats, or other predacious foes, is heavy in many colonies. Fortunately there is a striking difference in the voices of the two species, and it is possible, even when fifty birds are screaming overhead, to localise individual sounds, and then to get the glass on the bill ; it was in this way that I satisfied myself that there were quite a number of Arctic Terns nesting with the Commons. Some of these had not wholly red bills, there was a very small black or dark tip.

In some colonies, notably at Ainsdale, the Arctics keep rather to themselves, but at Blakeney the two often nested side by side. In at least three places, however, there were two or three nesting pairs of Arctics within an area of a few feet. The Arctic shows the same catholicity in choice of site and disregard of architectural elaboration as the Common ; its eggs and young vary just as much. On the whole, elaborate nests are less in evidence at Blakeney than at Ravenglass, Ainsdale and Llanddwyn, but there is little doubt that this is influenced by surroundings. At Ainsdale and Llanddwyn many of the nests are placed on dwarf willow or the thick stems of *Beta maritima*, and something in the way of a platform has to be constructed ;

at Blakeney, when marram or other vegetation is used, it lies, as a rule, as a surround rather than a lining. Several nests near the tide line contained straw, small drift chips, weed and shells, but shell decoration was unusual. The availability of nesting material appears to influence the method of construction, though individualism is an important factor. Thus æsthetic taste was exhibited by some of the birds on the New Point, for they had taken the trouble to carry material from a distance to the shingle bank where it was difficult to obtain anything but flotsam of the tide line. Here, however, a large number of eggs had been deposited on the bare sand without even an attempt at a scoop.

A large proportion of the nests, at the time of our visit, contained single eggs or couples; the normal threes were not abundant. These were incubated eggs, and many produced young. Pinchen told me that there had been losses through the high tides, and I concluded that these imperfect clutches were second or later attempts to bring off young. The failure of the Tern to learn that certain situations are unsafe is strange, seeing that instinctive selection of secure nesting sites is highly developed in many birds. There are certain Tern colonies where, year after year, eggs are deposited on tidal ground during the low tides, but are swept away by the springs. At the Point of Ayre this year the whole colony was destroyed by a high tide, and on the Dee Marsh I have known the same thing occur and no young be reared. Yet the birds return the following year to the fatal spot and again suffer calamity.

Pinchen picked up one "midget" egg, and I came across another. This second egg was almost white, but had a few small black specks towards the "north"; it measured about 22 by 12 mm. (I was without calipers at the time). These midgets may correspond with the so-called pullet eggs of domestic fowls, or they may be due to an attempt to produce eggs when the fertility of the ovaries is exhausted.

Variation in the young birds is not confined to the ground colour of the down. The darkest birds are buff-brown, some even chestnut, and the paler ones stone-coloured or grey. The streaks, blotches or flecks are black, brown or buff. The chins and throats show great variation, for in a few the chin is white

with a little grey from the angle of the bill, but in others—the majority—both chin and throat are for the most part dark grey or sooty black. The pinkish bills are tipped with black, on which the egg tooth is conspicuous in the younger birds; it is hard and sharp to the touch. The legs vary in shade from salmon pink to dull reddish brown.

Dimorphism is present in young Sandwich Terns. Three birds in one group—two in one nest—showed the extremes. No. 1 was typical, light in ground and with fine blackish markings. No. 2 was so closely flecked that it appeared almost self grey. No. 3 was almost white, the markings few and indistinct. In all three the legs were plumbeous and the webs and toes tinged with pink; the bills were bluish, reddish brown near the gape.

The eggs of Arctic Terns are, as a rule, indistinguishable from those of the Common Tern, although it is stated that they are a trifle smaller and that their markings are bolder; I am quite sure that the most experienced "sorter" could not safely say which bird was responsible for certain eggs. The eggs which I felt sure about at Blakeney—where I identified the sitting bird—were all of the dark type, but this by no means implies that dark eggs are normal.

BEHAVIOUR OF YOUNG AND PARENTS

The young Terns were fed by their parents with small fish. Sand-eels (*Ammodytes*) were frequently brought, and small clupeids, locally termed "whitebait," were also visible, but I did not see any pleuronectids or Weevers (*Trachinus*), both of which I have seen brought in at Ainsdale and Walney. It has been affirmed that the fish are dropped in front of the young, even dropped from a height, by the parent bird, but at Blakeney, though I saw very many fish brought in, I never saw one dropped. In every case the fish was transferred from the bill of the parent to that of the young. At Ravenglass, where the colony is more crowded, many fish are dropped, but as previously mentioned, the incoming birds are attacked by air highwaymen of their own kind, and the fish are allowed to fall by the harassed parent. This did not happen at Blakeney; attacked birds solved the problem by swallowing the food they had intended for their young. As a rule the bird bringing food

called, for they can and do call with food in their beaks, and the young one at once ran to meet it. One bird, two or three days old, bounced with excitement, gape wide and wings extended, in front of an unresponsive parent.

In one nest of the Little Tern a couple of young were brooded by one bird, presumably the mother, when the other of the pair arrived with food. He, for I assume that it was the male, called, and then hovered about four feet above the ground, when one of the young ones ran out from beneath the sheltering wing. He dropped and very rapidly fed the little one and went off to hunt once more. Perhaps ten minutes later he came again, and called; immediately a young bird ran out and was fed. Each time one only came for food, but the two were so much alike that I cannot say if they took fair turns, or if the parent bringing food had a distinctive call note which was understood by the one whose turn it was to be fed. This could only be learnt by watching a nest where the two birds differed in colour. It is, however, possible that one bird only was hungry, for the size of the fish swallowed whole by the young is often large, and a ten minutes interval would not allow for digestion. When I picked up one young Common Tern it promptly presented me with a five-inch Sand-eel, actually longer than itself. The head of this fish was partially ingested, but the greater part of the body was unaffected by digestive fluids.

The behaviour of even very young Terns varies in individuals, and as they grow older and stronger the characters develop. Some young leave the nest in an hour or two, immediately the down dries, but others remain until at least the second day. The little ones wander over the sand or take refuge in the vegetation, and when they can run well they are fond of visiting the tide line. Some young, when handled, refuse to rise and run, but others are off and away with wings extended at the first touch. When picked up some will disgorge the last meal, a habit very common with well-grown young Gulls. Some lie quiescent in the hand, but others pipe and peck. One bit savagely at my finger and then seized and worried its own foot. Mature birds exhibit individuality when the nests are approached, and on the whole, the Arctic Terns are more demonstrative than the Common or Sandwich. Many wheel and

scream high overhead, but others threaten to attack the intruder. The attacking bird hovers for a moment, then, half closing its wings, stoops towards the head of the man or woman near nest or young, but usually skims up, banking smartly, when within arm's reach, screaming as it passes. I have never been struck myself, but some of my friends have experienced a blow from the bill of the attacking bird. Mr. Purdy, who was staying at Blakeney, was struck on the head by one bird and the blows were severe enough to draw blood. It may sound unfeeling, but I was really glad to see what they could and would do. I think that the assailant was an Arctic, for he was attacked near where a very demonstrative Arctic Tern assaulted my wife and me. This bird did not strike either of us, but it had an unpleasant habit, and voided, at different times, upon us both.

The Sandwich Terns were on the whole less demonstrative than the others, though one bird swooped with angry cries over and over again. The Sandwich, as at Ravenglass, Walney, and Salthouse, show a marked tendency to group their nests. These nests are slight, seldom with any decoration, though occasionally a few bents are arranged round the eggs. They are arranged on and round miniature young dunes which are forming on the shingle. One or two nests were on the sandy patch, and odd eggs scattered round. The eggs showed more variation in ground and markings than the generally light coloured eggs that I have seen at Ravenglass and elsewhere; some were dark, and some heavily zoned towards the widest part. Out of 68 nests counted on one day only ten contained two eggs, but at Salthouse, where the colony is larger, more nests contained two and one or two had three eggs. Sandwich Terns void round the nest when sitting, and the outward directed splashes are conspicuous; this habit, one would imagine, must be a danger to the species, yet it seems to be general.

Elsewhere I have commented upon the strange behaviour of many sociable birds, Blackheaded Gulls and Terns in particular; the entire colony will rise suddenly without any visible cause, and fly off in one direction, returning again in a few minutes. I noticed these sudden combined departures on the 21st, 22nd

and 23rd, but not later in the month, and both Common and Sandwich Terns went off together. The clamour of the colony is suddenly hushed ; the silence after such a volume of sound is most impressive ; the only sound is caused by the movements of many wings. Almost before the last bird has departed one will call and drift back, and in a few moments the normal behaviour and noise is resumed. No signal is apparent ; no threat of danger noticeable. The idea suggested to the observer is that the birds are very nervous, and some unexplained panic has influenced them, or that there is some advantage in a combined simultaneous departure, and the birds keep in practice—a kind of fire drill. It is, however, more reasonable to believe that the instinct to avoid danger is very perfect, and that the utterance of some well-understood alarm note, by an alarmist individual, may, without actually striking terror, rouse a reflex response.

EGG PECKING

On the 21st and 22nd Pinchen pointed out frequent cases of what he termed “ egg pecking.” These pecked eggs, in every case that I noticed, were fresh ; they had apparently been stabbed by a sharp peck by the bill of some bird, and much of the contents had either escaped or been sucked ; as the heavier yolk generally remained, I concluded that they had not been sucked, but were deliberately smashed. Ramm, at Salthouse, told me that he had suffered loss in the same manner, but he was convinced that the damage was done by Herring Gulls ; Pinchen believed that it was the work of Terns. I believe that in both places the habit is new and unexplained.

I watched carefully through a telescope but never detected any deliberate assaults from either Gulls or Terns ; in a day or two the trouble ceased, and it was over when we visited the Salthouse colony on the 26th.

At Salthouse there is a colony of Blackheaded Gulls on the Island, but Ramm assures me that these birds are not guilty. Mr. W. Bickerton, however, found Blackheads sucking the Sandwich Terns' eggs at Ravenglass. At Blakeney I more than once saw Blackheads pass over and apparently attempt to alight near the Terns, but they were always driven off, and Pinchen believes that the Terns invariably prevent Gulls from

doing damage. Gulls, mostly immature Herrings and Lesser Blackbacks, and occasionally Greater Blackbacks, spent some time at low water on the mud near the Ternery, and their presence did not look healthy for the colony. In Anglesey the Herring Gulls nesting on the rocks of the Ternery have certainly done damage, and have had to be driven off by the watchers.

Pinchen's contention that robber birds would not be tolerated by the Terns was confirmed by the behaviour of the colony when Gulls came too near, and when Rooks and a couple of Herons passed over; they were savagely attacked and driven off the ground. There may, however, be times when the eggs are little guarded, and the waiting Gulls may take advantage. At certain states of the tide, when no doubt shoal fish were inshore, large numbers of the Terns would fly off in a body, but when this happened there were usually enough left to attack any stranger. At Ravenglass the Common Terns will kill the young Blackheaded Gulls and even young Rabbits, when these innocents foolishly wander over their sacred ground. They will even attack a cow.

On the whole, however, I am inclined to think that Pinchen is correct, and that the eggs were smashed either by the Common Terns, objecting to the increase of the larger species, or by the Sandwich Terns themselves. The eggs did not look to me as if they had been broken for the sake of obtaining their contents, or as if any attempt had been made to carry them off, and so far as I remember, it was only the eggs of the Sandwich that had been damaged. As already noticed, only fresh eggs had been pecked, and within a few days, when the attacks ceased, young Sandwich Terns were hatching. It is thus evident that these damaged eggs were late. From the 21st to the 23rd numbers of the Sandwich Terns were indulging in courtship manoeuvres, the males offering fish as love gifts, and the pair taking aerial nuptial flights. On the 22nd, in addition to the gift offering, I saw one case of actual pairing, and immediately after the two birds stood in the characteristic attitude, heads and tails pointed upwards and wings depressed and half open, which indicates the acceptance of the gift and consummation of the rites.

It is therefore evident that so late as this some of the birds were still sexually active, and it is possible that these birds

might destroy eggs so as to delay the brooding instinct which follows the deposition of the clutch. Mr. G. H. Wilkins found that in South Georgia "when all the Albatross young were hatched and a week or so old, mating was taking place with as much enthusiasm as in the egg-laying season." The behaviour of an Albatross is no guide to that of a Tern, but both species are colonial in their habits, and doubts have been expressed about the constancy of the pair in many colonial species. The Sandwich Terns are too much alike to render identification of paired birds possible, but during the first three days social gatherings of birds were frequent at a short distance from the nest, and it was at these gatherings that courtship, which may have been miscellaneous, was noticeable. My suggestion is that unpaired or dissolute males may deliberately have destroyed fresh eggs, the last attempts of delayed or worn-out females to rear young.

Of course this is mere conjecture, but it may be a suggestion for further investigation. There is another possible solution, and one which has more direct bearing on the gregarious or sociable habits of species which live in colonies. The season was late and it was time that all young were hatched; late young are a danger, or at any rate an annoyance to a community which has sociable habits. The colonial spirit, a mysterious force, compels the gregarious animal to work in such a manner that the welfare of the community is assured; the individual does not count. Rooks will not tolerate the nesting of pairs which endanger the food supply; perhaps the Sandwich colonies at Blakeney and Salthouse are too large for the welfare of the whole. It is easy to say that the sea is a large feeding ground, but the fish supply is not always sufficient. If, then, late eggs or too many eggs are a danger to the colony, the overruling colonial spirit may have ordained their destruction. The behaviour of the Sandwich Tern impressed me as far more that of a sociable species than that of the Common or Arctic, whilst the Little Tern has few social instincts. To suggest any argument against protection on a specially-protected area may be unwise, but the fact remains that we may, by removing natural checks to increase, so increase a species that it becomes a danger to itself as well as to other organisms. Persecution

and man's rapacity have reduced many species to a status far below the normal numerical ratio, but at an Ecological Station the endeavour should be to find what the normal ratio is, and though every endeavour should be made to prevent human interference with the various species, any natural attempt to adjust balances should be watched and allowed to continue unchecked.

ROSEATE TERN

The Roseate Tern baffled me. Indeed, I cannot be certain that I saw more than one pair of birds, and I am not sure if any of the species had nested. I saw Roseate Terns many times, but never more than two at any given moment. This pair, or at any rate one pair, showed no inclination to nest, no interest in any particular part of the ground. The birds flew together, sporting in the air with that peculiar, graceful, easy flight so characteristic of the species, and on one occasion alighted on a bank at some distance from the colony but within easy range of our glasses, where they toyed with one another's bills, and behaved like affectionate paired birds, but by no means like parents.

A nest containing two rather small dark eggs, which Pinchen believed were of this species, did not convince me. These eggs were certainly not typical, and though I am prepared to find that there is much variation in the eggs of the Roseate—more than most oologists believe—I was never sure what bird was brooding them. I tried to mark them, but could never get in the right position, near enough to them, to be sure about the birds which nested all round; some certainly were Commons.

Another couple of eggs, in quite a different part of the colony, were very much more like typical eggs of the Roseate, but I did not get Common, Arctic nor Roseate to claim them. I only once or twice heard the harsh alarm note of the Roseate, though the mating call was frequent; I do not believe that the birds had eggs during my visit. Perhaps a first nest had been destroyed by tide, gull, stoat or rat, and the birds had not nested again.

OYSTER-CATCHER

Individuality in nest decoration is shown by both Oystercatcher and Ringed Plover. Of three Oystercatcher nests on

Yankee Bank, the first, containing four eggs, was entirely decorated with cockle shells ; the four young hatched and left the nest during our stay. The second nest contained two eggs only and these were chipping on the 29th ; it was far less elaborate and was lined with a few shells and pebbles. The third nest had contained six eggs, but one had already hatched when we visited it, and the remaining five were either addled or infertile, and finally Pinchen removed them. This nest was well paved, but with various shells and assorted pebbles. Pinchen suggested that the six eggs were the produce of two females, and it seems to me likely that the bird which later had two fertile eggs in the second of these nests had, perhaps in error, deposited the two extra eggs in the wrong nest. On the 27th I captured a well-feathered young Oystercatcher on the ridge, and it is likely that it was the one of the six which hatched out.

When released, this young bird exhibited a trait which is common to many young waders : it ran rapidly for a few feet, and then stopped and turned sideways, running on again for another short stretch and constantly repeating the half turn ; one of the laterally-placed eyes thus observes the imagined danger. But it also had another little habit, which I have noticed in Lapwings, Ringed Plovers and other birds. As it ran, it repeatedly dipped its bill towards the ground as if picking up food, though I do not think that it ever really ate anything.

Here, again, reflex action may function ; the bird's muscles respond to a stimulus set up by the eye on seeing possible food ; but it is far more likely that the trick or trait is inherited, for in the old birds, who also do it when trying to lure enemies from their young, an apparent unconcern—a bird innocently feeding—may serve a purpose in deluding the enemy. The behaviour of mature Oystercatchers is, as in other species, unfettered by hard and fast rules. I have known birds in Anglesey stand from one to two hundred yards away from their crouching young, and preen their feathers, feed a little, and even mob a passing Herring Gull, though I was searching for the young bird and not many feet from it. They pretended that they were uninterested, though every few moments they gave a pipe of warning which told the young one to keep still. Some of the Blakeney birds also showed little concern, even when I captured the young

one, but the parents of the four newly-hatched young dashed past close to me with distressful cries, and kept up an incessant clamour.

RINGED PLOVER

Ringed Plovers were very numerous, and I marked some 18 young birds with "B.B." rings. Some of these young refused to move, even when ringed and replaced upon the ground, but others refused to crouch, disregarding the parental warning calls, and were only captured when I fairly ran them down. One or two I turned over on their backs, but when righted they still crouched, but most of them struggled and piped when picked up. One and sometimes both of the old birds squattered when the young were in danger. The normal action of the parent when endeavouring to draw attention to itself and away from its infants is to drag itself along on its belly with the tail depressed and spread, so as to show the conspicuous pattern of the inner and outer rectrices and the subterminal dark band. At the same time one or both wings are waved above the back, the bird rolling on one side at times in a peculiarly helpless attitude. If no attention is paid to its eccentric behaviour, it will fly a little nearer and repeat the operation. That the action is an ancient and useful habit and instinctive there can be no doubt, but there is in the repetition at a nearer range something which suggests the realisation that the ruse has failed; it is safe to say that the bird *reasons* that it must try again, and be a little more emphatic.

In many cases the two parents were striving to lure us away, but often a third bird took a share, and this was also noticeable with Oystercatchers. Krapotkin's "Mutual Aid" is shown by this joint action by outsiders, but here again the stimulus of an alarm cry may rouse certain responses, and alarm cries are well understood, even by birds of other species. One young Ringed Plover when released ran towards the Pit, but its parents headed it off and strove to turn its course shorewards. This was accomplished somewhat roughly, for one bird twice bowled the young one over before it forced it to return. When the little one was running in the shoreward direction the old birds led, running a little ahead of it, and constantly stopping to see if it was following.

In addition to numerous young there were many nests still containing eggs. One was paved with small white stones, another had shell chips but no pebbles, but the most interesting nest was close to one of the huts, and was constructed in the charcoal and cinders where a brazier had stood. Naturally, the eggs were conspicuous in this black setting.

RESIDENT AND PASSAGE BIRDS

Other nesting species noticed were Redshank, numerous, Lark, Meadow Pipit, still with eggs, Pied Wagtail and Starling, as well as a fair number of Linnets. In addition there were frequent visitors from across the Channel, young Starlings in flocks, Rooks, and perhaps Cuckoo and Swallows. Swift and House Martin were seen, but I believe that these were still on passage; the Swifts, flying well over the water, were working west. To my surprise, I did not meet with a single Wheatear.

Fifty-three Sheld-ducks was the largest gathering that I counted, but smaller parties were about daily at low tide. The drakes and ducks were exchanging courtesies, the former bowing demurely, the latter replying by a quaint upward sweep of the extended and depressed head and neck. On the ridge we met with nine young in down. Most of these birds, I fancy, and on the 26th a large number on the Cley marshes, were non-breeders, but some of the ducks may still have been in the burrows of the Hood and Marrams.

Passage had not ended by the 30th. A few Bar-tailed Godwits were about the whole time, and Curlews also, though these and some black-bellied Dunlins may have been summering birds. Twelve immature Grey Plover were on the mud on the 23rd, and next day a mature bird in full summer dress was accompanied by a white-bellied companion.

On the 24th a Manx Shearwater passed westward, and on two or three occasions Divers, apparently Black-throateds, flew or swam in the same direction. On the 27th a party of immature Kittiwakes flew eastward, and a dark Gannet, a second year bird, passed in the same direction. An Arctic Skua visited the Ternery on the New Point, and so long as it remained crouching on the sand created no disturbance, but immediately it rose, the Terns attacked. It had no difficulty in avoiding them, and dispersed its assailants by a determined swoop at one individual, but it did not, whilst I watched it, obtain any food.

On the flooded marsh at Cley we saw an immature Little Gull, and this was specially interesting, for on the 17th a mature bird in full dress remained most of the day on Hickling Broad, and gave us many opportunities of watching a bird in this unusual plumage. Other birds at Cley were a Little Stint, in summer dress, and a Ruff and two Reeves.

MARINE MAMMALS

Twelve Common Seals, some large males, others quite young animals, was the largest number that I noticed on the banks; on the 26th a large cetacean rolled westward. From the small size, shape and position of the dorsal fin I believe that it was a Dolphin, *Tursiops tursio*. It certainly was not a Porpoise, Killer, or Whitesided Dolphin.

VARIATION AND THE COLONIAL HABIT

I had hoped to discover some explanation of the great variation in behaviour and habits as well as colour and markings of eggs and young of the Terns, but the lesson is still unlearnt. Variation is certainly more marked in sociable than in solitary species, but it appears to me to be emphasised in the Common and Arctic more than in the Sandwich, although the last has certain sociable rather than gregarious habits which are lacking in the first two. So far as colouring is concerned, the eggs of the Common Tern, as also the young, may or may not be protective; they are certainly less constant in this character than those of the Little Tern and Ringed Plover. The colonial habit undoubtedly gives protection, and the predatory foe has little peace if it attempts to hunt for eggs. Therefore the special type of colour or markings which would best give protection ceases to function, and there is less weeding out of the unsuitable; variation has its chance and runs riot, as it does in the little threatened eggs of Guillemot and Razorbill. The habit of living in colonies, and of mutual aid when the colony is threatened, detracts from the necessity of specially-hidden eggs or young.

Variation in behaviour is not, however, the special prerogative of the Common Tern, or indeed of sociable species; all birds show it when we investigate their habits. It is one of the most important factors of evolution, for without it advance would be impossible.

IV

NOTES OF A NATURALIST IN THE
NETHERLANDS

BY ROBERT GURNEY, M.A., F.L.S.

THE Norfolk Broads district is, to a naturalist, an area of extraordinary interest, raising many perplexing problems which await solution. In Britain there is, so far as I know, no district which can in any way be compared with it, but the Dutch meres and waterways have often been likened to the Norfolk Broads, and it had always been my desire to visit them and to see how far such likeness goes and what are the differences. Many years ago (1870) Brady and Robertson, writing an account of the results of dredging in tidal estuaries, alluded to certain species which they had found to be common to the East Anglian rivers and to the rivers of Holland, and supposed that there might be a similarity in the crustacean fauna of the two countries due in part to their having at one time formed the drainage area of a single river—the Rhine. Although the species upon the occurrence of which they relied have since been either suppressed or found to have a wider distribution, the expectation of a faunal relationship is not unreasonable, and the resemblance of the Broadland region to the lowlands of Holland invites comparison. An invitation from Dr. Long to join him in a visit to Holland in the Spring of 1920 was therefore readily accepted and, though the visit was all too short to allow of an exhaustive study of the fauna of the Dutch waters, we covered a considerable area of the country and saw much that was of the greatest interest. We were greatly indebted to Mr. A. Burdet, whose stereoscopic photographs of birds are so well known, and to Mr. P. G. Van Tienhoven, the secretary of the Dutch "Natuurmonument" Society, for their hospitality and invaluable assistance in this attempt to acquire during a short visit some knowledge of the main features of their country.

Very roughly one may say that there are three types of country in the Netherlands:—(1) The clay area, including North and South Holland. (2) The low peat district of Friesland. (3) The drift area of the East. The former is flat, fertile agricultural land, built up from the silt of the Rhine in pleistocene times. The greater part of it is below sea level, and much of it has been reclaimed by the enclosure and drainage of marshes and meres. The drained lands, or polders, are sometimes of vast extent, as for example the Haarlemmer-meer which, in 1840, was a lake of 41,640 acres and four metres deep. The success of the Dutch in such land-winning is marvellous, but in some cases even they have failed, and the Naardermeer is an example of a polder which it was found impossible to keep drained.

I have not been able to find any information with regard to the chemical nature of the waters of the clay district, nor to the aquatic flora, but the impression one forms from a visit to the Naardermeer is that the vegetation is of the fenland type, which develops where the water is rich in dissolved salts. The Friesland meres, on the other hand, lie in an area of sandy deposits, and polders are rare in this district, since they are only profitable where the subsoil is clayey. All over the Friesland-mere country the sand is overlaid by thick deposits of peat formed by the growth of aquatic vegetation, but dark-coloured, close-grained, and quite unlike the loose Norfolk peat built up in the same way, but in a more or less hard water.

The drift area is covered by glacial deposits from the Baltic region and is a district largely of heath, pine woods and peat moors. Round Groningen there are immense numbers of erratics of all sizes and of many kinds of rock, and the largest of these have in some places been used by prehistoric man for the erection of megalithic monuments—the so-called “Hunnebedden.”

THE NAARDERMEER

The famous bird-sanctuary of the Naardermeer covers an area of nearly 1,500 acres, and is situated about 2 kilo-

metres from the south shore of the Zuiderzee. It was first drained in the 17th Century, but was shortly afterwards flooded as part of the defence-system against invasion. In 1883 a new attempt was made to drain the lake, but there proved to be so great an infiltration of water through its bed that the attempt had to be abandoned after an expenditure of about £20,000. The mere therefore reverted to its natural condition of open water and marsh, and was eventually bought by the Natuurmonument Society.

Situated, as it is, so close to the Zuiderzee, it is to be expected that its waters would contain, as do some of the waters of the Norfolk Broads, slight traces of salt. This is, in fact, the case, since I am informed by Dr. Van der Sleen that the salinity of the Naardermeer is about .236 grm. per litre, which is the equivalent of 16.5 grs. per gallon. In none of the Norfolk Broads is a salinity of just this amount found. Sutton Broad has usually 7 grs. per gallon, and the Broads of the Bure rather less, while those of the Hickling group are much more salt, usually containing about 50 grs. per gallon. The amount of salt in the Naardermeer is not sufficient to have any noticeable effect on the vegetation.

As one passes down the main channel of the Naardermeer a first feeling of similarity to the Broads gives place to a realisation of the essential unlikeness. The banks are fringed with reeds and reed-mace, and one recognises the great Bur-reed (*Sparganium*), but the reeds are of a mighty size and girth and must belong to a variety of *Phragmites communis* different from our own, while *Butomus umbellatus*, which is so rare a plant in Norfolk, is here common by the water-side. In the water the difference is more striking. In place of the rich variety of Potamogetons which choke the waters of Sutton Broad, for example, or the sheets of *Chara* of the Hickling district, there was *Elodea*, *Myriophyllum*, and only one species of Potamogeton—apparently a large form of *P. lucens*. Water-lilies (yellow and white) abound, the latter with the leaves strikingly red, but there is also seen in fair quantity that aquatic gem which is not found in the

Broads District—Villarsia. I have tried to grow Villarsia in ditches by Calthorpe Broad without much success, for, after a year or two, it has succumbed to the competition of the Potamogetons, but in Holland it seems to thrive, and to prefer rather deep water. There is, perhaps, some connection between its success here and the comparative scarcity of the plants which are its competitors in Norfolk. Utricularia, which is so common in the Sutton and Hickling areas, is, in the Naardermeer, quite rare. I particularly looked out for it, but saw only one plant of *U. vulgaris* and none of *U. intermedia* or *U. minor*. The Water Soldier (Stratiotes) abounds as with us, fairly choking some of the ditches, and here also only the female plant occurs. In one open sheet of water the bottom was carpeted with the moss Fontinalis, among which grew also *Naias marina*, whose only British station is Hickling Broad. Lastly the abundance of *Lemna trisulca* even in the most open parts of the mere is a feature strikingly unfamiliar to one accustomed to the Broads. True, the plant is common enough with us, but it is a ditch plant and never establishes itself in open waters.

The marsh vegetation too is puzzlingly like and unlike that of Norfolk. Here and there are boggy spots covered with the marsh fern, *Lastræa thelypteris*, exactly as in some of our marshes, and most of our common marsh plants are common also at the Naardermeer—such as Lythrum, Peucedanum, *Rumex hydrolapathum*, etc.; but close by will be found a sheet of Sphagnum with Drosera growing thereon, while Pedicularis and Bogbean (*Menyanthes*) are absent (or at least were not seen). Guelder Rose, too, and *Rhamnus frangula* are common on the higher ground. We have, in fact, a curiously mixed effect of fen vegetation grading into a bog flora. It is hard to say wherein it differs from true fen, but the impression one gets is of a marsh flora most closely resembling that of some parts of the marshes near Hoveton in the Bure valley, where Drosera is found.

The Crustacea of the moss and marsh pools were numerous and varied, but did not differ from those usually found in

such situations in Norfolk, with the one important exception that *Moraria brevipes*, which usually occurs only in "lime-free" waters, was common in one collection. No other "sphagnophil" species were taken.

The Molluscan fauna of the Naardermeer is strikingly rich. In the Norfolk Broads, Molluscs, though no doubt numerous, are by no means conspicuously abundant, but in the Naardermeer they are not only conspicuous but very varied. Dr. Van der Sleen has recorded 39 species, and among them is one of special interest—*Dreissensia polymorpha*, the Zebra Mussel. This species of mussel was widely distributed in Europe in pre-glacial time and was then a native of England, but altogether disappeared after the Glacial Period. During the 19th Century it was re-introduced to Europe, probably largely by man's agency, from the Danube region, and spread over Germany, Holland, and about 1824 reached England. It is mentioned in Bridgman's Norfolk list as having been found in Breydon, but, so far as I can find, it does not now occur anywhere in the Broads district. In the Naardermeer I found a few specimens, but later on, in Friesland, I found it to be very abundant.

The Crustacea of the Naardermeer are much the same as those of the Ant and Thurne regions of the Norfolk Broads. The plankton, as one might expect, contains littoral and bottom forms, and the true plankton Daphnias, *D. lacustris* and *D. cucullata*, are absent, while *Bosmina longirostris* is common. *B. coregoni* which accompanies it in the Friesland Meres does not occur here. On the other hand I am informed by Dr. Van der Sleen that *Leptodora kindti* is found in the Naardermeer, though I did not see it myself. This fine Cladoceran does not occur anywhere in the Norfolk waters, but abounds in Friesland. *Eurytemora lacinulata* is common, as it is in most of the Broads. Perhaps the most interesting species taken was *Neomysis vulgaris*, of which one specimen was caught in the large open southern part of the mere, where the bottom is covered with Fontinalis. This Mysid is a brackish water species which, 20 years ago, was abundant

in Hickling Broad and Horsey Mere, but has now died out from there and is only found within the brackish region of the Norfolk rivers. Its occurrence in the Naardermeer, in so low a salinity and without connection with the sea, is rather remarkable.

On the whole, one may say of the Naardermeer that, both in fauna and flora, the similarity which it shows to the Broads of the Ant and Thurne region is due in large part to its comparatively high salinity and its small depth. The marsh flora, on the other hand, is more akin to that of the Bure valley.

The birds of the Naardermeer have already been so ably dealt with in our Transactions* that it would be superfluous to refer to them. The Natuurmonument Society continues with conspicuous success its policy of strict protection.

THE DUNES OF HAARLEM

In the neighbourhood of Haarlem the coastal dunes cover a belt two and a-half miles wide and form a stretch of country of great beauty and interest. Their seaward face is kept perfectly regular and with an even slope covered with marram grass, but within this outer barrier are sandy mountains and valleys in bewildering array. Naturally it is regarded as of the utmost importance that the whole surface should be covered with vegetation, since a bare place very rapidly becomes a wind-blown hollow, and where such a patch is found it is often covered with branches of heather as a temporary protection. But for the most part the dunes and hollows are covered with vegetation. Large areas are planted with Sea Buckthorn, which forms impenetrable thickets in hollows and on the slopes of the dunes, but the Sand-sedge is the most valuable sand-binder. The Marram grass grows throughout, and even in the pine-woods of Bloemendal, but it does not appear to be really luxuriant as it is on some of our Norfolk dunes. The Lyme grass (*Elymus*) I did not see.

* Trans. Norfolk and Norwich Nat. Soc. X. 1916, p. 107.

In the hollows of the older inland dune system are woods of Birch, Guelder Rose, etc., and the old dunes of Bloemendal are covered with Pines, Beech, and other trees. The most beautiful plant of the Dutch dunes, particularly abundant in those of Texel, is the Rose (*Rosa pimpinellifolia*). The abundance of Spindle Trees is rather striking, and the success of this tree and of the Beech in this sand may be partly due to the fact that the sand is very largely composed of comminuted shells. On our own coast the sea casts up very few shells, but the Dutch coast is strewn with thick banks of shells of many kinds, and it is their wastage which provides the material for the dunes.

It is from the dunes of Haarlem that Amsterdam draws its water supply. The rain water falling on the dunes percolates through them and forms a great mass of fresh water resting on and depressing the sea water to a depth of 240 feet below sea-level, and it is this mass of water that is drawn upon. But the requirements of the city now exceed the amount of the annual supply of rain, and the accumulated reserves of water are being rapidly exhausted. To meet the difficulty it is proposed to carry water from the river Lek to the dunes, which will then serve as a great filter bed for the river water. The effect of the exhaustion of the dune water is already seen in the vegetation, since hollows once marshy are now dry and *Pyrola*, which once abounded, as it now does in the dunes of Freshfield, near Liverpool, has disappeared.

These dunes, which are private property and consequently strictly preserved, are rich in bird life. Curlews, Oystercatchers, and Black-tailed Godwits all nest here, and the Birch woods are full of birds. It was in one of these Birch woods that we saw a nest of the Golden Oriole, and had the opportunity of realising how extraordinarily difficult it is to see this vivid yellow bird in its natural surroundings. The Nightjar is very common in the pine-covered sand-hills, and it was a rare pleasure to sit here in the growing dusk while all around the birds were "churring" and occasionally giving exhibitions of their extraordinary love flight.

THE FRIESLAND MERES

I cannot claim sufficient acquaintance with the great meres of Friesland, since we were only able to stay two days at Grouw, in the centre of the district, and did not visit any of the larger meres, such as Fluessen or the Sneeker Meer. But a long day's sail through meres and waterways round Grouw gave a good opportunity for gaining a general impression of the fauna and flora of the waters and marshes. So far as the waters are concerned, the contrast with Norfolk is profound. The bed of the meres is a hard, compact peat, and the water is of a dark brown colour, which is most striking and quite unlike the clear transparent water of the Ant and Thurne broads or the green, plankton-filled water of the Bure and its broads. So dark is the water that it is impossible to see the bottom anywhere, and it is no doubt partly as a result of this opacity that submerged plants seem to be very few. A little *Littorella* and *Elodea* were seen in some places, and *Stratiotes* abounds in sheltered backwaters, but the *Potamogetons* which are so common in Norfolk were apparently absent. *Villarsia* was seen, but not in abundance, growing in water of considerable depth.

Another point of contrast with Norfolk is of some interest. In Norfolk, the shells of mussels may last for years with little or no signs of decay, even the cuticle remaining intact except, perhaps, on the umbo. But in Friesland, erosion of the shell is general, and apparently rapid. Even living shells were found much eroded, and dead shells rapidly decay and fall to pieces. Such erosion is, of course, a sign of marked "acidity" of the water as compared with the generally alkaline waters of Norfolk. The water is also perfectly fresh.

The Zebra Mussel (*Dreissensia*) was found to be quite abundant, growing in small clusters on any suitable submerged object. Numbers were seen on a broken bottle, and others on the shell of a large mussel (*Unio*).

The plankton here is rich, and contrasts with that of the Norfolk Broad in one or two important respects. In Norfolk

there is, properly speaking, no crustacean plankton in the Ant and Thurne area, but a plankton community is present in the Bure broads and in the large isolated broads of the Ormesby group. This plankton consists largely of *Bosmina longirostris*, and includes *Daphnia cucullata*, *Ceriodaphnia pulchella*, *Cyclops vicinus*, *C. hyalinus*, and *Eurytemora lacinulata*. The Phytoplankton consists mainly of Diatoms. In Friesland *B. longirostris* and *D. cucullata* are common, but the latter has a very much greater seasonal variation than it has with us, the crest in summer being produced to an enormous extent. On the other hand, Diatoms are inconspicuous and *Ceratium hirundinella*, which is never found in the Norfolk Broad, is common. *Bosmina coregoni* occurs in numbers nearly equal to those of *B. longirostris*, and *Leptodora* is quite common—both species which do not live in Norfolk. *Eurytemora lacinulata* is replaced in Friesland, curiously enough, by a small slender form of *E. affinis* which, with us, is a species confined to more or less brackish water. *Cyclops hyalinus* also is replaced in Friesland by *C. oithonoides*, and I did not meet with any of the species of *Cyclops* of the “*strenuus*” group.

Much, therefore, as the Friesland Meres resemble the Norfolk Broad in their general surroundings, they have little or no biological resemblance, and belong to the Central European type of lake.

The marsh flora is, as was the case round the Naardermeer, rather a puzzling mixture. Whereas one may find in places associations of plants very much the same as those of the Bure valley, to some extent indicating a “hard” water, the abundance of *Sphagnum*, *Drosera*, and, in places, of *Vaccinium*, pointed clearly to a “lime-free” water. *Peucedanum* abounds, but the plant which was most striking was *Thalictrum flavum*, a plant which, so far as I know, does not occur at all in the Bure valley, but is common in the valley of the Yare. *Ranunculus lingua*, which is a characteristic plant of the Sutton area, was very rare, and *Cladium*, which covers acres

in parts of East Norfolk, was by no means common. One patch of *Osmunda* and one of *Myrica gale* were seen. The entire absence of Orchids of any kind was rather striking and unaccountable. It may have been in part due to the earliness of our visit, and indeed many plants were no doubt overlooked for this reason, but I think some Orchids would have been seen even at that time.

A good deal of reed is cut in Friesland, though I saw no thatched houses. The reed beds are leased by the cutter and the reeds are sold by the "Voer," which is 60 bundles. These bundles are much smaller than our Norfolk "shofes," the standard girth being 25 centimetres, or about 10 inches. This standard seems to be commonly exceeded, since the bundles I saw measured about 13 in. round. The price per voer was, in 1920, 3 gulden as against 1.50 pre-war. In Norfolk, reed is sold by the "fathom" of 5 bundles (in some places 6) with a girth at the height of the bond of 6 feet. The price is now £11—£12 a hundred fathoms (120), but it is difficult to work out the comparative cost.

The Friesland Meres cannot boast of Spoonbills or Purple Herons, but they are the home of other equally interesting birds. Ruffs were seen in numbers along the canals, showing up very conspicuously on marshes where litter had been cut, and more than one pair of Marsh-Harriers were seen. We were disappointed in not seeing the nest of the Black Tern, which was said to breed in numbers near Grouw. Many of these Terns were flitting to and fro, but the spot where there had been a colony of them the previous year, nesting on the Water Soldiers, was deserted. We were told that the whole of the eggs had been taken by one collector in 1919, which shows the necessity for the stringent protection afforded when possible by the Dutch Natuurmonument Society. Bitterns were heard booming all day long, but there did not seem to be as many as one would expect. It was here that we saw the one and only Stork met with during our visit. Until recent years the Stork was a familiar sight in Holland,

but the bird has now practically disappeared. It is said that this disappearance is due to destruction of the birds in South Africa as a consequence of extensive poisoning of vermin.

WINDMILLS

As in Norfolk, so also in the Netherlands, the drainage mills are a striking feature of the flat landscape. The first mills are said to have been erected in Holland in the 13th Century, and made possible the great engineering feats of the reclaimed polders. Reclus states that there were 9000 mills in Holland in 1850, but the number is being greatly reduced by the introduction of the more efficient steam mill. It is said that Leghwater estimated for 168 windmills for the drainage of the Haarlemmer-meer, but the three steam mills which were erected lifted, in the four years from 1848 to 1852, 800,000,000 metric tons of water from the mere, and have kept it dry ever since.

The windmills of Holland differ from our own very materially. The scoop wheel which, in Norfolk, was universal till the introduction of the turbine, seems to be rarely used in Holland, and I did not see the turbine either, though no doubt it is used. The lifting apparatus most generally used is the Archimedean Screw or *vijzel*, which is a most efficient apparatus, and easily adjusted to various degrees of lift. It is a beautiful piece of carpenter's work, but one would imagine rather costly to make and maintain. The automatic winding gear and sails with adjustable vanes seem to be entirely unknown in Holland, the sails being of open lattice work, over which a cloth is spread. This, of course, necessitates drawing down each sail in turn and spreading the canvas by hand, the cap of the mill being brought to the wind by means of a chain and windlass. This type of hand-winded, cloth-dressed mill was no doubt universal in Norfolk until the introduction of the automatic winding gear about 1750, by Andrew Meikle,

and few of the old kind remain. Two may be seen at Stokesby, and there are others on the marshes near Breydon.*

Whether the idea of the windmill was brought from Holland to East Anglia or from East Anglia to Holland it is difficult to say, but there were certainly corn mills in England in the 12th Century. Jocelin of Brakelond records a dispute between Abbot Samson and Dean Herbert about a mill which the latter had erected, from which it appears that the Abbey and also the Cellarer of the Abbey already possessed mills. Whether drainage mills existed then, however, I cannot say.

AZOLLA

One of the first things noticed from the train on the journey from Rotterdam to Haarlem was a quantity of Azolla in a ditch. We are familiar with this plant and its history in East Norfolk, but it has never established itself in the open waters of the Broads or in the rivers, though in the west, in the Ouse and the Bedford River at Denver, it is in such abundance as to be a serious nuisance. In Holland, though here also it does not appear to live in the meres and was not seen in Naardermeer, it is a troublesome pest in parts of Friesland and the East. Two species, *A. filiculoides* and *A. caroliniana*, have been recognised in Friesland, but we have only the former. Both are said to have escaped from Leyden Botanical Garden. The plant has spread over the greater part of the canal system of the eastern Netherlands, though, at least in 1920, the western part of Friesland was reported still clear of it. In Holland proper it is said to have been first noticed about 20 years ago, and to have become troublesome during the last 10 years. It is fortunate that Azolla does not produce spores in all years and that it suffers from hard winters; otherwise it would be as formidable an invader as Elodea was in its luxuriant phase.

* There is a photograph of St. Benet's Abbey in the Norwich Free Library, which was taken about 1856, and shows the mill which was then in use to have sails of the Dutch pattern and no automatic winding gear.

THE EASTERN NETHERLANDS

The country round Groningen is to some extent intermediate between the fenland of Friesland and the Drift area of the East. Quite close to the town is a lake, the Paterswoldsche Meer, a mile or more across and with a depth of about 6 feet, which is said to be artificial and to owe its existence entirely to the removal of peat. It is naturally impossible to dig the peat to this depth, and it is got either by pulling it out as one would pull out the mud from a Norfolk dyke, with a "dydle," or by special dredging machines. The semi-liquid peat is spread out on the ground and dried into solid bricks, which make excellent fuel. In many places in Holland a peat bog has been in this way completely cleared of peat, leaving a pool or lake in its place, and then the whole has been drained, exposing a depression with rich cultivable land. These areas are known as Droogmakerijen. The whole business is systematised, a certain sum (the Veengeld) being set aside from the sale of the peat in order to provide for the eventual drainage and reclamation. An example of such a Droogmakerij is the Alexanderpolder near Rotterdam, which has an area of 7,370 acres and was drained in 1874. The water level is kept, by means of four centrifugal pumps, at $21\frac{1}{2}$ feet below mean high water at Amsterdam (this is the Amsterdamsch Peil or A.P., equivalent to our Ordnance Datum or O.D.).

The water of the Paterswoldsche Meer is surprisingly clear as compared with that of the Friesland meres, but contained much the same plankton, including *Bosmina coregoni* and *Leptodora kindti*. On the other hand the phytoplankton was characterised by the abundance of *Anabæna* and of *Fragilaria*, both of which are rare or absent from the Friesland meres. *Anabæna* is a common Norfolk Alga. There are other lakes in the neighbourhood of Groningen, particularly the Zuidlaarder Meer, where we saw Ruffs, but I was unable to take plankton collections from them.

A little to the South of Groningen, at Haren, the erratics of the Baltic ice-sheet are met with in quantity, and not far

from Haren a good section was seen in a sand pit. Here, beneath a foot or so of sandy heather-peat, was a layer, about 5 feet thick, of glacial clay, containing innumerable transported pebbles and stones of Scandinavian origin, while beneath was a perfectly white sand, the "Rhine and Meuse Diluvium," which is dug for building and for the manufacture of glass. Some of the largest of the erratics have been used by early man for the erection of Dolmens, which are known as Hunnebedden. One of these which we visited was built on a small mound, and consisted of four great pillar stones supporting two huge stones as a roof.

Between Groningen and Utrecht is for the most part sandy heath country with pine woods and heather moors. In Drenthe and Overijssel there are great stretches of high fen, where there is a large peat-litter industry, and at Hugeveen we saw quantities of the light brown peat stacked for transport. The peat moors are systematically exploited by fen colonies. The bog is first drained; then the surface peat is cut and set aside and the remainder is removed down to the underlying sand and used for litter. Finally the top layer is replaced, covered with sand, and ploughed in, the resulting soil, aided by artificial manure, producing large crops of potatoes and rye. Even from the railway some idea may be gained of the extraordinary transformation of the country which can be achieved, fields of thriving rye being seen in some places bounded on either side by desolate heather moor, which seemed utterly intractable. An excellent account of the fen colonies and their work can be seen in Robertson Scott's "A Free Farmer in a Free State" (1912), a book which should be read by everyone interested in the Netherlands.

A CO-OPERATIVE AUCTION

At Alkmaar, in North Holland, an interval of about an hour between trains gave an opportunity for watching a co-operative auction, which is one of the many excellent devices of the Dutch for the encouragement of agriculture. The members of the co-operative society sit, each in an

allotted numbered seat in the auction room, facing a large dial, round the rim of which figures are placed indicating prices. Between them and the dial is a water-way so that barges can be poled into the room. A barge-full of produce is poled in and the auctioneer starts the pointer of the dial at a price exceeding the value of the produce. The pointer then shifts lower and lower until it reaches a price which one of those present is willing to pay. He then presses a button on his seat which communicates electrically with the dial. The pointer stops at the price indicated, the buyer's number appears, and the sale is concluded without a word spoken other than announcement by the auctioneer of the nature and quantity of the produce to be sold. The whole proceeding was mysterious and almost uncanny to witness, and it was only later that the explanation of it was obtained.

V

NOTES ON NORFOLK PLANTS

BY J. E. LITTLE, M.A.

IN August, 1922, as I proposed to stay at Wells, I wrote to Dr. F. Long, a fellow member of the Watson Botanical Exchange Club, asking him for a little information about the salt marshes, and besides much other help he sent me his paper on "The Salt-Marsh Flora of Wells," which appeared in the N. & N. S. Transactions, Vol. VIII., pp. 523-527. His paper suggested to me that, as he was now no longer resident in Wells and I could hear of no other botanist on the spot, it might be of some interest to the Society to receive the impressions even of a visitor who only spent a fortnight there, and whose view is therefore limited to what he could observe in that short space of time. During my stay, I noted every plant that I saw in the district, but as I was principally concerned with the marshes and did not go more than a few miles inland, the proper land flora only received passing attention. I have, however, sent to Mr. Nicholson the results

as a whole. One of the more interesting additions to the land-flora of the district is *Geranium rotundifolium* L. by the roadside near Stiffkey. I saw *Arctium vulgare* (Hill) Evans and *A. minus* Bernhardi, but not *A. Lappa*, L. sec. A. H. Evans (Jl. of Bot. Ap. 1913, 116). The Elms noted were *U. nitens* Moench, *U. vegeta* Lindley (planted), and *U. montana* Stokes. *Salix triandra* L. (male) was seen at Stiffkey, and *S. alba*, var. *cærulea* (L) at Holkham. Neither appears to have been noted for district 4.

CHANGES IN NATURAL VEGETATION FOLLOWING UPON
THE EMBANKMENT OF A SALT MARSH

Between Wells, Overy Staithe, and the sand hills of the coast lies an area of some three square miles, which in its natural state was salt marsh, but which has now been reclaimed. The greater part is pasture land, drained by dykes of fenland character and defended by two main banks, the western along the channel from Overy Staithe, the eastern along the channel from Wells to The Run. There are also two older banks within these, one running about N.N.E., on the east of the Danish Camp, the other from Wells to Holkham Gap, cutting off a smaller area first enclosed and reclaimed. The changes which have taken place in the last sixty years are rather strikingly illustrated by a small portion south and west of the Life Boat Station on Wells Channel. In regard to this Dr. F. Long writes:—"When I went to Wells in 1864, this portion was covered with blown sand with no vegetation upon it. Before the eastern sea-bank was made the old men used to go there cockling. After a few years grass and other plants such as clovers began to grow. Some willows were planted, and seeded. *Hippophae rhamnoides* was planted by the late Earl of Leicester. As time went on the ground gradually became covered with herbage. Until about 1880 I did not pay much attention to the development of the marsh. One very odd plant for such a place was *Ophioglossum vulgatum*, found by Mr. C. B. Plowright, of Lynn. How did it get there? The seedling pines were, I think, from the Corsican pine planted on Holkham Meals, which spread very freely."

The portion thus described is now fenced in and protected from cattle, and is steadily afforesting itself. There are few trees over 20 ft. and still considerable intervals of scrub and grass. On the landward side of the sand-hills is a fair-sized shallow brackish pool with remains of saltmarsh vegetation, as *Aster Tripolium*, *Glaux maritima*, *Limonium vulgare*, *Salicornia*; but over the greater part land or fresh-marsh vegetation has now obtained a firm hold.

Dr. Long's list, from memory, of plants he noted there includes:—

Sagina maritima (now vanished, but growing with *S. procumbens* on the east side of Wells Channel under the Horse-shoe Bank). *Epilobium angustifolium* (present in quantity). *Gnaphalium luteo-album* (not seen here, but found in "lows" at the Burnham Overy end of the sandhills). *Sonchus arvensis*, var. *angustifolius* (see note 1 appended). *Hippophæ rhamnoides* (spreading). *Juncus Gerardi*. *Habenaria conopsea*. *Helleborine longifolia*. *Schænus nigricans*. *Carex extensa* (not seen). *Arundo Phragmites*.

The shortness of my stay at Wells prevents my list from being in any way complete, but I am able to add to the above the following plants seen in August, 1922, upon the foregoing enclosed portion:—

Gentiana Amarella.

Euphrasia nemorosa Gremler var. *ciliata*, Drabble.

Atriplex patula.

Betula alba (segregate).

Salix cinerea.

S. aurita x *cinerea*.

S. repens.

Listera ovata.

**Juncus maritimus*.

**Scirpus maritimus*.

Carex arenaria.

C. flacca.

**C. distans*.

Calamagrostis Epigeios.

Molinia cærulea.

Those marked with a * are the remains of a salt marsh flora.

The birch was probably originally planted, but is now spreading by seedlings. The smaller land plants must have seeded naturally, and in most cases from several miles away.

Upon the eastern sea-bank between Wells and the Beach House I noted the following :—

Linum angustifolium (recorded by C. E. Salmon), *Erigeron acris*, *Atriplex hastata*.

Inside Holkham Gap, at the termination of the older sea-bank, I found *Medicago arabica*, *Geranium pusillum*, and somewhat nearer Wells, *Lepidium Draba*.

The western extremity of the salt marsh close to the Burnham Overy Channel has *Juncus inflexus* and *J. effusus* in some quantity. Noticing this, I was led, as in Hertfordshire, to search the area for *Juncus diffusus* Hoppe, and found a clump. It has not been recorded there before. It is now generally considered a hybrid, and its occurrence under the above conditions strengthens the argument. I saw no *Juncus conglomeratus* there (though I saw some at Wolferton). *J. conglomeratus* is in many county Floras noted as common, but I am inclined to think that it is by no means as common as *J. effusus*. In my own county, Hertfordshire, it is certainly scarce in the district round Hitchin. Similarly at Midhurst, in Sussex, I recently found hundreds of *J. effusus* for one of *J. conglomeratus*. The compact form of *J. effusus* approaches it closely, sometimes I think even to considerable striation of the stem, but lacks the little mound in the retuse tip of the capsule. I would suggest that the distribution of *J. conglomeratus* requires re-consideration.

Omitting the littoral and sand-dune maritime plants, the larger area above described now has :—

WATER PLANTS

Ranunculus circinatus.

R. Baudotii (& ? f.)*

Myriophyllum spicatum.

Apium nodiflorum.

*As to this latter form, Mr. W. H. Pearrall writes :—“*R. Baudotii* Godron ; a small form frequently met with in places liable to be flooded occasionally by tidal water.” Floating leaves were absent.

Sium erectum.

Rumex Hydrolapathum.

Ceratophyllum demersum.

Elodea canadensis.

Sparganium erectum.

S. simplex.

Potamogeton natans.

P. panormitanus Bivona-Bernardi? (See note 3.)

P. pusillus (det. W. H. Pearsall).

Zannichellia palustris L. (det. W. H. P.)

P. pectinatus var. *diffusus*, Hagström (det. W. H. Pearsall).

Ruppia rostellata (det. W. H. Pearsall).

Scirpus Tabernemontani.

Carex divisa.

C. vulpina.

C. acutiformis.

Glyceria fluitans.

The Lake in Holkham Park, on the site of an old inlet of salt marsh has :—

Bidens cernua.

Polygonum amphibium.

Rumex maritimus.

Potamogeton lucens.

Scirpus maritimus type, and var. (or rather forma) *monostachys* Sonder.

Among the land-plants of the marsh are :—

Hypericum tetrapterum Fries

Trifolium scabrum.

Geranium pyrenaicum.

Rosa Eglanteria.

R. lutetiana.

Epilobium hirsutum.

E. parviflorum.

E. palustre.

Plantago Coronopus.

Lolium perenne.

To the east of Wells lies a smaller marsh from which the tide has been longer excluded. The banks are largely covered by *Agropyrum pungens*, and its var. *littorale*. In one part

there is a little *Hordeum marinum*. The dykes contain *Ruppia rostellata*, *Zannichellia pedicellata*, and *Butomus umbellatus*. Upon bare mud at a watering place for cattle was growing a small quantity of *Glyceria distans* and *G. Borreri*. Both these are more abundant at Cley in the marsh east of the River Glaven, also embanked. Some years ago, however, the sea broke over the shingle beach and partially drowned the pasture, converting some of the land to bare mud, which is now being colonised by these two plants. The conditions here appear similar to those of a part of the area of Pagham Harbour, W. Sussex, embanked and drained and converted into marshland pasture from 1879 until 1910, when the sea broke in again and formed in several places a foreshore of bare mud which for some years after 1913 was occupied by *Glyceria distans* and *G. Borreri*. (See Watson Exch. Club Report, 1913, 426; 1917, 81; 1919, 125.) As the vegetation closed up on the foreshore the latter plant disappeared, and its place was taken by *G. maritima*. Probably the same cycle of colonisation is taking place at Cley. The Cley *Glyceria Borreri* has been confirmed by Mr. A. Bennett. Dr. Long writes:—"I found *G. Borreri* growing in a dyke at Holkham "near the coast; it was confirmed by A. Bennett, who said "that it had not been reported so far north before."

On Warham Marsh, near the old Rifle Butts, the coast line is apparently being extended seawards. My companion on August 22, revisiting the spot after an interval of several years, noticed at once that at the north end of East Fleet, outside the very low seaward edge of the marsh, there had sprung up on the outer sand a growth of *Limonium binervosum* and of *Salicornia*. I had previously seen children picking "Samphire" on these higher sands towards Stiffkey. The normal relative succession of the three Sea Lavenders, from lowest to highest, comes in the order (i.) *Limonium vulgare*, (ii.) *L. bellidifolium* (iii.), *L. binervosum*; so that these outer sands were being colonised by that species whose horizon is usually the highest. At the same time, I must note that just on the edge of the marsh, where the sand is being blown over it, all three species were growing together, and that *L. vulgare* var. *pyramidale* was particularly fine.

The sand, or the salts brought with it, may in this case have acted as a fertiliser. At Blakeney Point, Dr. Oliver shewed me marram with a beautiful growth of green leaf pushing up through an accretion of fresh sand. Dr. Long had previously written:—"You will find very good specimens of var. "*pyramidale* growing chiefly on the sides and top of the Horse-shoe Bank, contrary to what one would expect." My general impression of the sands between the Horseshoe Bank and Stiffkey was that over a large area they were being piled up and that the ultimate result would be a considerable extension of the land. This has its counterpart in the growth of Blakeney Point noted by Dr. Oliver, and as at Blakeney there are several low shingle banks one outside the other showing the growth of the marsh. Some bore traces of artificial assistance, but the "hooks" were quite consistent with natural growth.

On the east of Wells, near the Harbour, *Mercurialis annua* grows plentifully on cultivated ground. Having recently seen the form *ambigua* at Chichester, shown to me by Preby. R. J. Burdon, I searched for it at Wells, and found almost immediately a couple of narrow-leaved (female) plants, which also bore one or two (male) flowers, but further attempts were unsuccessful. Although figured by Sowerby as a variety, and so described by Syme, the latter notes that Borrer and others were of opinion that it was not constant, and this appears now to be generally accepted. I may add that at Chichester one plant had a single perfect hermaphrodite flower. (See note 2.)

On June 21, 1922, I gathered some *Festuca loliacea* Huds (*F. rottboellioides*, Kunth) at Snettisham Beach, and on reaching home discovered among it a few plants of *Lepturus incurvatus*, Trin. Stems short, incurved—base of the culm hidden in the upper sheath: anthers about 0.6 mm. long (which Hackel, in W. E. C. R., 1908, 209-10, gives as the certain distinction from *L. filiformis*, Trin, the anthers in the latter being 2.8 mm. long).

On the same shingle grew a small quantity of *Agropyrum pungens*, Roem and Schult, var. *pycnanthum* (Gren. and Godr.), as to which Mr. A. Bennett writes, "Your specimen

“ seems to agree very well with Grenier and Godron’s description in Fl. de France, iii., 606 (1855), except that your plant “ is a small one. They call it a species.” The drought of May, 1922, may explain the dwarfer growth, as very many plants were quite burnt up.

In a dyke behind the beach grew *Ranunculus Baudoti*, f. *confusus* (Godr.), confirmed by W. H. Pearsall.

Near the mouth of the River Ingold is a drain coming from Wolferton, in The King’s Marsh. Here were growing *Salix acuminata* (Sm.) and *Alnus glutinosa* (Gaertn) f. *macrocarpa* (Fedde), with fruits measuring (green) on Aug. 23, 23 mm. long and 16 mm. broad. In a plantation nearer to the railway I found *Salix caprea viminalis* (no striation of the wood), and *Juncus conglomeratus* L. On reaching the greensand I noted *Sagina ciliata* Fr. (conf. by W. H. Pearsall), *S. apetala* f. *barbata* (Fenzl), *Polygonum Hydropiper* L., *Tillæa muscosa* L., *Hypochaeris glabra*, var. *erostris*, Coss and Germ.

Several coast and inland forms of *Erodium cicutarium*, L’Hérit, have been submitted to Messrs. Baker & Salmon.

Rumex Hydrolapathum Huds., King’s Marsh, Wolferton, 23 Aug., 1922. With the type occurs a variant having leaves near the base (the true radical leaves were withered) with an obliquely cordate or subcordate lower extremity to the lamina and a petiole with raised margins; but the fruits are those of normal *R. Hydrolapathum*, viz., with “ ovate-triangular ” (Syme. & Bab.) fruiting segments. In the form of the leaf it compares with *R. Hydrolapathum* var. *latifolius* Trimen: but the fruiting segments of the latter are broadly deltoid, and distinctly denticulate in specimens sent me by Mr. A. Bennett, gathered near Lewes and Alfriston, Sussex, by the Hon. J. L. Warren. Also the latter were sterile, as far as I could observe, while those of the Wolferton plants were fertile.

The Wolferton plants appear rather to correspond to a sheet in Hb. Brit. Mus., labelled “ *R. Hydrolapathum* var. “
“ Edenmouth, nr. Kelso (in rich moist soil),
“ Co. Roxburgh, Coll. A. Brotherston, Aug. 7, 1878,” to which

“ is added the note:—“ Many of the leaves are obliquely cordate, “ the petioles channelled and margined above. I have gathered “ the same form several miles further up the Eden at Millers- “ tarn in Berwickshire.” And. Brotherston.

Syme, E. B. VIII., 51 (1868), gives for *R. Hydrolapathum* Huds.:—“ Leaves subcoriaceous, the radical ones elliptical “ or elliptical-oblongate, gradually attenuated at the base, “ and insensibly decurrent into flat petioles, acute, very “ finely repand-crenulate and flat at the margins; lower “ and middle stem-leaves similar but smaller, less gradually “ attenuated, and with shorter petioles; leaves at the base “ of the whorls strapshaped-elliptical or strapshaped.”

This description does not cover the plants now under discussion; nor does Dr. Beck von Managetta (Reichb. Ic., XXIV., 1903-9) mention any such leaf variation.

Hooker's “ Students' Flora,” however, gives “ Leaf-base “ rounded, cordate or acute: Petiole flat above, not winged,” for his type.

NOTE 1. *Sonchus arvensis* L.

Dr. Long wrote to tell me of a narrow-leaved plant which he had found at Wells, and I kept a careful watch for variations. Only one plant of those which I brought home agrees with a sheet in Hb. Brit. Mus., “ *Sonchus arvensis* var. *angustifolius* Meyer, Ex Herb. H. & J. Groves, Coll. F. Long, Sept., 1889, Wells, W. Norfolk.”

Meyer's description in *Chloris Hanoverana*, Göttingen, 1836, p. 424, gives:—“ Schmalblättrige Feld-Gansedistel “ . . . Die Spielart hat doppelt schmälere Blätter und “ Blattfedern.”

Mr. A. J. Wilmott interprets this to mean that there are narrow leaves with narrow runcinations.

Bosch Prod. Fl. Batavæ (1850), p. 135, has:—“ *beta angustifolia*, Caule simplici, 1—2 floro, foliis integris acute denticulatis; “ habitus *Sonchi maritimi*, Duinen bei Scheveningen. Bosch “ refers to Detharding's *Flora Megalopolitana* [Mecklenburg], “ 1828, p. 60. But Detharding does not name the variation “ as *angustifolius*, merely saying that it is a var. which “ Schultz thought was a species.” (A. Bennett, *in litt.*, 6.1.23.)

From these two descriptions it seems to follow that Meyer's plant is not the same as that of Bosch. Meyer does not limit his plant to the sea-coast.

Sonchus arvensis is a plant with a wide range of variation. Mr. W. C. Barton, F.L.S., shewed me, Feb. 21, 1923, a specimen from Ashmansworth, Hants (gathered at an altitude of 800 feet), an inland station, which corresponded very well with Dr. Long's plant in having narrow subentire leaves, a slender rigid stem, and few *capitula*.

NOTE 2. *Mercurialis annua*

In 1916 a single (male) plant of *Mercurialis annua* appeared in my garden at Hitchin. I had previously had only one record for N. Herts, viz., on a waste heap of London rubbish near Welwyn Tunnel, and one for S.E. Beds, at Southill. Since the species does not grow naturally round Hitchin, I watched the plant but could detect no male flowers.

Fertilisation from some other similar casual was, of course, not impossible, but judging from their rarity somewhat unlikely. Nevertheless the plant set seed, and next year a number of plants both male and female appeared, and after that, although I hoed it down, it continued to spread every year. Was the explanation that in 1916 the female plant produced a sufficiency of male flowers for fertilisation?

NOTE 3. *Potamogeton panormitanus*, Biv.-Bern.
(? at Wells.)

Mr. W. H. Pearsall writes:—"Judging mainly by the facies of these plants they are *P. panormitanus*, but in bad condition. For stable determination there should be any or all of the following:—

- " 1. Young and well-formed ligules well displayed.
- " 2. The base of the stem, shewing a few characteristic winter buds.
- " 3. Single leaves, flat and separate.
- " 4. Mature fruits, or carefully shown flowers—
" especially the stigmas.

"The plants are certainly not *P. pusillus*, and the usual ramification of the branches of *P. trichoides* is absent.

“ They are certainly worth gathering again and floating out
“ carefully for distribution.”

The place from which they were obtained was a dyke north of Holkham station, west of the road leading to the Meals. As the dykes are periodically cleaned out, the conditions next year may not be the same. May I commend the form to the attention of a botanist nearer at hand, who can go in September and obtain a sufficiency of mature plants? I could only get material for one sheet.

VI

NATURAL HISTORY IN NORFOLK PLACE-NAMES

BY W. G. CLARKE, F.G.S.

IN Vol. III., pp. 212-227 of our “ Transactions,” the late Mr. W. H. Bidwell published a paper on the names of Norfolk parishes which appeared to be derived from animals, birds, and plants. It is probable that not all which he claimed would be admitted at the present day, but apart from parish names there are in the county many farms, plantations, houses, and hills named after animals, birds, flowers, and trees, and the evidence they afford is of value to the naturalist as well as the topographer. From the one-inch Ordnance Survey map I have noted and classified all the place-names (except those of parishes) which have a bearing on natural history.

The fox has affected the topographical nomenclature of Norfolk more than any other mammal. There are Fox Coverts at Tittleshall, Hillington, Hockham, Swaffham, and Morston; Fox Hills at Little Ryburgh, West Bilney and Northrepps; a Foxhill Plantation at Hillington; a Fox Plantation at Beechamwell; and a Foxtail Covert at West Tofts. The home of the fox is indicated by Foxburrow Hill, North Elmham, Foxburrow Farm, Hindringham, the Fox Burrows, Bedingham, and a house known as Foxhole at Saxlingham Nethergate. With the exception of the two last-named, all these are in the north and west of the county.

Deer have left but little trace on place-names. There is, however, a Hind Wood at Hindolveston, and a Buck's Hill at Loddon, though the latter may be derived from a surname. This is also the case with a number of others, as it is impossible to tell whether a name is derived directly from an animal or from a personal name. Coney is slightly more common than rabbit, for there is a Coney Hill at Foxley, a Coneyford Plantation at Stiffkey, and a Blackrabbit Warren at East Wretham. Hare occurs three times, in Hare's Hill (a barrow on Roughton Heath), Hare's Grove at Loddon, and Hare Fen at South Walsham. The only other places named from mammals are Mouse Hall in Stanford, Ferret's Hill, in East Winch, and Whale's Jawbones at Upwell. This, however, does not include names derived from farm animals.

Reptiles and amphibians have had little effect on place-names. There are Snake Woods at Weeting and Taverham, Lizard Common at Wymondham, and a Lizard Farm at Foulsham. Frog's Hall is at Swanton Morley, Frogshall at Northrepps, and Frog's Hall farm at Hedenham.

The Anthill farm at Redenhall is the only name derived from an insect, and fish have affected Eelfleet Dyke at Horsey—fleet probably from the Anglo-Saxon *fleot*, a flowing stream—and Perch Lake at Westwick.

Birds have affected place-names much more widely, and one is not surprised to find that the rook, or rather the rookery, has been most commonly utilised. There are houses called "The Rookery" at Halvergate, Potter Heigham, North Walsham and Bodham, and Rookery Farms at Thuxton, Walcott, Earsham, Pulham St. Mary Magdalene, Aslacton, Besthorpe, Thurning, Bedingham, Topcroft, Denver, Scottow and Winfarthing. These are distributed all over the county, and it would be interesting to know with how many a rookery is still connected. Crow is also fairly common, for there are Crow Halls at Burnham Westgate, Cawston and West Lexham, Crow's Meadow at Stow Bedon, Crow Hill at Bedingham, Crowhill Farm at Shipdham, and Crowhyrne Farm at Hilborough.

Poppylot Farms at Feltwell and Methwold were supposed by the late Professor A. Newton to have been derived from popeler, the old name of the spoonbill, and a Poppylots Farm at Bunwell probably has the same derivation. Hernehill Farm at Shipdham may owe its name to the heron, or to hyrne, a corner, but there is not this doubt about Heron Farm, Besthorpe. There is a Woodcock Hill at Hockham, Woodcock Wood at Sandringham, Cockshoot Broad at Woodbastwick, Sparrow Hills at Thompson and Blakeney, Sparrow Green at Gressenhall, Peacock Farm at Beetley, Magpie Farm at West Bilney, Peewit Farm at Shipdham, Eagle Tower at Sturston, Curlew Cottage at Stanford, Larkshill at East Wretham, Cockrobin Farm at Attleborough, Robin's Lodge at Stanford and Swan Lodge at Cley-next-the-Sea. Starling's Hill, Edgefield, and Spink's Hill, Broome, may equally well be derived from surnames. It is difficult to associate the bustard, great or little, with The Bustards, Walpole St. Peter, but Swim Coots at Catfield is suitably named. Dowe Hill, Ormesby St. Margaret, may be from the Norfolk word dow, for a pigeon, and The Whews at Stow Bedon may be connected with whew, the dialect name for wigeon. The reason for naming a portion of the foreshore west of Sheringham, Robin Friend, is by no means obvious.

With the exception of furze, broom, and various species of trees, place-names derived from flowers are not numerous. Yarrow House, Bintree, is probably not so connected, but there is more certainty about Lilac Farm, Beeston All Saints, Tulip Hill, Great Dunham, Sweetbriar Lane, Thorpe Market, Blackberry Hall, Trimingham, Blackthorn Farm, Diss, Elder Hill, Rushford, Eldertree Farm, Upwell, Bluebell Common, North Walsham, and Wormwood Hill, Stody. The primrose gives its name to a Corner at Woodbastwick, a Hall at Tibenham, and a Green at Lyng. Mustard Hryn, Martham, may be derived from the crop, and not from the various wild species, but this does not apply to Cranberry and Cranberry Rough at Great Hockham. There is a Sedge Fen at Southery, a Rush Meadow at East Dereham, an Osier Holt at Hockwold, and a Reed Fen at Tottington.

Bracken, gorse and heather are uncommon in Norfolk place-names, as the older forms, brake, whin, and ling are used. Despite the abundance of bracken, the only place-names derived therefrom are The Brakes, Aylmerton, Great Brake Hill, North Lopham, Brake Farm, Billingsford, and Brake Hill, Swaffham. Broom on the contrary is fairly frequent. There are Broom Hills at Hardley, Saham Toney and East Bilney, Broom Coverts at Litcham, West Bilney, Quidenham, Swaffham, Brettenham and Oxburgh, Broom Farm at Chedgrave, Broomhill at Wimbotsham, Broomhill Farm at Merton, and Bromehill Farm and plantation at Weeting.

Furze, gorse and whin all occur. There are Furze Heaths at Ickburgh and Ketteringham, Furze Hill at Beechamwell, Furze Covert at Rushall, Furze Grove at Hockham, and Redcastle Furze at Thetford. Gorse only appears in Gorse Moor, Congham, and The Gorse, South Creake. Whin appears to be used in the northern part of the county, for there is a Whin Hill, North Creake, Short Whin and Whin Close Villa, South Creake, Whin Close, Sedgeford, Whin Covert, East Bilney, and Whin Common, Denver.

Heather occurs in no place name, but its older Norse equivalent Ling is common. There are Ling Hills at Shouldham, Ling Common at Castle Rising and Coltishall, Ling plantation at North Elmham, Ling Farm at Garboldisham, Ling House at Dersingham, Lings End at Little Fransham, Ling Heath at Tottington, The Lings at Little Snoring, Linghills Farm at Great Cressingham, Neat's Ling at Ringstead, Thornham Ling Farm at Thornham and a house known as Finnegate Ling at Kirstead.

Of place-names derived from trees, seven only occur once, namely Larch Wood, Beechamwell, Juniper Plantation, Stanford, Conifer Hill, Starston, Yewtree Farm, Wacton, Sallow Bridge, Bunwell, Cherrybush Hill, Edgefield and Birch Wood, Banham. Five occur twice,—Hazel Hurn, Wood Rising, and Hazel Plantation, Barton Turf; Limetree Farm, Stratton St. Mary and The Limes, Paston; Sycamore Farm, Raveningham and Bedingham; Walnut Farm, Waxham, and Walnut tree Farm, Lyng;

and Peartree Cottage, Wortwell, and Peartree Corner, Oxwick. Willow and Vine each occurs in three places—Willow Farm, Southburgh, Willow drove farm, Hilgay, and Willow Glen Farm, Welney; and the Vineyard, Attleborough, Vine Farm, Diss, and Vine Cottage, Little Melton. Beech appears four times, in Beech Plantation, Flitcham, Beech Belt, Feltwell, and The Beeches, Tunstead and Pulham St. Mary the Virgin; and Alder five times in Alder Carrs, Repps, Gillingham and Crostwight, Alderfen Broad, Irstead, and the hamlet of Aldercarr Green in Ditchingham. There is only one Hawthorn Farm, which is at East Tuddenham, but there are Thorn Hills at Earsham, Thickthorn House at Hethersett, Friar's Thorn Farm at Burnham Westgate, and Great and Little Friar's Thornes at Swaffham. Poplar occurs seven times in Poplar farms at Scarning, Hilgay, Downham, Sisland and Attleborough, Poplar tree farm at Terrington St. Clement, and Poplar House at Tunstead. Pine and fir also occur seven times in varying forms as in Fir Hill, Keswick, Fir Patch, Briston, Fir House, Hellesdon, The Firs, Martham, Deal Wood, Threxton, and Scotch Plantations at Cranwich and Roudham. Elm occurs nine times in The Elms at Loddon, Ditchingham, Toft Monks, Earsham, and West Lynn; Elmtree farms at Gissing, Tivets-hall St. Margaret, and Pulham St. Mary Magdalen, and High-elm farm at Deopham.

Ash is found eleven times in Ash farm, Shipdham, Ash Carr, Clippesby, The Ashes, Carleton Rode, Ash Hill farms, Hilgay, and Erpingham, High Ash farms, Caistor, and Ketteringham, Highash Plantation, Ickburgh, Highash Hill, Didlington, Ash Tree farm, Moulton, and Ashwood Lodge, Pentney. Holly occurs in that form twelve times, but five times with the local name of hulver. There are Holly farms at Longham, Wendling, and Diss, Holly heath at Corpusty, Holly Hill at Wood Norton, Hollybush farm at Ditchingham, and houses known as Holly Lodge, Berghapton, Holly Grove, Neatishead, Hollygrove House, Worstead, Holly House, Smallburgh and Wiggshall St. Mary Magdalen, and the hamlet of

Holly End in Emneth. Great Hulver Hill is in Cley-next-the-sea, Hulver Hill in Beeston All Saints and Trimmingham, Hulver farm in Ranworth, and Hulver Street is a hamlet in Scarning.

Place-names derived from the Oak number twenty-two, and are more frequent than any other, the nearest approach being the Holly with seventeen. Houses known as The Oaks are at Booton, Cantley, and Bressingham, Oak farms at Stradsett, West Tofts, Terrington St. John, and Kerdiston, Oak Woods at Sheringham, Rushford, and Threxton, Oak Plantation at Illington, Oak Close at Hargham, Oak grove at Heydon, Oak Hill at Northrepps, Oak Lodge Farm, at Sprowston, Oakmeadow Farm, Diss, Burntoak Lane, Alburgh, Oaklands farm at Redenhall, Higoak, a hamlet of Wicklewood, Oakwood House at Tottenhill, and a house known as Barsham Oaks at West Barsham. The only individual trees marked on the one-inch Ordnance Survey map, are Ketts Oak, Ryston, and Big Oak, Tivetshall St. Margaret, but the latter has long been felled.

The only name which appears to be derived from a fungus is Bullfer Grove, Gunthorpe, probably from bull-feist, the local name for the common puffball.

VII

NORFOLK NATURAL HISTORY CORRESPONDENCE

BY W. H. BURRELL, F.L.S.

In 1919, by bequest of the late Miss Bonfellow Todd of Normanston, Lowestoft, three manuscript volumes bound in green calf were placed in the Society's library, containing copies of 279 letters, dated 1823-5, that had been preserved in the family of the Rev. John Burrell of Letheringsett, and had been given to Miss Todd by his grand-daughter, Miss Young, shortly before her death some nine or ten years previously. Three generations have passed since the letters were written; little is remembered locally of the men who wrote them, and thanks

papers by Burrell papers at 96. (B.)

are tendered to Mr. James Edwards, F.E.S, and Mr. Sidney Cozens-Hardy, who, with several gentleman now deceased, aided in rescuing from oblivion the few details given below.

The correspondence originated in the desire expressed by several naturalists living in Norwich and elsewhere in the County, for more intimate communication ; suggestions were made for the formation of a society, meeting quarterly in Swaffham, and for an annual conversation at Dereham ; eventually it was decided to establish a monthly correspondence, with John Burrell as "focus and registrar." Each member was to send his natural history notes with specimens to Letheringsett on the first of each month, the registrar replying on the thirteenth or fourteenth day following, the letters being copied in a book and preserved for mutual reference.

The agreement required that, during the two and three-quarters years up to Mr. Burrell's death, eight of the nine signatories should write thirty-three letters each, and that the registrar should reply with two hundred and sixty-four letters. The actual numbers were—Thomas Brightwell, 3 ; John Burrell, 181 ; Henry Denny, 23 ; Caleb B. Rose, 4 ; John Scales, 1 ; Thomas Skrimshire, 10 ; George Sothern, 22 ; Joseph Sparshall, 10 ; Robert Wigham, 25. In addition to the letters, Burrell wrote an Index Companion to Curtis' British Entomology, which incidentally led to a discussion of that work as it appeared in parts. A copy of the first part of the Index was enclosed with each letter of January, 1824, and the work was carried on regularly to part 23, entered in the Correspondence book, Oct., 1825, immediately preceding the last unfinished letter ; Brightwell's copy of this index is in the society's library.

Nothing need be said here about the better-known men whose memoirs have been written. Of George Sothern and Joseph Sparshall little has been traced ; both acted as honorary secretaries for the Norwich Museum in its early days. The former was a chemist and druggist in business on the Gentleman's Walk ; the latter, whose cabinet of insects is now in the Castle Museum, was a dyer who came to Norwich from Leeds and returned to that city at a later date.

THE REV. JOHN BURRELL, M.A., F.L.S., F.E.S.

(*vide Trans. N. and N. Nat. Soc.*, Vol. IV., fol. 98, 100, 107 ; Vol. V. fol. 428) born at Letheringsett Sept 20th, 1761, educated at Gresham's School, Holt, and Sidney Sussex College, Cambridge ; married Sarah, daughter of the Rev. William Towers Johnson (North Barningham, 1769, Beeston-near-the-Sea, 1772) at Holt Church, 1796, by whom he had eight children ; elected a Fellow of the Linnean Society of London, June 17th, 1800. on the proposal of Thomas Marsham and Alexander Macleay, being described in his certificate as a good entomologist ; buried Nov. 18th, 1825, in the family vault on the North side of the Chancel in Letheringsett Church, the broken and defaced marble slab now being hidden by the Choir stalls. The family residence near the Church, not the present rectory, has iron tie-rods with the initials J.B. He was the third rector of his name, the cure having been held by the family for one hundred and twenty years with a break, 1741-1759, during the minority of John the elder. It is not known how the family became possessed of the advowson—isolated facts, gathered from various sources, together with the christian name Nathaniel, held by Palgrave and his successor, suggest that it may have been derived by inheritance from the Bayfield estate. A sister of Robert Jermy of Bayfield married Sir John Palgrave of Barningham about 1640 ; Nathaniel Palgrave was presented to the benefices of Letheringsett and Bayfield in 1674 by Robert Jermy, and Nathaniel Burrell was presented to Letheringsett on the death of Palgrave in 1705 by Mary Cocksedge, who may have been a relative. Until Nathaniel's time the name of Burrell does not appear in the parish registers, and nothing is known locally from whence he came. John Burrell the elder, who was only seven years old when Nathaniel died in 1741, was the son of a medical practitioner ; he was not baptised at Letheringsett. The Rev. Henry Briggs, D.D., rector of Holt 1722-48, was presented to the living in 1741 by Sarah Burrell, probably John's mother, and Robert Leek, 1747-1759, was another "warming pan" presented by John Burrell, who must have been the doctor, his wife Sarah being dead and his son still a minor. John the elder presented himself 1759 ; John, the entomologist, presented himself 1786 on his father's death.

His social position, education, and scientific tastes procured him a wide circle of friends, and he was directly or indirectly in touch with the leading British entomologists of his time ; despite some rather severe criticisms to which he has been subjected, the tone of his letters leaves the impression that he was a genial man of the old School, leading a busy life with clerical duties in three parishes—Letheringsett, Langham, and Wiveton—and farming his glebe. The Vicar of Langham has pointed out that he was not Vicar of that Parish ; he acted as Curate, apparently from 1804 until his death, during the incumbency of two absentee vicars. He served for eighteen years on the Committee of the Fakenham Provident Society, and a sympathetic interest in his neighbours is suggested by various small references, from the “ leeching and cupping of Hardy by Harold ” to the detection of some rascals who had broken into the village carpenter’s shop and stolen the poor fellow’s tools.” He was most solicitous for Denny in his illness, offering him financial assistance when his “ Monographia ” seemed threatened by lack of support.

Evidence exists that a strained relationship existed between him and his wealthy neighbour at the Hall, on the question of tithe, but there was nothing unusual in that ; given a vigorous-minded parson of independent means and an equally vigorous-minded dissenting squire, nothing else was to be expected ; it may be placed to his credit that he allowed no trace of this to appear in the correspondence, although occasional references were made to the Hardy family.

The break-up of his health dated from the Autumn of 1824, when he was seized with illness in church at evening service. Writing to Denny, he deplored his enforced inactivity, sitting in his parlour, an idle spectator upon his harvest wagons, as they bore home the corn. Attacks of angina pectoris and asthma compelled him to avoid effort or exposure to cold, and although he maintained the correspondence to within a month of his death, it deteriorated from that time. His publications included three papers in Vol. I., Transactions of the Entomological Society of London, which covered the period, Dec., 1806, to June, 1812,

“ On *Lygæus mycropterus*,” probably read in 1807.

"*A Catalogue of Insects found in Norfolk*," probably read in 1807. Mr. Bridgman's copy with MS. notes is in the library.

"*Remarks on Staphylinus tricornis*," being a letter written to A. H. Howarth, dated May, 1810, giving an account of an excursion to the sand hills at Cley on Easter Tuesday of that year.

In the Public Library at Norwich there is a copy of a sermon preached in Letheringsett Church Feb. 13th, 1801, the day appointed by proclamation for a general fast and humiliation.

HENRY DENNY was born in Norwich in 1803, his home during the period under discussion being in Crook's Place. He was a draughtsman in the service of Simon Wilkin, and did work for Kirby, in addition to colouring the plates of "*Monographia Apium Angliæ*." In 1823 he visited London, attended a meeting of the Linnean Society, and was introduced to Bentley, Milne, and others in the hope that he might find an opening with more scope for his talents than Norwich offered. His chance came in 1826, when he was appointed Curator of the Museum of the Literary and Philosophical Society of Leeds, a post he occupied with conspicuous success until his death in 1871. The city records show that when the Norwich Museum was established he was made an honorary member and his collection of insects was purchased for £10. In "*Bibliotheca Norfolkensis*" it is stated that he was for some years Curator of the Norfolk and Norwich Museum; this appears to be an error; he was recommended for the post, but Wilkin was unable to spare him, and George Denny was appointed instead, Jan. 1826. His first literary work, "*Monographia Pselaphidarum et Scydmanidarum Britannicæ*," was published by S. Wilkin at Norwich, 1825. "*Monographia Anoplurorum Britannicæ*" was published in London, 1842, the British Association subscribing fifty guineas to assist the Author in his studies for the latter work.

THE REV. THOMAS SKRIMSHIRE, LL.B., born 1775, was a son of William Skrimshire, Surgeon, of Wisbech, and brother of Fenwick Skrimshire, M.D., of Peterborough. Books and documents in the possession of his grandson John Truscott Skrimshire, M.D., of Holt, showed that he was in residence at St. Mary Magdalene College, Cambridge, from February 25th, 1794, to June 24th, 1795, and was appointed to the vicarage

of South Creake in 1822. He married Rose Raven of Whissonsett, a sister of Mrs. Hardy of Letheringsett, and the interchange of visits between the two families gave opportunities for the transmission of letters to and from Letheringsett rectory. The correspondence discloses that he removed to Syderstone at Christmas, 1824, where he had sixty-two resident pupils, his clerical and scholastic duties leaving little leisure for the pursuit of Entomology. His tombstone in Whissonsett Churchyard shows that at the time of his death in March, 1836, he was Rector of Hockham, Vicar of Houghton, and Chaplain to the Marquess Cholmondeley.

The following three letters have been selected to show the nature of the correspondence :—

J. SPARSHALL TO JOHN BURRELL, APRIL 13TH, 1824

. . . Since you were here I have paid a visit to Horning several times and taken the following insects :—In January—*Bryaxis longicornis*, *sanguinea*, *impressa*, *juncorum* ; *Stenus cærulescens* *biguttatus*, *fuscipes*, *lineata* ; *Drusilla canaliculata* ; *Rugilus orbiculatus* ; *Oodes helopioides* ; *Amara tibialis*, *communis* ; and about twenty specimens of *Arcopagus bulbifer*.

In February—*Cryptorinchus urticæ*, *obstrictus*, *fuliginosus* ; *Bembidium* 4 *guttatum*, *rufipes*, *aquaticum*.

In March—*Chrysomela Populi*, *polita*, under bark ; out of moss collected *Bryaxis longicornis*, *sanguinea* ; *Arcopagus glabricollis*, *bulbifer* ; with many small *Steni* and a pair of *Lestiva obscura*. On the 19th of the same month, Wiggam (!) and I went again, and in breaking up some old stumps of alders near the ditches, we took twelve specimens of *Omaseus aterrimus*, a pair of *Panagæus Crux-major* ; several pair of *Staphilinus erythropterus* ; *Harpalus æneus*, *azureus* ; *Elater sputator* ; *Bryaxis longicornis* ; *Gyrinus natator* ; *Auchenia cyanella* ; *Oodes helopioides* ; *Helodes ferrugineus* ; a pair of *Pselaphus dresdensis* ; *Euplectus pusillus* ; *Scydmaenus hirticollis*.

I think that the oftener we visit Horning, the more we take, and I am persuaded that for all kinds of collecting there is not such another place in the kingdom, for plants, birds, and insects—and I do hope that some time in the summer you will pay it a visit.

I cannot make out what your *Cryptophagus* is. I thought at first sight it was either *Populi* or *Typhæ*, but upon examination, it appears to differ from both, being very much more pubescent than any I have. Where was it taken? I hope you will be able to take more specimens of *Tychus niger*. I cannot now spare time to answer about your Appendix to Curtis' work, but will soon. I have just got the number for April, in which the famous *Omaseus aterrimus* is figured, and very beautifully. Indeed, so they are all.

H. DENNY TO JOHN BURRELL, JUNE 17TH, 1824

I must now announce that your *Bythinus* is certainly a new species which I shall be happy to name after you, instead of the *Scydmænus* which I wrote to you about. I was not aware at the time I mentioned it being new, that there was another specimen in Norwich. While I was in London last year, Mr. Sparshall took it; I readily conjectured that it was the same as one I took at Horning, which is a new species, but upon closer examination, I found it was the same as yours, although of a very different colour.

Amongst the insects you have now sent are several good things. I have returned some, and the others I have kept back till I can send you their names. You will observe that the contents of the box I this day transmit are selected from the different boxes which you have sent. No. 2 is *Scydm. scutellaris*. No. 3 is the new *Bythinus*. There was only one female which I will send you as soon as I have quite done with it. I have reserved a pair of males for myself, as you permitted, and had the misfortune to break some in examination, for which I will endeavour to remunerate you. I expected they were all *Bythini* till the other day, when I discovered some of them were *Arcopagi*. No. 4 *Scydmænus thoracicus*. This insect was unique for nearly twelve years, till I and Mr. Wigham took it at Framingham; this is an insect I intended to send you, but as you have found one, you probably will find more. No. 5, *Scydm. hirticollis*. No. 6, you know is *Orchesia micans*. No. 7 is nova species, at least to all Norwich entomologists. Mr. Sparshall has a specimen which he caught at Horning and took with him to London, where he now is. I have sent you one back and hope soon to affix a name, as I expect to visit London as soon as Mr. Wilkin returns.

J. BURRELL TO H. DENNY, JULY 29TH, 1824

A new habitat has been discovered in which *Cillenus lateralis* is found in abundance. Rev. T. Skrimshire caught in one visit to the spot between 30 and 40 specimens, and has benevolently presented two to me. In it, as he had before endeavoured to persuade me that I should, I recognised an old acquaintance, one, I am certain, which was first communicated by me many years back to Mr. Haworth, and I think to Leach. Skrimshire's habitat is at Wells, on a sand within the shore, over which the tide daily flows, and when that retires, the insect comes forth and indulges in gambols. It no doubt seeks food at that time, and also, I argue from the similar manners of life of *Bledius armatus*, it wantons in amours. My habitat from whence I supplied Haworth, the Hookers, the Skrimshires, etc., etc., I recollect to be at the bank between Cley and Salthouse, where you last year participated in capturing Raptor *Burrellii*. These valuable insects, I well remember, were caught by me in the same hour, but I think in September; consequently, I do not despair of taking them this year if health and weather permit.

VIIIREPORT OF THE BLAKENEY POINT RESEARCH
STATION

FOR THE YEARS 1920-1923

BY F. W. OLIVER

The present Report deals generally with the period since the issue of the last in 1919. No attempt is made to deal with all the matters that are receiving attention, nor is any strict chronological sequence followed. Though first place is given to a note on the Tern Colony, the body of the Report should serve to show that Blakeney Point is much more than just an expansion of a birds' breeding ground.

THE TERN COLONY

Since the issue of the last Report, in 1919, the Tern Colony has continued to thrive. In addition to the Common and Little Terns, of which it then consisted, other species of Tern

have now come to share the ground, including a few pairs of Arctics and Roseates, and a large number of Sandwich Terns. These last are a great acquisition, for besides being magnificent as birds, their nesting habits are very distinct from those of the other species. The circumstances of these new arrivals do not however require description here, for they have been fully dealt with by more competent hands in the Reports of the Committee for Wild Bird Protection in Norfolk, published in the Trans. of the Norf. and Norw. Nat. Soc., Vol. XI., pp. 304 and 425, also by Mr. T. A. Coward in his interesting observations (loc. cit. p. 344) based on a visit in 1923. Further, in June, 1920, a third Tern Census was carried out by a party from University College, an account of whose visit from the pen of Dr. Katharine Watson appeared in the same Transactions (Vol. XI., p. 168). The full results of this investigation are on the point of publication in *Biometrika*.

One of the circumstances that have undoubtedly led to the increasing success of our colony is the development of the Far Point, and the establishment there of a pioneer vegetation adequate to afford a reasonable amount of shelter and cover for the young birds. The Far Point, standing out as it does far into the harbour (for chart see Trans. Norf. & Norw. Nat. Soc., Vol. XI., p. 173), commands ideal feeding grounds for the Terns on both sides, and it is no wonder that this area should tend year by year to become the principal focus of Tern activity. At the same time, the old breeding ground, centred around Great Sandy Low, still continues to be frequented by large numbers of birds, whilst an increasing number nest by the Beachway along the line of telephone poles.

The beauty and fascination of the breeding ground draws many visitors, including a large number of expert ornithologists and other naturalists. The interests of the birds are looked after by Mr. Pinchen, the National Trust Watcher, in a manner beyond praise—indeed his own family could not be more jealously guarded. At the same time should the number of visitors, especially in June, continue to increase, it is evident that the Committee will have to devise some scheme of partial restriction, lest the purpose for which the birds visit the Point be frustrated. Meanwhile, it is not too much to ask visitors to walk on the breeding ground with the

greatest care lest they trample on nests or crouching young, and, when they have been shown round, not to remain or return there. For, so long as people are strolling about on the breeding grounds, the parent birds are prevented from delivering the "whitebait" to their young. This exposes the old birds for long periods to the attacks of marauding Terns, who either deprive them of the fish or cause them to swallow it in self-defence. It is thus evident that if the colony is disturbed for long periods the young birds, unable to feed themselves, will die of starvation.

Several general problems connected with the habits of our Terns are discussed in Mr. Coward's paper just referred to. It is intended that copies of this shall be on sale at the Point House with other literature relating to the area.

THE AIR SURVEY

The first photographic aerial surveys were carried out in 1921, an important date in the topographical history of Blakeney Point. This is owing in an especial degree to the good offices of Capt. H. Hamshaw Thomas, the Cambridge botanist, who during the war was in charge of the air survey of Palestine in connexion with Lord Allenby's advance. On the conclusion of hostilities Capt. Thomas devoted his attention to the means of rendering the technical experience gained in the war available for cartographic purposes, and, knowing of our work on Blakeney Point, decided, as I think very happily, that the Point would be a very suitable area for his experiments. As a result three surveys were made—in May, October and December respectively, by the Cambridge University Aeronautical Department in conjunction with the R.A.F. Special Experimental Flight at Duxford. The photographs were taken by Major J. C. Griffiths acting as observer, and Flying Officer Allen as pilot.

Having been able through Capt. Thomas's courtesy to study sets of the photographs obtained, I have no hesitation in saying that a notable contribution has been made to the knowledge of the topography of the Point and that air photography promises to become an adjunct of value whether applied to general cartographic purposes or to vegetation mapping.

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BLAKENEY POINT



Aerial Map of **The Headland**, Blakeney Point, taken from 7000 ft., October 17th, 1921, about 1 p.m. Scale 6 inches to 1 mile. From untouched aeroplane photographs taken by Major J. C. Griffiths, acting as Observer and Flying Officer Allan, as Pilot.

On left (*l2* to *a11*) parallel ranges of sand dunes (youngest outside); *d6* to *c8*, **Great Sandy Low**; *g4* to *d8*, **Glaux Low**; *h5*, **Laboratory**; *h3* through *g6* to *d9*, **Long Low**; near *j4* three huts are shown; the crescent *h4* to *h5* is a Suaeda Low near the Life Boat House (which lies $\frac{1}{2}$ inch to left of its lower cusp). The shaded triangle stretching from *h5* and *h9* to beyond *b13* is the Salicornia marsh (or "Beachway") filled by all the higher tides; the Salicornia zone ends where the shade lightens near *d11*; its creek with branches is well shown, it discharges into the main channel at 8. Projecting into this salt-marsh are several low shingle hocks, *h7*, *h8*, *g7*; at *h7* is the houseboat *Britannia*, and near *h7* a derelict boat (since drifted on a big tide to *h11*); The specks on the beach near *l7* are Suaeda bushes. To the right of this saltmarsh is a high beach (*h9* to *a15*) called the **Long Hills**, overlaid with eroding sand dunes at *b15* and *c13* to *h10*. The long shaded lozenge at *g11* is a low (filling at the springs) with dwarf Suaeda bushes and *Statice reticulata*. Below *h10* the beach forks and encloses an Aster Marsh—a part of which (*l11*) is the locality for *Statice humile*. At *g10* is the houseboat *Yankee*. The end of this beach (at *h9*) was broken by a storm in 1912, the debris being now arranged harpoon-wise. From *c13* to *a17* is a fringe of Suaeda bushes. The right hand portion of the map is occupied by bare muds intersected by very shallow irrigation channels (darker). **The Hood** abuts on the main beach just off the map, top right hand corner.

The Terns' breeding ground has two principal centres, *viz.* at *d5* and on the Far Point to the left of *j*, off the map.

To map successfully from the air an area like Blakeney Harbour and the adjacent land surfaces, an area some six miles long and one to two miles wide, is an exacting exercise. The mere maintenance of the aeroplane at a constant elevation (7000 ft. in the cases reproduced here, 10,000 ft. in at least one subsequent survey); the elimination of rolling so that the plane is always horizontal, and the successive exposure of photographic plates so as to give the required degree of over-lap, alone furnish technical problems needing high skill for their solution. When a survey involves, as in the present case, a number of parallel flights on the same occasion, whatever the direction of the wind, the difficulty of the work must be considerably enhanced. We who frequent the Point are much beholden to the gentlemen named and to the departments concerned for all they have done in the matter, and trust most sincerely that in addition to providing a series of maps, novel and valuable to us, they have found the area useful in the advancement of their craft in a technical sense. It is hoped that in course of time detailed maps based on these surveys may become generally available.

Here in this Report we publish (1) a mosaic map of the Headland, Beachway and Long Hills; (2) details on a larger scale of a portion of the Marams, and of the new Aster Marsh lying south of the Hood; (3) a diagrammatic sketch map on a lower scale (based entirely on air photographs) of the whole of Blakeney Point from Cley Beach to the recent extension at the western extremity known as the Far Point.

(1) Taking first the mosaic map (Pl. XXVI.) of which the legend accompanying it gives the principal features. The dune complex on the left is readily separable in the photograph into parallel ranges or systems according to the density of the Psamma hummocks. The older ranges along the Beachway (Salicornia Marsh) show a fairly uniform shading owing to the continuity of their vegetation covering, whilst nearer the sea the younger dunes are characterised by isolated Psamma tufts standing out as spots of shade on a light ground. An air photograph seems to be an ideal method of analysing dune and similar complexes into the apposition units which have been successively incorporated. The sketch map by means of diagrammatic rendering shows these units with consecutive

lettering (see explanation of that map). Where good contrast exists between bare ground and isolated hummocks it appears that plants as small as two feet in diameter are recognisable. In a later survey, taken at 10,000 feet, with a better lens, individual plants down to one foot can be made out.

As it is the *shadows* of the plants which are especially conspicuous in these photographs, care must be used in their interpretation to discriminate between the shadows of individual plants or groups of plants and the shadows caused by the hillocks or ridges on which the vegetation is seated. Good examples of these ground-relief shadows occur at *C 8*, *e 7*, and just above *f 7*. It is the same with huts and house-boats, cf. *h 5*, the Laboratory; *l 7*, the "Britannia"; and *h 10*, the "Yankee" (Pl. XXVI.).

The white lines crossing the dune ranges and converging at some of the huts will be noted. These are tracks worn by the foot of man and date especially from the period of the war when soldiers on guard duty continually patrolled the same lines. These tracks tend to deepen and widen at spots where the wind erodes them, and once started such blow-outs are difficult to eradicate.

On the marsh to the right of the dunes the creeks and projecting beaches are well delineated. Over a large portion of the area the lighter peripheral Obione zone (as at *d 11* and *k 6*) is distinguished from the more central Salicornia sward. In general, where vegetation is zonate, the several belts can be distinguished in these photographs (see also Pl. XXVII., the lower print).

On the Long Hills the area of eroded dunes is excellently portrayed (*d 12*), whilst on the right are the bare muds with their capillary drainage channels (dark) often enclosing meshes 100 feet across. The relief here is extremely low, the contrast in tone depending on a difference in wetness of the surface layer. The same type of relief is excellently shown in the middle parts of the upper photograph on Pl. XXVII.

Photographs of more or less bare muds, such as these, have a considerable interest in connexion with possible developments later on. Some day these muds should be carrying salt marsh vegetation, and their ultimate relief should have some relation to that now obtaining. Not much is known in such

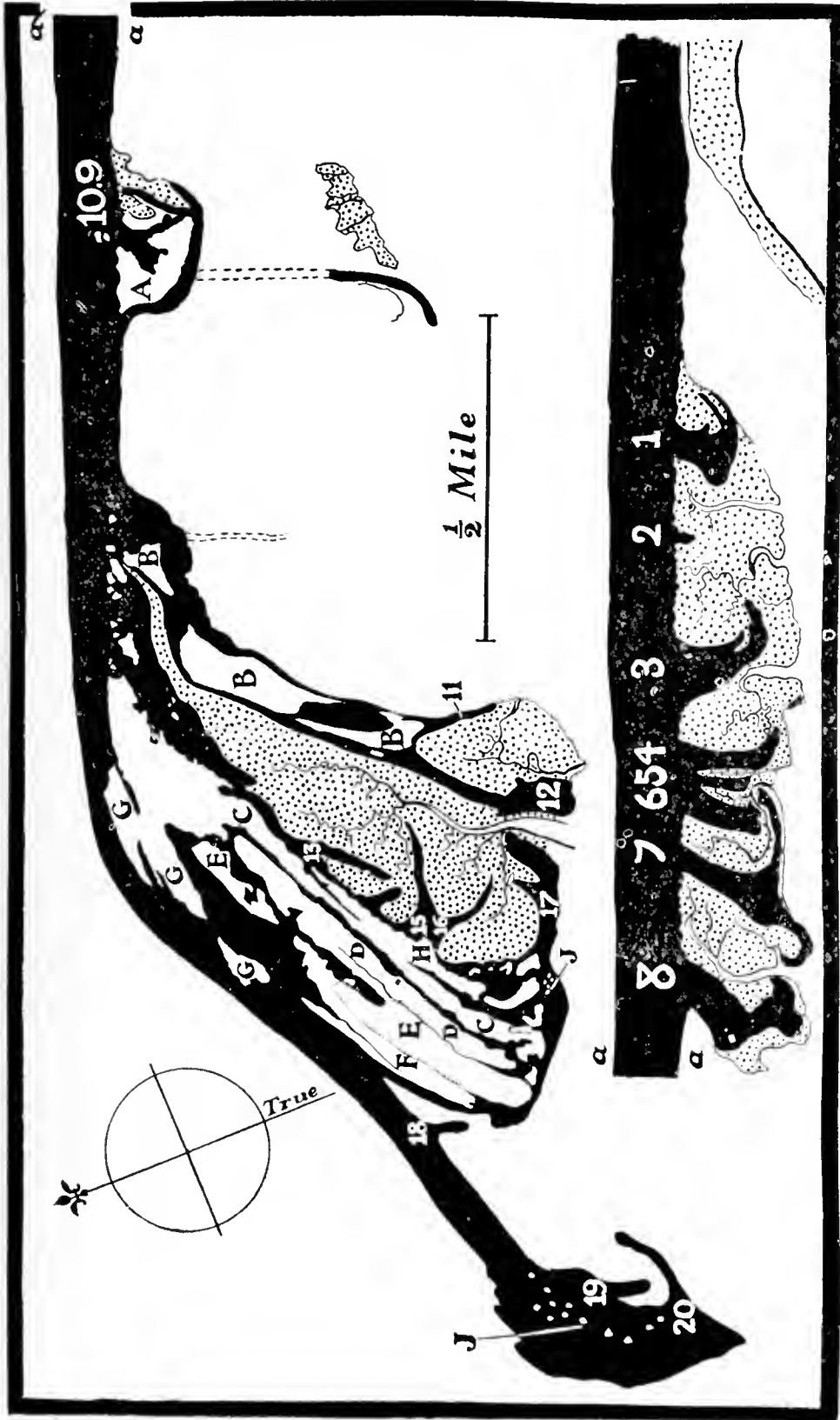
primitive stages of salt marsh succession either from an ecological point of view or in relation to reclamation problems. The existence of so many air photographs showing with great fidelity the distribution of drainage and other features in these pre-vegetation phases ought to prove of the greatest value.

(2) The Marams photograph (Pl. XXVII., lower figure) includes a section of the beach along the top with two of the marsh units below separated by the dormant lateral No. 3 (of the sketch map). On the extreme left is part of lateral No. 4. The main beach shows a cusped margin on the marsh-ward side. The projections are fans of talus shingle thrown over by wave action at very high tides. They show an intermittent advance amounting on the average to perhaps two feet a year. Photographs taken a year later than that reproduced here show quite recognisable changes in the details of these fans.

Over the central hook or lateral a much more extensive fan is advancing; at the same time, owing to the fact that the lateral is a few feet higher than the marshes on either side, it is much thinner than the fans which directly invade the marshes. The rows of spots represent the bushes of *Suaeda fruticosa*, of which three zones are present here, an upper zone, then, well separated from this, a middle zone near the points of insertion of the fans, whilst the lowest zone borders the fans where they touch the marsh and show a greater development in the bights between the fans than on the advancing tips.

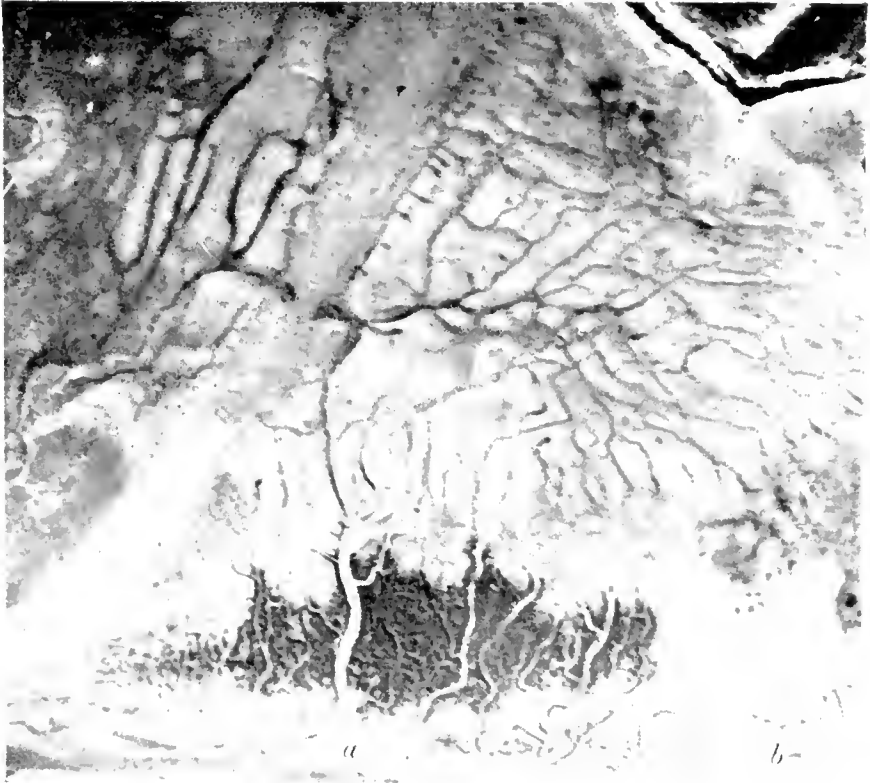
The lateral (No. 3) is mainly covered with *Suaeda* bushes (No. 4 on the left shows the flat crest, a *Suaeda* zone and a lighter *Artemisia* zone). The light oblique streak is a footpath used to reach the ford at low water to Blakeney. This track actually is much less distinct than it here appears and is often overlooked by persons new to the ground.

The marshes show their systems of creeks with great distinctness—the relief appearing positive instead of negative, due to the fact that the illumination is from the lower side of the picture. The surface of these marshes carries mainly a covering of *Obione portulacoides*, the darker areas right and left of lateral No. 3 being areas of mixed halophytes not yet over-run by this plant and correspond to an earlier stage in the development of marsh. Just below the shingle



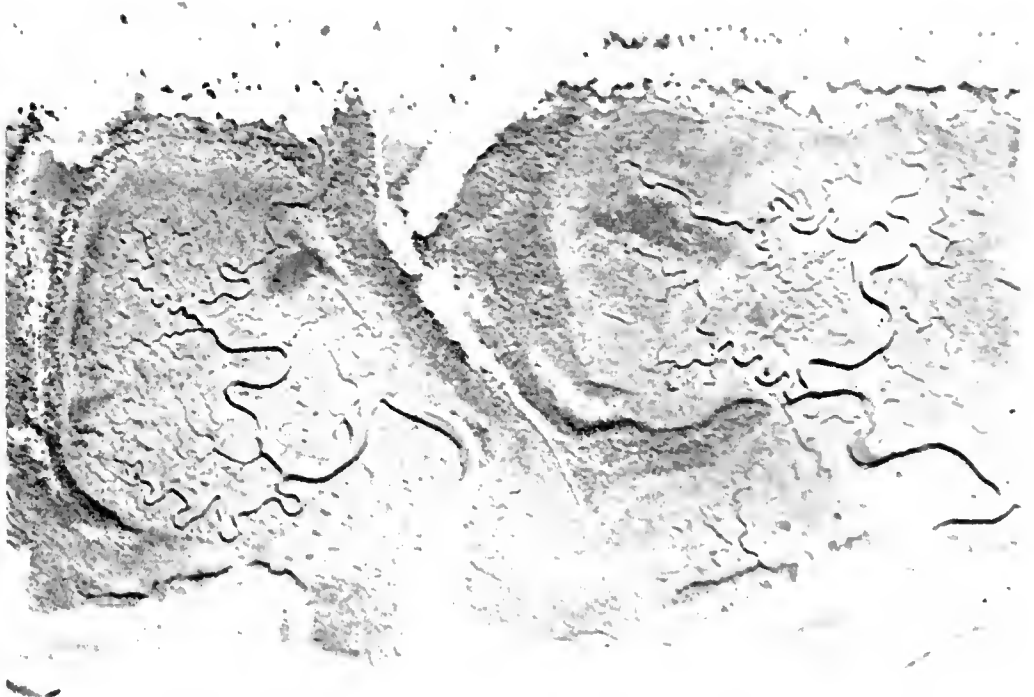
BLAKENEY POINT: scale, 3 inches to 1 mile (1: 21,160). The lower section (Cley Beach to Marrams) fits at *a, a*, on to right-hand end of upper section. *Shingle beaches*, where exposed, are marked in black, the laterals (or "hooks") being numbered in their supposed developmental sequence. *Dunes* are white, successive systems being lettered A to J. The fringing dunes H, alphabetically out of position, represent a S.E. extension of the Headland series, from which they are derived by strong N.W. winds. In *time* they are subsequent to the G system. *Salt marshes* are dotted. The youngest to establish (since 1910) is the detached area $\frac{1}{3}$ mile south of The Hood (A). Adapted from air survey photographs of 1921.

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Aerial photo of Muds south of the Hood. The Aster Marsh (dark) is traversed by numerous creeks, of which that marked *a* is rapidly becoming dominant.

Scale 1/5000



Aerial photo of position of Main Beach in the Marams Section, with dormant lateral No. 3 in centre, and a Salt Marsh on either side.

Scale 1/5000

fans, which it almost touches, is a delicate sinuous line ; this is a track at the edge of the marsh, liable to frequent diversion as this or that fan advances over it. The scale is 1-5300 (about twelve inches to a mile).

The upper photograph on the same plate includes the S.E. corner of the Hood and the Aster Marsh some distance to the S. of it. This latter is an area of some five or six acres, tapering towards the E. and W. and traversed by numerous creeks in the N.-S. direction. At the present time this marsh is covered with *Aster Tripolium* at maximum density (dark on photo.). In 1913 this marsh was surveyed by plane tabling and the chart then made shows a young and newly-vegetated area in the same position as the present Aster Marsh. Ten years ago this marsh carried almost pure *Salicornia* growing in a close sward, and it was here especially that the local samphire gatherers used to come in search of the staple of their trade. Of Asters there were not more than a few dozen. To-day the Asters have spread everywhere over the central area, and the Samphire Marsh of ten years ago has become an Aster Marsh. Here and there specimens of *Obione*, *Statice Limonium*, *Salicornia radicans* and *Glyceria maritima* have established. In this period the average rise in level of the ground is more than a foot. The creeks have altered in detail, whilst one of them (at *a*) has become much more important than its fellows and promises to become the master-creek of this area. The hooked structure on the left is a low shingle beach known as the Wolf's Back. Any extension of the vegetation further S. is hardly to be expected, in view of the scour of the tide in the main channel. The dark network above the Aster Marsh consists of low drainage channels on almost bare muds. The creeks in the Aster Marsh, on the other hand, cut deep—often two to three feet below its surface.

During the course of the successive aeroplane surveys, which were spread over 1921 and 1922, the Far Point was undergoing very rapid change in form. These changes are recorded in the most admirable manner in these surveys and serve to illustrate another value of the method. As the history of the Far Point, from its origin in 1913 to the present

day, is to form the subject of a forthcoming Blakeney Point publication, we refrain from reproducing any of these photographs here (for scenery of the Far Point cf. Pl. XXX.)

The series of visits of the airmen was not destined to pass without accident. On July 25th, 1922, when on one of their usual visits to the Point, engine trouble necessitated a landing. In alighting on the beach outside the sand-hills, owing to inequality of ground or other causes, the machine turned over and Pilot and Photographer were thrown out. The former got a cut on the head from the heavy camera which fell at the same time. When the pilot had been attended to, the crowd of fishermen, coastguards and visitors which assembled from nowhere in miraculous fashion turned their attention to righting the machine. In a few hours, by digging a hole to allow the body clearance, and hauling the tail with ropes, this was accomplished. The photograph (Plate XXVIII.) shows the machine, right way up, with Flying Officer Allen and Major Griffiths (photographer) standing in front. Later in the day we sailed across to Blakeney to arrange for horses from Mr. Everitt's farm at Cley to come out to the Point the following morning to tow the machine to Cley by the beach. On the way across the harbour a first aid and salvage party of the R.A.F. were discovered navigating themselves over from Morston, but as the services they would have rendered had been already supplied locally they were able to return to their base. The incident will serve to illustrate, however, the fine state of organisation of the R.A.F., which within a few hours is able to place a "breakdown gang" on a remote and rather inaccessible spot like the Point. Early on the 26th four of Mr. Everitt's horses arrived, and the machine in charge of the officers was towed along the beach to Cley, where it was dismantled and taken in an R.A.F. lorry to Duxford. Flight Officer Allen's comment in the O.L.B.H. Visitors' book happily describes the incident as "a piece of good bad luck." Let us hope that nothing worse may ever befall flying men on Blakeney Point.

THE SOILS OF BLAKENEY POINT

The following is an outline of soil investigation carried out in 1921 under Dr. E. J. Salisbury's direction. The results



THE MACHINE RIGHTED: F/O ALLEN IN UNIFORM (HEAD BANDAGES) AND
MAJOR GRIFFITHS (IN SHIRT SLEEVES) BESIDE HIM.

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have already appeared (Ann. of Bot., 1922) and form Blakeney Point Publication, No. 20.

Our knowledge with respect to natural, *i.e.* undisturbed, soils is very meagre as compared with that respecting the artificially disturbed soils of arable land. But if we know little about natural soils as they are presented to us at a given time there is still less known respecting those secular changes which bring about corresponding alterations in the vegetation. This is largely due to the difficulty in finding comparable areas of varying ages, since the changes in question are so slow that observations on one and the same area could scarcely be expected to yield decisive results within the life-time of any one investigator.

For such a study maritime soils offer a peculiarly favourable subject, and in this respect Blakeney Point is perhaps exceptional. Although the actual age of the different parts of the area cannot be dated with any degree of certainty, yet the whole system offers three types of habitat, namely, the dunes, the lateral shingle beaches, and the salt marshes. On these the chronological sequence can be gauged with considerable accuracy and, within broad limits, the *relative* ages of the constituent units.

The investigation centred mainly around three types of determination, *viz.*, the Hydrogen-ion concentration; the Carbonate content; and the Organic content. The first was determined colorimetrically by means of various indicators, and standardised buffer solutions; the second by means of a Collins calcimeter; the third by loss on ignition corrected for carbon dioxide given off from carbonates. Data on a less extensive scale were also obtained with respect to the reaction of the humus formed by various species, the effect of rabbit faeces, the water content, the relative proportions of coarse and fine particles in beaches of varying age, the volume of air present, the vertical distribution of the differing conditions, etc. When it is stated that over 470 soil samples were dealt with and that in many cases three or more determinations were made on each, it will be realised that the magnitude of the work involved was such that its accomplishment was only possible through the co-operation of a trained section, especially in the collection of samples.

The results show not only that the real acidity (Hydrogen-ion concentration) is a valuable indicator of soil conditions, but that there is a general tendency in all the three types of maritime habitat investigated towards increasing concentration of hydrogen-ions (diminishing concentration of hydroxyl-ions) with increasing age of the habitat, thus conforming to the edaphic succession already indicated by investigations on the soil of woodlands. In the latter, however, the conclusion was based on inference, not on a definite chronological sequence of phases such as we here possess.

The early phase of the dune with its comminuted shells exhibits not only an alkaline reaction but also a high calcium content. With increasing age the calcium is washed out by the action of rain water containing dissolved carbon dioxide until, in the oldest phases as represented by the Long Hills and the Hood, there may be no calcium carbonate remaining. *Pari passu* with this process there is increasing stability and an increasing flora which, in its turn, results in an increased organic content, bringing with it a higher capacity for water retention. With the removal of bases by leaching and the augmenting of the organic content there is a rise in acidity, till ultimately on the older dune phases we find the Polypody flourishing, or in other areas Heaths developing with *Calluna vulgaris* and *Erica cinerea* as the chief species. The same type of sequence is shown by the successively older lateral beaches, whilst the salt marsh soils show an increasing organic content although their periodic inundation precludes the possibility of any very profound change in reaction.

The relation which is found to exist between organic content and acidity is not very close owing to the variety of species involved, each probably producing humus of a specific reaction, and the fact that the reaction varies with the state of decay. The fact that such a relation exists at all emphasises the importance of rabbits which are producing faeces almost entirely composed of fragments of *Psamma* leaves, *Carex arenaria* leaves, etc., which are constantly being incorporated in the soil.

Estimations were made which showed that the average number of faeces on the surface of the ground was between 825 and 950 per square metre, and the annual deposit repre-

sented an addition to the soil of about 0.18% of organic matter by weight.

THE DRIFT LINE

This zone of the shore and beaches is all important, as it forms the gathering ground for water-carried seed. Moreover it provides the mulch or protection under which these seeds germinate and establish. The plants which have colonised the Far Point all came this way, as did the *Statice binervosa* which is covering everywhere the previously bare shingly flats at the northern end of the Headland. Till a lucky tide, in 1912, left this seed just at the right level, these flats were perfect deserts and no specimen of this *Statice* was known south of the Bend. Had that particular tide been a few inches higher or lower this seed would have been non-effective and scores of years might have passed before fresh supplies found their way to these wastes.

Occasionally foreign seeds are picked up on the drift line. Thus in January, 1921, Miss Edith Pinchen brought in a specimen of the long pipe-like pod of *Cassia Fistula*. Such finds are common on the West coast of Ireland, Scotland and Scandinavia. The French botanist Martins records a specimen of this pod coming ashore at Montpellier in 1856, the seeds of which germinated. We were less fortunate, for the seeds (which looked all right) failed to germinate when entrusted to competent hands at Kew and at the Chelsea Physic Garden. In July, 1922, Mr. E. H. Chater found two fruits of *Terminalia Chebula* (the Myrobalan, native of India, etc.), whilst in July, 1923, two seedling plants of *Ricinus communis*, the Castor Oil Plant, were found establishing in drift lines. One of these occurred just above Glaux Low, near the Laboratory, the other on the seaward side of Great Sandy Low. It is noteworthy that these three examples of tropical seeds are articles of commerce and may well have originated from passing ships or wrecks. Although these cases are too much open to suspicion to be accepted as genuine instances of auto-flotation from their land of origin, they serve to point the way and show how such common and characteristic plants of the Point as *Statice binervosa* and *Suaeda fruticosa* found their way in time past from the Mediterranean area from which they must have come.

In their power and speed of germination the seeds of different plants show a wide variability, some remaining dormant for long periods¹. Examples of these tardy germinations are afforded by *Psamma arenaria* and *Lathyrus maritima* (the Sea Pea—not a Blakeney Point plant). In the case of *Psamma* treatment with acids or mechanical friction accelerates germination, whilst *Lathyrus* (as Prof. W. Stiles, of Reading, informs me), if the seed coat be perforated, will germinate as quickly as a garden pea, but if left intact remains dormant for many months. It appears therefore that many seeds are enclosed in an impermeable coat and that until this is ruptured by decay or otherwise the water for germination cannot get access. In the case of seeds commonly distributed by currents of salt water this deferred germination may very likely be a valuable adaptation. Neither of the above plants, though growing by the shore, is a true halophyte, and were their seeds liable to germinate prematurely whilst still immersed in salt water, the young seedlings would instantly be killed.

In connexion with seed germination we have a few results which may appropriately find a place here. In August, 1919, Miss Margaret Adams (at the time attached to the Seed Testing Station of the Food Production Department, and an expert in the technique) was with one of our parties on the Point, and advantage was taken of the opportunity to collect and submit to her for report samples of some of our common seeds. Miss Adams' report is given in the following table and is based on the standardised methods current in the Department.

	Percentage Germination			Length of Test
	Open Petri dishes in Hearson incubator with		Jacobson Tanks	
	6 cc Water	8 cc Water		
<i>Senecio Jacobæa</i> ...	63	49	61	3 weeks.
<i>Triglochin maritima</i> ...	18	24	35	3 „
<i>Silene maritima</i> ...	76	66	66	3 „
<i>Rumex trigranulatus</i> ...	97	98	98	10 days
<i>Arenaria peploides</i> ...	2	2	0	1 month
<i>Psamma arenaria</i> ...	—	—	—	1 „

¹ For a full account of this subject see H. B. Guppy, *Plants, Seeds and Currents*, Williams & Norgate, 1917, cap. 2.

These results are in general agreement with our experience in the field. Thus, we have never seen seedlings of *Arenaria peploides*, although it is one of the very commonest plants of the shingle beach, and produces vast numbers of seed capsules.

Other matter less welcome than seeds and humus finds its way to the drift line. We refer to the thousands of bottles, treacle tins, containers of metal polish, and the like which sailormen light-heartedly pitch overboard when they have no further use for them, little thinking that all floating rubbish must land somewhere and become an unsightly nuisance analogous to the sandwich papers which careless tourists leave. The bottles are the worst of all for, being a mixed lot, nobody will collect them as a commercial proposition, so they lie about a continual temptation to persons of weak mind and others to throw stones at them.

Should these remarks fall under the eye of anyone so placed in the shipping world as to be able to draft and obtain obedience to a regulation to the effect that bottles and tins should be thrown overboard in a *non-floatable state* he would earn the everlasting gratitude of all lovers of the shore. School teachers in seaports where sailors are bred will also know how to help in this propaganda !

VISITS BY THE NORFOLK AND NORWICH NATURALISTS' SOCIETY

A whole day visit by members of this Society had been arranged as long ago as 1914, but was abandoned owing to the outbreak of the war. At length, on May 29th, 1921, the idea took shape and a party of 120 spent the day on the Point, and in June, 1923, a second of eighty or more members. The first of these visits was an important occasion for the Point, as it was in effect a sort of official "house-warming"—the first since the National Trust had taken over the area. Everything conspired to make the occasion a great success, flowers, birds and atmospheric conditions were at their very best, and visitors and hosts, alike, spent a memorable day.

The crux of the organisation on these occasions, when large parties visit us, is the problem of transport from the shore. On the first occasion a large motor-smack brought

the party from Morston in two journeys on the high tide; whilst on the second, owing to the smallness of the tide, sailing and rowing boats were requisitioned at both Morston and Blakeney. The latter method (boats being ample) is the preferable, because visitors can step ashore dry-shod, whilst the mobilisation of so many boatmen and fishermen tends to widen local interest in the affair. It is hoped that in future these visits may be held at shorter intervals.

SOUNDS

Perhaps the most characteristic sound heard on the Point is the cry of the Curlew—a plaintive bubbling, sometimes ending in a trill worthy of the nightingale. This cry greets the visitor at all times and in all seasons and is the welcome he expects on arrival. Another sound proper to spring and summer is the shrill, rhythmic, and most cheerful warble of the Ringed Plovers as they skim the little beaches that divide the *Salicornia* marsh. Here in the sunshine of a morning with the tide up, the marsh seems alive with these beautiful birds as they dart to and fro with accompanying waxing and waning of their note. Not far away over the sand hills the Terns maintain a continuous hubbub—the raucous notes of these nervous and quarrelsome birds dominating the world of sound from the beginning of May till the time of their departure in August and September. In recent years Arctic, Roseate, and many Sandwich Terns have joined the colony, previously composed of Common and a small number of Little Terns, and it is by the recognition of the specific notes which they utter that the various sorts are most readily distinguished.

From the earliest spring the voice of the Starling is with us as he looks up his old quarters in the big lifeboat house and in the tide-gauge. He makes us merry with his excellent imitations of the Curlew and other birds, also of the dog, Prince, and other frequenters of the habitations. During the reconstruction of the big lifeboat house numerous specimens of young starlings in a mummified state were discovered between the corrugated iron and match-boarding, where they had fallen from the nests. In reorganising the tide-gauge, which had been discontinued during the war, five starlings'

nests were found, one above the other, in the pipe which contains the counterpoise of the float.

Perhaps the most curious and mysterious sound on the Point is the "roaring" of the sea, heard occasionally when the wind falls dead. This is in no way connected with the bustling, rushing noise often heard at the turn of the tide when a multitude of little waves begins to beat on the banks outside. The "roaring" appears to come from the Bend and is well heard outside the lifeboat house. It is most frequent at night and gives a tremendous volume of sound, rather terrifying to timid persons. If you go to the shore in the direction indicated there is nothing to account for it. Locally it is described as "the sea crying for the wind to come back." The phenomenon, which is unexplained, may be conjectured as depending partly on a magnification of imperceptible wave beats, partly on some process of sound refraction. Owing to its occurrence at remote and uncertain intervals, it almost defies investigation.

Among the sounds produced by man may be mentioned the ringing of the ship's bell which hangs outside the Old Life Boat House. It is clearly heard all over the Headland, including the Far Point, and, under favourable conditions, at the Hood and Watch House. Its note is also familiar at Morston. From the mainland in calm weather the crowing of cocks and the call of the Cuckoo are often heard and our clocks can be regulated by the starting sounds of the trains at Wells.

During the war the guns in Flanders could be heard (or felt) distinctly in the hollows between the sand hills, but not on their summits, nor on the open shore.

COLOURS

Blakeney Point is justly famous for the displays of colour which centre upon it. Partly it serves as a frame or setting for the great chromatic displays of sky and sea, partly it has a more local coloration depending on the reaction of its vegetation to the lighting and atmosphere of the moment. All these displays are greatly enhanced by the beauty of form of the adjacent coast line and by the rapidity of change called forth by the unstable physical environment. Turner, had he painted here, would surely have immortalised this land of enchantment. In the present note reference will be made

only to the vegetation colours. In this character all our plants show a seasonal change parallel to that elsewhere. The cardinal points are the tender greens of early growth, the flowering at maturity, and the autumnal tints towards the close. These latter are mainly yellows and browns; crimsons and reds, with the rare exceptions mentioned later, are wanting. Nevertheless, our maritime plants hold their own in vividness under an autumnal sun with any plant community. The plants referred to here are such as occur in masses and tell conspicuously in the landscape.

In respect of flowering three seasons or periods are outstanding; viz: the Sea Pink and Campion season in early June, the Sea Poppy in mid July, and the season of Sea Lavenders, which extends from the third week of July to the middle of August. In a good year (and it is hardly possible to define precisely what determines such a year) each of these seasons attains at Blakeney Point a perfection beyond which nothing remains to wish for.

The grassy salt marshes at Morston are studded with Sea Pinks in June like daisies, but if you want to see this plant rioting in its fullest glory, the crest of the Watch House bank and the other banks of the Marams should be visited. Here the Armerias grow tall, flower in maximum density in all shades from lightest pink to crimson, and they are mingled in greater and lesser profusion with the Sea Campion which flowers at the same time.

To see the Campion by itself turn your steps to the Long Hills and especially to that broad flat shingle beach which runs alongside the house-boat "Yankee" and extends far in the direction of Pits Point. The counter-attraction of the Terns' nesting ground draws away most visitors at this time of the year, and you have the Long Hills to yourself. Here the Silene is like driven snow, knee deep in a good year (and this means early rain to secure its full growth). Nor is there monotony in this carpet of incredible purity, for the individuality of each unit plant in the aggregate is not lost. There are numerous slight variants among our Silenes depending firstly on the degree of purple pigmentation of the calyx and flower stalks, or the absence of such pigmentation (the so-called "Albinos"), and secondly, on the divergence, parallelism or inturning of

the petal halves, or on the presence of additional lobes on the "claws" or stalks of these petals. These points of distinction, trivial as set down here, in the field are recognised at once, emphasised as they are by the contrast which juxtaposition calls forth.

The effect of the Horned Poppy (*Glaucium*) in its prime is entirely different. This plant grows on the open shingle of the main beach between the Watch House and the Bend, with maximum development near the Hood. Scattered irregularly, these stately plants swaying in the breeze appear to touch when viewed from a low angle. The leaves covered with short, shaggy hairs (on which account they are un-wettable) have a tint of light green approaching that of *Salsola Kali*, a colour not common in nature, whilst the crisped basal leaves are more blue. The plants are flecked over with a constellation of yellow flowers, diaphanous and ephemeral. As they fall gently to the ground the fairies surely collect the petals and carry them away. The high key of this spangled Poppy-field is seen at its best against the sunlit ground of sand and pebbles, with a deep blue sea beyond.

The Sea Lavenders begin their flowering towards the end of July with *Statice reticulata*, its lilac flowers prone upon the sand. Here on the Point it is fairly abundant all along the "Yankee" bank, on the sides of many of the lows, and on the edges of the Marams banks. In its greatest perfection this plant occurs at Scolt Head, especially in the lows S.W. of the summit. In some places it occurs there in zones of pure formation unique in its display.

Next follows the ordinary Sea Lavender of the Marshes (*Statice Limonium*) to be found in sheets on our Marams, but better far at Wells and Stiffkey. The second week of August finds the Lavender of the fixed shingle in bloom (*Statice binervosa*). It frequents especially the highest drift lines and the shingle wastes vacated by retreating dunes. As a re-coloniser of such "deserts" it is pre-eminent. In flower this species differs from the common form (*S. Limonium*) in that its trusses are less compact, more feathery and spaced, and in tint slightly more red. These sheets of colour stretching from the drift line have a grace and lightness shown by no

other form; they suggest a sort of purple spindrift distilled from the margin of the tide.

Statice binervosa has a further claim to mention in that its rosettes of radical leaves turn blood-red in Autumn, glowing in the sunshine. The only other case is *Suæda fruticosa*, the most characteristic of all the Blakeney shingle plants. All along the borders of the Salicornia marsh ("Beachway"), from the landing place to the Bend, these bushes are kept coppiced by rabbits, so that they assume the form of low hummocks six inches in height instead of growing into bushes two or three feet high, as they do normally on the main beach along the Marams and elsewhere outside the rabbit radius.

It is especially these coppiced plants which change colour in Autumn, assuming a wide range of tints which include pinks, purples, and crimsons, set off by shades of green and yellow. The broad belt or zone fringing the sand hills for three-quarters of a mile forms a wonderful colour-mosaic, low on the ground, in which are blended these various tints—rivalling in brilliancy, but exceeding in delicacy, a moor with mingled species of heather in full bloom.

Outside the rabbit radius the *Suædas* have a different appearance. The tall crowded bushes turn colour mainly at their extremities, and these in detail parallel the tints of the coppiced plants, though owing to their height and the interior masses of leafy twigs which turn less readily, the exquisite colour-mosaic of the dwarfed form is wanting. As these projecting coloured twigs lose their foliage earlier than the rest, and then die, it is suggested that the mosaic of the coppice is likewise a pathological phenomenon. Be this as it may, the coppiced zone loses each year an appreciable percentage of plants, though the gaps are filled by seedlings which are always springing up. Broadly stated, we seem to have here a pretty problem in autumn coloration, accelerated or retarded according to habitat and treatment.

It may be added that old, more or less moribund plants of *Suæda fruticosa* on the beach are stimulated by access of new sand, shingle or humus to vigorous growth, and then present a deep green colour (without autumn coloration) so long as these conditions prevail. Likewise, when red, coppiced specimens, which it is conjectured are on the verge

of decline, are transferred to garden soil, all developing branches produce green leaves only and the plants remain green indefinitely, whilst the normal habit is gradually assumed.

A HIGH TIDE

It may be of interest to include here some account by an eye-witness of the high tide or "rage" of December 31st, 1921, without doubt the highest experienced here since the famous inundation of November 29th, 1897. The calculated expectation of the tide tables for this date promised a tide of no unusual height for the time of the springs, a tide which, under favourable conditions, is perfectly harmless.

Staying at the Old Life Boat House, we turned in as usual on the evening of December 30th expecting high water about dawn. Sleeping in the entrance, I was aroused at 4 a.m. by Mr. Pinchen, who said the tide was already nearly high, and that as it was blowing hard from the N.W., and the outlook being dubious, he had, as a precaution, transferred his family from the *Britannia* to one of the huts, where they could await developments in safety. The immediate object of the visit was to borrow a kettle and as he withdrew he remarked that the tide would be in the boat-house in a few minutes. Profoundly sceptical, I went forth into the darkness in my pyjamas to find myself up to the knees in water at the third step. Having aroused my son, we lighted the lamps, piled on the table such things as stood on the floor, made cocoa and awaited the arrival of the tide. This shortly announced itself by a characteristic hissing sound as it percolated under the door and by rat holes and other chinks in the weather boarding. These sounds were repeated with each surging wave; the floor gradually disappeared from view and the water crept slowly up the walls. At this stage time readings were taken of the rise, and in the light of previous experience it was evident that the tide would cease flowing long before the table could float. Actually, the height reached in the boat-house was 14 inches.

At grey of dawn we emerged for a tour of inspection. The flat ground on which most of the huts stand was covered and several of the huts awash. With all its high beaches and lower dune slopes under water the much diminished Point seemed extraordinarily exposed and unprotected. Had the

wind, which was blowing a gale, veered to the S. or S.E., it seemed as though nothing could have saved several of these habitations from demolition by the waves, their natural bulwarks on this side being under water.

All the lows were full, *e.g.* four or five feet in Long Low, so that neighbouring points on the dunes were often inaccessible, except by circuitous lines of approach. At the Bend, where the Headland merges in the main beach, an unusual sight was witnessed. Here, and at numerous points, as far as the eye could see towards the Hood, great volumes of water were surging in cataracts over the beach. Practically at all points where the beach was not at its highest the sea level was the level of the crest, with the result that every wave washed over and plunged down the incline—carrying with it great quantities of shingle which were left as fans or deltas stretching far over the marshes. These phenomena were repeated on a large scale between the Hood and Watch House, at places along the Marams, and to an unprecedented degree all along Cley Beach. Here the shingle was at many points advanced landwards fifty feet or more by this single tide, the channel behind being to all intents and purposes temporarily obliterated.

Further east, this same tide demolished Mr. Cozens-Hardy's concrete sea wall which had for so many years protected the east marshes at Cley—a serious disaster, as the marshes thus become liable to flooding by the sea at every high tide, and are consequently useless, whilst the right flank of the defences of Cley itself is broken down (*cf.* Plate XXIX., lower photograph).

The concretes, long maintained under difficulties, cannot be rebuilt on the old site. If these marshes are to be reclaimed the sea wall will have to be set back—a risky and expensive operation. Needless to say, the position has become acute.

A walk along the beach after the tide had run off, when the cumulative results of shingle transported became visible, merely served to emphasise the magnitude of the forces involved. No quantitative estimate is possible; all one can say is that many thousands of tons of shingle were moved that morning.

THE POINT HOUSE

For a long time there has been need for a shelter for visitors, a place where teas could also be provided. A residence was also required for the Watcher and his family. These objects



[The Point House after reconstruction, and O.L.B.II. (1923) 10 . . .]



Concrete sea wall broken by tide of Dec. 31st, 1921

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it became possible to realise when, in 1922, the Royal National Lifeboat Institution decided to dispose of the large boat-house. This house, now known as the Point House, was secured by the National Trust, and during the earlier months of 1923 underwent reconstruction at the hands of Mr. W. R. Allen, of Blakeney. Its north end has been transformed into living rooms for the Watcher, whilst a large section of the original house has been fitted up for the convenience of visitors. A portion of the annexe on the west side is reserved for museum purposes. On the east side a verandah has been added. On the whole, the architectural difficulties of the transformation have been grappled with as successfully as could be expected (Plate XXIX., upper photograph). The expenses of purchase, adaptation, and equipment reach a total of about £500, towards which contributions from well-wishers will be gratefully received by Dr. S. H. Long, 31, Surrey Street, Norwich; Mr. T. W. Bourne, the Red House, Blakeney; or the present writer. The house is under the management of Mr. and Mrs. Pinchen.

The history of the lifeboat settlement at Blakeney Point is shortly as follows:—The first lifeboat to be placed here by the R.N.L.I. was the *Brightwell*, in 1862; it was housed in the present Old Lifeboat House (probably an older structure). This was replaced a year later by another boat bearing the same name, and saved fifty-three lives. In 1873 this boat was succeeded by the *Hetty*, which saved twelve lives. In 1891 this lifeboat, being out of date and worn out, was replaced by the *Zacchæus Burroughs*, which in its turn was, in 1908, replaced by the present boat, the *Caroline*.

The large lifeboat house was built in 1898 on the site of the O.L.B.H., which was moved to the position it now occupies. It was used as a carpenter's shop during the building of the big house, after which it was purchased by Mr. C. J. Temple-Lynes, and let for the convenience of beach parties for a few years. It then passed from hand to hand till, in 1912, it was purchased and renovated by the present writer for the Botanical Department, University College, London.

In an old painting now hanging in the O.L.B.H., the Point is depicted as it appeared about the year 1810—the artist being a coastguard at Morston at the time. In this picture are represented the Pilot House, flagstaff, and another hut in the position

of the lifeboat house ; so that it is not improbable that this older building was the immediate forerunner of the O.L.B.H., if indeed it has not been incorporated therein.

THE NATIONAL TRUST

The questions are sometimes asked, "What is the National Trust?" and "When did it acquire Blakeney Point?" The National Trust is a Society founded in 1895, mainly by the efforts of Canon Rawnsley, Sir Robert Hunter, and Miss Octavia Hill, and incorporated by Act of Parliament in 1907. Its objects are concisely defined in the Act as follows :—

"The National Trust shall be established for the purposes of promoting the permanent preservation for the benefit of the nation of lands and tenements (including buildings) of beauty or historic interest and as regards lands for the preservation (as far as is practicable) of their natural aspect features and animal and plant life."

In July, 1923, with the acquisition of Scolt Head the Trust possessed ninety-eight properties, Blakeney Point curiously being number forty-nine of the series. The circumstances of the purchase of Blakeney Point (fully set forth in the Report for 1913 ; see also *Trans. Norf. and Norw. Nat. Soc.* Vol. IX. p. 703) were briefly as follows:—In 1910 the late Lord Calthorpe granted a lease to the Botanical Department of University College, London, to carry out investigations on the Point, together with a site for a field laboratory. After his death in 1911, the successors sold the Norfolk estate, including Blakeney Point, to Mr. A. Crundall, from whom the latter was acquired by purchase by one or two generous donors, lest the ground should fall into the hands of speculators. In 1912 the Point (from Cley Beach westwards) was presented to the National Trust as a Nature Reserve, and placed under the management of a Committee, partly local, partly nominated by the Trust.

The rights of the then existing hutholders were respected, and they continue to occupy their sites on agreements terminable at six months' notice. Proposals for fresh sites on Blakeney Point have not been entertained, for if one were granted it would be impossible to refuse any eligible application, and in that case there can be no doubt that the Point would in a very short time be covered with huts and bungalows. As far as we

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*Psamma
arenaria*



*Arenaria
peploides*

Triticum junceum

Cahile maritima
Salsola Kali

BLAKENEY FAR POINT

LOOKING N.E. AND SHOWING THE FIVE MAIN SPECIES OF PIONEER PLANTS, SEPT. 1923

know a new site has never been granted since the arrival of the Trust. One of the huts and one of the houseboats changed hands in 1922, but no new right has been granted.

BLAKENEY POINT PUBLICATION FUND

Hitherto the cost of laboratory upkeep and equipment has been met by a grant made in 1912 by the Percy Sladen Trustees, supplemented by gifts from friends. In the matter of our publications we have had to depend largely on the sales of separate copies to defray the charges of reprinting.

Early in 1922 Dr. S. H. Long handed me a cheque for £121 2s. contributed by a number of residents at Norwich and in the County¹, to form a fund to assist in publication where necessary or expedient. This fund is as welcome as it was unexpected, and I should like here to express my hearty thanks to those generous donors. It is especially gratifying to me and to all connected with the work here that this gift should have come from Norfolk sources. We interpret it as friendly appreciation of what we have been trying to do and encouragement for the future. Already the fund has been drawn on to assist in printing tables in Dr. Salisbury's account of the Soils of Blakeney Point, as well as for several half-tone blocks, etc., in illustration of this and other papers.

I have also to acknowledge the following gifts received since the issue of the last report:—

Miss Violet Anderson, £2 2s. 0d.; Dr. J. L. Gayner, £5; Mr. Robert Gurney, £1; Oldfeld School, Swanage, 10s.; Miss A. Vera Hay, £1; Mr. T. S. Sabnis, £1 1s. 0d.; Mr. A. G. Tansley, £5; Mr. Linn Chilvers, trees and plants for experimental purposes; Dr. E. P. Farrow, surveying poles and a telescopic alidade with graduated arc; Mr. H. Graves, set of old negatives of local views; Dr. S. H. Long, books, including *Trans. Norf. and Norw. Nat. Soc.*, continuation; *Norfolk and Norwich Naturalists' Society*, Nicholson's "Flora of Norfolk"; Prof. R. H. Yapp, pamphlets.

The personnel of the Committee of Management for 1923 is as follows:—Sir Edward Busk, Mr. A. W. Cozens-Hardy,

¹ The contributors were, Mr. R. H. Bond, Miss Colman, Miss Helen Colman, Mr. H. J. Copeman, Mr. T. Elliott, Sir Eustace Gurney, the late J. H. Gurney, Mr. Robert Gurney, the late F. W. Harmer, Mr. F. C. Hinde, Mr. H. N. Holmes, Mr. W. T. F. Jarrold, Mr. Charles Larking, Mr. Walter Lloyd, Dr. S. H. Long, Mr. A. E. Soman, Sir Charles Tomes.

Mr. Walter Derham, Mr. G. Claridge Druce, Mr. W. A. Forsyth, Mr. Quintin E. Gurney, Mr. Robert Gurney, Dr. Sydney H. Long, Professor F. W. Oliver, Mr. F. H. Partridge, the Hon. N. Charles Rothschild, Miss M. A. Sewell, and Mr. C. J. Temple-Lynes.

This seems a fitting place to refer to the death of Mr. B. K. Hunter at Easter of this year. Ten or eleven years ago he was a regular member of our parties on the Point, and there was no one who entered more enthusiastically or usefully into the pioneer work which then occupied us. Thus it was Hunter who dug the first well yielding fresh water, a well constantly in use till replaced by one of improved type. He was clever with his hands and his fertile mind always found them occupation for odd moments and wet days. Often it was some want he had discovered, and this he proceeded to fill before the rest of us had discovered its existence. In 1913 Mr. Hunter's health broke down and he was obliged to abandon his courses at University College. Enforced rest in the country brought a measure of recovery, so that although he could not return to London he was able to take a Mastership at Oldfeld School, Swanage, where outdoor duties fell to his lot, and eventually the management of the school farm. Hunter was a man of charming personality and high ideals. He never spared himself but always gave of his best. At Oldfeld his magnetic influence had a marked effect on the boys and girls under him, as I was repeatedly able to observe when camping with Hunter on the shores of Poole Harbour with a squad from the school. As a memorial to this lovable man a bookcase and small scientific library is being established at Oldfeld by former pupils, with contributions from a number of his old Blakeney contemporaries.

Last year we had to deplore the loss of the Rev. E. J. Bishop, Rector of Cley, who had served on the Committee from the beginning. He was a most valuable member of this body, where his opinion always carried weight. To a very full knowledge of local conditions was added a gift of frank utterance combined with shrewd common sense. He attended the meetings with regularity and will be greatly missed.

At the moment of closing this report the sad news of the death of the Hon. N. Charles Rothschild reaches us. Though the fact may never have been stated publicly it is an open secret that Mr. Rothschild was the principal donor of Blakeney Point to the Trust. Maritime lands attracted him on account of their insect fauna, and on several occasions he sent larvæ of insects to the Point in the hope of their becoming naturalised. He also followed with interest the investigations done there, and himself assisted in the identification of the insect collections. To many it may appear singular that Mr. Rothschild should have done all this and yet should never have visited the locality. He used to say he "hadn't time," but I always wondered whether the real explanation might not be that having acquired the habit of making transactions on the best information available, when the matter was completed he was content to leave it at that. At the time when Blakeney Point came on the market and his support and assistance had been secured, Mr. Rothschild simply said, "Go ahead, I'll see the thing through." Quite without financial experience or capacity, I was, in negotiating with the seller, inspired by the trust thus reposed to grapple as best I could with the problem of reducing the comparatively large sum originally asked to the comparatively small one at which the property eventually changed hands. Mr. Rothschild was an ardent supporter of the movement for "Nature Reserves" and, indeed, founded a society to promote this object. In the field of Entomology he was an acknowledged authority.

SUMMER TIME

Whilst the world outside the precincts of Blakeney Point is in the throes of controversy, let me record our practice in this matter. It will be understood that our dependence on the tides in all relations with the main land has habituated us to constant flux in the time relation. Each day has its co-efficient or factor to relate us to milking-time, railway-time, and the comings and goings of the postman at Morston. The tide is the cardinal thing and those who sojourn on the Point quickly adapt themselves to it.

In summer time we have dabbled for years. Sometimes we adopt it as promulgated, at other times we add a further

half or full hour of super-summer time. This year, when summer time ran out early, with universal consent it was prolonged on the Point up to October, without any serious strain to our capacity of adaptation.

Nevertheless there are occasional lapses, one of which may be related here—the victim being a lady well known in the ornithological world. This lady happened to be staying on the Point in the latter half of September, and, like ourselves, adopted summer time after its official close on the main land. Having to go ashore for three days she naturally put back her watch an hour to conform. On returning to the Point she again altered her watch to be in line with our local usage, but inadvertently *put it back* once more instead of forward. Nemesis sometimes comes with swift strides, and the intelligent reader will perhaps anticipate what would happen. When next morning the O.L.B.H. bell clanged forth the reveille as usual at 7 a.m., the hour marked by the lady's watch was only 5, and naturally, she expostulated vehemently with him who rings the bell for such an apparently unbridled indulgence in an orgy of I don't know how many hours of unauthorised super-summer time!

IX

WILD BIRD PROTECTION IN NORFOLK IN 1923

REPORT OF THE COMMITTEE

The year 1923 will ever remain memorable in the ornithological annals of the county by reason of the addition of Scolt Head to our other bird sanctuaries. This island is a most important nesting area and will doubtless afford opportunities for valuable migration observations in years to come. Hitherto, it has been entirely neglected from this standpoint, owing to the difficulty of access and to the absence of any sort of shelter; but a well-found hut is now in course of erection, which will give sleeping accommodation to at least four people.

The Committee felt it imperative to provide a watcher and, as stated elsewhere, Mr. T. Loose was appointed to look after the birds during the breeding season. This has, however,

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Photo

YOUNG BITTERN IN ANGER. PHOTOGRAPHED IN NORFOLK, 1923

E. I. Turner

considerably increased its financial liabilities, for which reason it urges extended support to the Wild Birds Protection Fund. During the past season it has supplied six paid watchers to different parts of the coast line of the county, and it has good reasons for congratulating its supporters on the efficient and conscientious manner in which these men have carried out their, often difficult, duties. A list of subscribers to the fund, with a financial statement, is appended to this report.

BREYDON

The Society's watcher, George Jary, was on duty on the house-boat in the middle of this estuary from March 4th to August 18th. The following entry, taken at random from his note-book, is an indication of the number and variety of waders which pass through these extensive feeding grounds during the period of migration, though it must be remembered that from no single observation point can all the birds on the area be seen at one time. "May 17, 1923.—About 2000 Dunlin and Ringed Plover, fifty Knot, thirty Whimbrel, fourteen Godwits, four Turnstones, and four Cormorants here to-night. Wind N.E., fresh."

As an indication of the very short period of the year in which no migration is taking place, it may be noted that the last Whimbrel was seen on Breydon on June 2nd, but by July 13th the return migration had already started, and by July 25th there were "several Whimbrel" recorded by the watcher.

Breydon is not a nesting area, though it is satisfactory to report that a few pairs of Sheld-ducks breed in the locality. On June 3rd three broods of young ones were seen on the estuary. Contrary to the experience of past years no Spoon-bills visited Breydon during the summer of 1923.

HORSEY

Owing to the alterations in the contour of the dunes and to the fact that the birds so often lay their eggs on the shingle within reach of the high tides, this small colony of Little Terns was further reduced this year and not more than from ten to twenty pairs nested on the area. On August 12th we counted eighteen old birds bringing fish to their young, which were mostly hiding in the dunes. The part-time services of a watcher were secured for looking after the nests.

SALTHOUSE AND CLEY

The Committee appointed Mr. Edward Ramm, of Cley, as Watcher for Salthouse Broad during the past nesting season: he was on duty from May 1st to August 4th. The Cley marshes are protected by the owner, Mr. A. W. Cozens-Hardy of Cley Hall. The most noteworthy feature in connection with these two breeding areas was the great increase in the number of the Sandwich Terns' nests this year. It will be remembered that last year, for the first time, a colony of these birds nested on one of the islands on Salthouse Broad; in all, ninety nests were found. During the past season the watcher counted 303 nests, containing 391 eggs, of this species on the large island. In addition there were about 150 nests of the Common Tern on the island, and from 100 to 150 nests of the Black-headed Gull. On what may be called the small island there were originally twenty-two nests of the Sandwich Tern, which, however, were all deserted during the very cold weather in May. Some of these birds laid again. On the surrounding smaller islands the watcher counted ninety-five nests of the Common Tern. During May the weather was so cold and wet that many of the Terns forsook their eggs and, in addition, many were sucked by immature Herring Gulls and by Rooks. The watcher estimated that he lost 121 Sandwich Terns' eggs from these causes. On the shingle bank there were about fifty nests of the Little Tern, nearly all of which were robbed of their first clutches by rooks. Most of these birds laid again, the second clutches consisting of two eggs only.

We are indebted to Mr. Cozens-Hardy for the following information about the birds nesting on the Cley marshes; in a letter dated July 16th he says:—"My man counted 180 nests of the Sandwich Tern, in twenty-six of which there were two eggs. There were only eight rotten eggs, and he has counted just over 200 young birds, so they hatched well. We had, roughly, 140-odd nests on an island fifteen yards by five, at the outside; and there were also about twenty nests of the Common Tern on it. On a small island close by there were forty-odd nests, where there were also some Common Terns' and Black-headed Gulls' nests. The Terns have killed the young Gulls." Common Terns were nesting "all

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Photo

E. L. Turner

ROBERT JAMES PINCHEN—WATCHER ON BLAKENEY POINT SINCE 1901



Photo

R. Gaze

GREY WAGTAIL (MALE) ON NEST, AT TAVERHAM MILL, 1923

over the place" on the Cley marshes, and Mr. Cozens-Hardy says "we think we can, without exaggeration, say there were quite 100 nests." In spite of almost continuous watching on the part of the keeper some thirty Sandwich Terns' eggs were stolen one night, though it is satisfactory to record that in many cases these robbed birds laid again.

During the course of the season several rare visitors were noted. For example, when on the Broad during the last week in June, Mr. T. A. Coward says (*in litt*): "We had great luck at Cley, for we saw there a Ruff and two Reeves, an immature Little Gull, and a Little Stint in breeding dress." Black Terns in one's, two's, or three's were seen on the marshes, on and off, throughout the summer and on July 1st, in addition to seeing one of these birds hawking flies from the surface of the water, the writer had the pleasure of watching a Spoonbill for a couple of hours. Ramm had seen it come in over the sea on the previous evening. Mr. Cozens-Hardy has no knowledge of Black Terns having nested on the Cley marshes. Although several pairs of Reed-Warblers still nest in the reeds bordering these marshes, it is some years now since Bearded Tits nested in this locality.

BLAKENEY POINT

This Reserve of the National Trust is perhaps the most important nesting area on the Norfolk coast-line and, with a watcher resident all-the-year round, in the person of Mr. R. J. Pinchen, and by reason of its inaccessibility, the birds suffer the minimum of disturbance from outside agencies. There seems to be little doubt that Terns and other shore-nesting birds will become so accustomed to the periodical visits of one particular man that his presence causes them but little anxiety. Certainly such would seem to be the relationship existing between the birds and their watcher on the Point; and in the case of a pair of Oyster-catchers which have nested on the area for several successive years there has undoubtedly arisen a feeling of mutual confidence between the two. It is perfectly obvious that these birds are entirely familiar with the appearance and voice of their guardian, and only formally resent his intrusion upon their nesting area. These remarks do not apply to strangers, and especially not to bright-coloured dresses and to parasols.

During the past season five pairs of Oyster-catchers nested on Blakeney Point, two of the nests being on the Hood. One nest contained six eggs, three had four and the other had only two eggs. All these hatched off. More than the usual number of Redshanks nested here this year, the nests being found generally distributed over the sandhills. The nests of the Ringed Plover were wide spread over the whole area and second (and third) clutches were laid.

COMMON TERNS.—There was no diminution in the number of these birds nesting on the Point this year, but rather there seemed to be a slight increase of birds in the top colony, that in the neighbourhood of Long Low and the Beach-way. The numerical strength of the two colonies, that is reckoning all but the Little Terns, cannot have been less than 2000 pairs of birds. Nests were not destroyed by high tides and the birds hatched off well.

LITTLE TERNS.—On the south side of Long Low there is one colony of about fifty pairs, and another colony of about the same strength between the end of the sand-hills and the Far Point.

SANDWICH TERNS.—Although Sandwich Terns have been observed at Blakeney as occasional visitors for many years past, it was not until 1921 that a nest was found. In that year Pinchen found two nests, and last year, as will be remembered, nine nests were recorded. In 1923 there were just over 100 nests. There were only fourteen nests, each with a single egg, in the top colony, and none of these hatched off, though the old birds continued to sit long after the period of incubation. The remaining nests were on the Far Point, and practically all the eggs were laid at the bases of the embryo dunes which are now becoming so conspicuous on this area. Except for a slight depression no attempt at a nest is made, so that the eggs easily get hidden by the blowing sand. It is one of the duties of the watcher daily to inspect these eggs and to keep them uncovered.

During the cold weather of the latter half of May and early June many of the eggs were found to have had a small hole pecked in them, but otherwise uninjured—not sucked. The same thing was noticed by the watchers on Salthouse Broad

and on Scolt Head Island. It seems probable that these holes were pecked by the birds on the adjacent nests, perhaps from irritability. At any rate, when the improvement in the weather permitted uninterrupted incubation the trouble ceased.

ARCTIC TERNS.—There is no doubt that there were several pairs of these birds in the colony this year, and in the opinion of Mr. T. A. Coward, who stayed on the Point for several days in June, there were at least ten pairs. The watcher thinks he identified four nests, and the writer another.

ROSEATE TERNS.—We have the confirmatory evidence of several independent observers that Roseate Terns were present in the Blakeney Colony this season, but amidst such a numerous collection of birds it was impossible to estimate their number. Whether or not the species nested was never decided.

WELLS

As stated in our report last year, Terns have practically ceased nesting on this ground, and during the current year the watcher (Cringle, one of Lord Leicester's keepers) found only a dozen nests. Some sixty to seventy pairs of Black-headed Gulls continue to nest on the salt marshes and many Redshanks nest in the sand hills. Four or five pairs of Oystercatchers also nested here.

SCOLT HEAD

With the acquisition of this area as another Nature Reserve for the county the most important nesting places on the coast-line of Norfolk are now secured for all time. Scolt Head Island embraces about 1200 acres of dunes and saltings, and affords ideal nesting sites for Terns, Sheld-ducks, and other shore-nesting species. Although birds have resorted to the island for nesting purposes for many years, not until this year have their eggs received any sort of protection, but have been ruthlessly robbed. The Committee has now taken over the responsibility for the protection of the island and employed Mr. T. Loose, of Overy Staithe, as their watcher from May 1st to August 4th. By next season it is expected that the watcher's hut will be completed and ready for occupation.

As the result of several visits during the past season it is obvious that the island is already a stronghold as a breeding

area for Terns and Sheld-ducks and, with protection, there would seem to be no reason why the Tern colony should not increase.

From our own observations and from the records kept by the watcher the following would seem to be a summary of the birds' doings during the season of 1923.

Fifty-nine nests of the Sandwich Tern were found, of which three only had two eggs. Some of these eggs never hatched off, but on July 8th the writer counted fifteen young birds, so that probably there were nearly double this number on the ground. Here, as on Blakeney Point, the Sandwich Terns nested on the most westerly end of the island: the eggs were laid on the bare sand and usually under shelter of young dunes. In one place there were ten nests within a radius of about three feet.

The Common Terns nested over a wider area, many nests being placed in the low dunes between Scolt Head and the New Point; the remainder were on the Point. About the middle of June the watcher counted 108 nests with eggs, which number, by July 8th, had undoubtedly increased, and there were then probably not less than 200 pairs of birds breeding, though many had already hatched off.

The writer paid a visit to the island with Professor Oliver on August 6th, when young Terns (Common and Sandwich) were running about all over the nesting area, and a few nests of the Common Tern, with eggs just hatching, were found.

Nests of the Little Tern and Ringed Plover were found scattered over the shingle beaches.

Four pairs of Oyster-catchers nested on the island, and the watcher found nine Sheld-ducks' nests in the dunes; doubtless there were others. A few Redshanks nested on the saltings but their eggs were washed out by a high tide. Two Mallards' nests were found.

On the shingle beach to the west of Brancaster Harbour there was a nesting colony of about twelve to twenty pairs of Little Terns, where also a few pairs of Ringed Plover nest.

Common Scoters in large flocks were seen off the island throughout the summer.

During some high winds in the middle of June sand was blown from the top of Scolt Head to a depth of one foot, as measured on the Flagstaff.

WOLFERTON

On July 12th, a day of extreme heat, the writer visited this ternery, where he was met on the ground by Dr. Plowright, of Lynn, and by keeper Bland, who is employed by the Committee as one of the watchers. The nesting area has gradually become contracted by the erection of huts and bungalows between Heacham and the King's boundary fence. The result is that this ternery is a diminishing colony, though the nests are more concentrated than formerly. Sixty nests were found this year, these being about equally divided between Common and Little Terns. There were a few of the latter in the air at the time of our visit and we found one newly-hatched chick. Six nests were destroyed by cattle, but the remainder would seem to have hatched off. Dr. Plowright had seen one Arctic Tern, which he had watched on to its nest. A few Ringed Plovers and Lapwing nest on the area.

There is always a small flock of Oyster-catchers (? barren birds) on the mud-flats here throughout the summer, and on the day of our visit the writer counted eighty of these birds. There was also a large flock of Dunlins, all of which appeared to be in nuptial dress. About fifty (or more) pairs of Shelducks nest on the high ground about Sandringham.

GENERAL

In addition to the work of protection undertaken by the Society, we are pleased to note that there is an increasing number of land-owners and others in the county who are assisting the Committee to protect the rarer nesting birds and to give hospitality to those rare visitors that pass through. A large area of the Broads district is fortunately in the hands of such sympathetic owners, and the nesting records from this part of the county are very satisfactory. On the Hickling-Horsey area ten male Bitterns were heard booming during this season, the last on July 18th—a very late date. Mr. Cator reports two pairs on his Woodbastwick and Ranworth estates, but he purposely did not look for the nests. One pair, at least, nested at Martham. At Sutton there were either three or four pairs,

and others were heard at Catfield. A Garganey's nest was found at Hickling, and there were several pairs of Shovellers nesting in this district. Captain Lloyd reports a nest of the Short-eared Owl at Martham. A Kestrel's nest was found on the bank of the river (Kendal Dyke), but was forsaken. We have records of six nests of the Montagu Harrier in the Broads district in 1923, and a pair of Marsh-Harriers were seen on the Woodbastwick estate as late as May 19th, but there is no evidence that they stayed to breed. A pair of Stone-Curlews nested again at Winterton this year. Miss Turner reports from Hickling that Bearded Tits nested well this year and that Reed-Warblers were abnormally numerous, singing up to July 19th. Also that there were six or seven pairs of Grasshopper Warblers in the district. She knew of only five nests of the Yellow Wagtail.

A WOODLAND BIRD SANCTUARY

As an example of the way in which birds may be encouraged to nest in an area under judicious protection, with the provision of suitable nesting sites and building material, we will record what Mr. N. Tracy, of King's Lynn, has been able to accomplish at North Wootton, near Lynn.

In 1921 Mr. Tracy bought six and a-half acres of woodland bordering on the main road between Lynn and Hunstanton, in which he made a clearing and built himself a bungalow. The wood consists principally of oak, birch, and Scotch pine trees, and heather grows freely. With the object of making this a small bird sanctuary he put up nesting-boxes, attached pieces of bark at an angle to the trunks of trees, planted a few shrubs, and was careful not to fell dead timber. He supplied nesting material in the shape of feathers and other suitable linings. The writer has several times visited this sanctuary, and when there on July 19th of this year Mr. Tracy showed him many of his nests. The Tits and Redstarts were the chief occupants of the nesting-boxes, while the Tree-creepers showed a partiality for the bark lean-to's. In one of the latter a Wren, a Redstart, and a Tree-creeper each had its nest, and all three at the same time. There are some boggy places in the wood which supply water for the birds.

The following is the list of nests found by Mr. Tracy in his sanctuary during this season :—

	Nests		Nests
Mistle-Thrush	12	Wood Pigeon	6
Song Thrush	4	Wren	5
Blackbird	3	Hedge Sparrow	2
Goldcrest	2	Robin	3
Tree-Creeper	5	Jay	1
Blue-Tit	1	Pheasant	5
Coal-Tit	3	Redstart	3
Great Tit	7	Willow-Wren	6
Chaffinch	20	Spotted Flycatcher	8
Stock Dove	1	Lesser Redpoll	1
Great Spotted Woodpecker	1	Total	92

Just over the boundary two pairs of Wood-Wrens have nested this year (the writer saw one nest from which the young had quite recently been hatched) and one pair of Long-eared Owls. Also, within about 200 yards of his sanctuary Cross-bills have nested for several years past, though no nest was found this year. Mr. Tracy says he has known the wood intimately for fifteen years, and a few years ago he thinks one would not have found more than a dozen nests in the whole area. His chief enemies are Jays, and the number of these has to be kept down. He further says, "You will notice that I am very short of Warblers, but I hope by planting more shrubs to get the White-throats, Garden Warbler, etc."

NORFOLK GULLERIES

NORFOLK GULLERIES.—At Scoulton Mere the gulls returned on March 19th, which is within one day of the date of their return last year. The first clutches of eggs are taken by the owner, after which no one is allowed on to the Heath; for years this has been the practice. It is quite impossible to estimate with even an approximation to accuracy the number of birds nesting on this beautiful historic spot; at the same time the number would seem to be increasing. Last year, as reported by us, a new gullery sprang into existence on Mr. E. S. Montagu's estate at Breccles, only a few miles away; and these birds are probably an off-shoot from the Scoulton

colony. This new gullery is difficult of approach and is situated on an area of fenland surrounded by dry heathland. We visited it on May 21st, when there appeared to be from 500 to 1000 pairs of birds nesting.

The small colony, of 100 to 150 pairs, continue to nest on Black Horse Broad, at Hoveton, and this is now the only Broad on which Gulls are nesting.

The above, with the inclusion of the Wells Gullery, completes the list in Norfolk at the present time.

A HYBRID GOOSE.—The large flocks of wild—mostly Pink-footed—Geese which annually winter on the Holkham and Burnham marshes are well known; and although these birds feed on the reclaimed marshes just outside the park wall they never go on to the lake in the park, where there are a considerable number of Canadian Geese. However, during the past two winters a Grey Lag-Goose has remained behind and has associated with the Canada Geese on the lake. During the spring of 1923 this bird mated with one of the Canada Geese and, as a result, five young were hatched. As the Grey Lag was commonly seen escorting the young goslings on the lake, it is concluded that she is the mother of the brood.

GREY WAGTAIL NESTING IN NORFOLK.—In Vol. 11, p. 216, of the Society's Transactions, Mrs. Smith records the nesting of a pair of Grey Wagtails on the River Waveney, but no eggs were laid. On May 10th, 1923, in the ruins of the old paper mill on the River Wensum, at Taverham, Captain L. Lloyd showed one of us (S.H.L.) the nest, containing four young and one addled egg of a pair of these birds. The nest, made of dry grass, was placed in a niche in the stonework of the ruins of the mill, and from the cover of an adjacent wood one was able to watch the old birds bringing insects to their young. After rearing their first brood the birds made a second nest near to the first, and on May 27th the hen bird was sitting on four eggs and hatched off a second time. We are not aware of any previous authenticated record of this species having nested in the county.

Signed (on behalf of the Norfolk W.B.P. Committee),

SYDNEY H. LONG, Hon. Sec.

LIST OF SUBSCRIPTIONS AND DONATIONS TO THE NORFOLK WILD BIRDS' PROTECTION FUND

FOR THE YEAR 1923

	£	s.	d.
H.M. THE KING ...	3	3	0
H.R.H. THE PRINCE OF WALES, K.G. ...	2	2	0
Andrews W. H. M. ...	1	0	0
Baker E. Stuart ...	5	0	0
Barclay F. H. ...	0	10	0
Barclay H. G. ...	2	2	0
Barrett-Lennard Sir T., Bart. ...	1	1	0
Barton S. J., M.D. ...	1	0	0
Bell R. C. ...	0	10	0
Bett S. H. I. ...	3	3	0
Bidwell E. ...	0	10	0
Collecting Box on Blake-ney Point, per R. J. Pinchen ...	2	16	6
Bird Rev. M. C. H. ...	1	1	0
Boardman E. T. ...	0	10	0
Boileau Lady ...	1	1	0
Boileau Sir M., Bart. ...	1	1	0
Bond C. E. ...	0	10	0
Brash T. ...	2	2	0
Brittain H. ...	0	10	6
Brooks J. R. ...	1	0	0
Buckle Col. ...	1	1	0
Burton S. H., F.R.C.S. ...	2	2	0
Buxton E. G. ...	2	2	0
Buxton G. F. ...	3	3	0
Byers J. ...	1	0	0
Candler C. ...	0	10	6
Chapman E. H. ...	2	2	0
Christie J. A. ...	1	1	0
Coe Mrs. A. E. ...	0	10	0
Coller G. A. ...	1	1	0
Colman Miss ...	1	1	0
Colman Miss H. C. ...	1	1	0
Colman R. J. ...	1	1	0
Cooke A., F.R.C.S. ...	0	10	0
Cozens-Hardy A. ...	1	1	0
Cremer W. ...	0	10	6
Cresswell Col. G., C.V.O. ...	2	2	0
Davey Guy ...	0	10	0
Deacon G. E. ...	1	1	0
Dew Mrs. Walter ...	0	10	6
Doughty C. G. ...	1	1	0
Ferrier Miss J. M. ...	0	10	0
Fleming Miss R. ...	1	1	0
Gossage Mr. and Mrs ...	2	2	0
Gurdon E. T. ...	1	1	0
Gurney Robert ...	1	1	0
Ditto (proceeds of lecture at King's Lynn) ...	1	1	0
Gurney Walter S. ...	1	1	0
Gurney Sir E. ...	1	1	0
Gurney G. H. ...	1	1	0
Gurney Q. E. ...	1	1	0
Gurney Mrs. Richard ...	0	10	0

Carried Forward ... 66 13 6

	£	s.	d.
Brought Forward	66	13	6
Halls H. H. ...	1	0	0
Harding J. R. ...	0	5	0
Hare Sir R., Bart. ...	1	0	0
Harker W. ...	1	1	0
Haydon W. ...	0	2	6
Horsfall R. E. ...	0	10	0
Hunter Miss B. ...	0	10	0
Jones Sir L., Bart. ...	1	1	0
Kinder Rev. E. H. ...	1	1	0
Knight E. ...	0	10	0
Knowles R. M. ...	0	10	0
Larking C. ...	1	1	0
Lee-Elliott Rev. D. L. ...	1	1	0
Long S. H., M.D. ...	2	2	0
Mack H. P. ...	2	2	0
McKenna Mrs. Reginald ...	1	1	0
Macpherson A. Holte ...	1	1	0
Meade-Waldo E. G. B. ...	1	1	0
Meadows Mrs. A. H. ...	0	10	6
Moxey J. E. ...	1	0	0
Murton Mrs. ...	1	0	0
Norwich High School for Girls, The ...	1	5	2
Oliver Prof. F. W., F.R.S. ...	2	2	0
Pain Percy ...	0	11	0
Patteson Mrs. F. E. ...	1	1	0
Pelham Rev. Canon S. ...	2	2	0
Plowright Dr. T. C. McL ...	1	1	0
Pond H. J. ...	0	10	6
Preston Sir E., Bart. ...	1	1	0
Purdy Col. T. W. ...	1	0	0
Ransome Mrs. ...	1	1	0
Richmond H. W., F.R.S ...	1	1	0
Riviere B. B., F.R.C.S. ...	2	2	0
Rogers Rev. H. ...	1	0	0
Rothschild the Hon. N.C. ...	10	0	0
Runton Hill School (per Miss Vernon Harcourt) ...	2	2	0
Smith Col. H. F. ...	1	1	0
Soman A. E. ...	1	1	0
Spalding G. ...	0	10	0
Stimpson E. ...	0	10	0
Strachan C. E. ...	1	1	0
Taylor Dr. Mark ...	1	1	0
Thouless H. J. ...	0	10	0
Ticehurst Dr. C. B. ...	1	1	0
Upcher H. E. S. ...	1	0	0
Walter Cyril ...	1	1	0
Walter J. H. ...	1	1	0
Washington Rev. Canon M. ...	1	1	0
Willet W. L. ...	0	5	0
Winch Maj. S. B. ...	2	2	0
Wright T. J. ...	0	10	6
Wyllys H. J. M. ...	0	10	0
Wyllys W. E. ...	0	10	0

£128 19 8

X

A SEA-ANEMONE (*SAGARTIA LUCIÆ* VERRILL)
IN BRACKISH WATER IN NORFOLK

BY ROBERT GURNEY, M.A., F.L.S., F.Z.S.

DURING the summer of 1921, when collecting Entomostraca in the brackish pools at Salthouse, I found a small Sea-Anemone to be very common on the pebbles in the pond on the east side of the Rocket House, but was unable to discover any reference in the ordinary text-books to any species living under such conditions. In 1922 this pool had been almost filled by a huge fan of shingle driven in by the high tides of the winter of 1921-22, and the Anemone had disappeared; but it was found in abundance in the larger pool west of the Rocket House, and specimens were sent to the Natural History Museum in London for identification. These specimens were named provisionally by Mr. A. K. Totton as *Sagartia luciæ*, and the identification was confirmed later by Mr. T. A. Stephenson. I am much indebted to these gentlemen for the trouble taken by them, and regret that Mr. Stephenson has found himself unable to write an account of this interesting species for our Transactions. The following notes embody such information as I have been able to gather.

Sagartia luciæ is a species of rather exceptional interest by reason of its distribution. It was first discovered at New Haven (Conn.) in 1892, and described by Verrill in 1898. Verrill had been acquainted with the fauna of the district for many years, and there can be little doubt that the species had been recently introduced, possibly, as he himself suggested, with oysters which are brought from the south and planted in Long Island Sound.

In 1895 it appeared at Newport, eighty-five miles to the east, and in 1898 at Woods' Hole some thirty-four miles further east. In 1899 it was observed at Nahant, on the coast of Massachusetts, and became later very abundant in tidal pools. In 1901 it was taken at Salem Neck, north of Nahant.*

* See G. H. Parker. Notes on the dispersal of *Sagartia luciæ* Verrill. American Naturalist, XXXVI. 1902. p. 491.

In all these cases the date of its first discovery may be taken as coinciding approximately with its first appearance, since the localities in question had been under observation for some years previously. No doubt the Anemone has by now greatly extended its range in the United States, but I am not acquainted with any further literature on the subject.

In 1898 it was found in Millbay Docks at Plymouth,† whither it had no doubt been brought on a ship's bottom.

I am indebted to Dr. E. J. Allen for the information that *S. luciae* has now been recorded not only from Millbay Docks, but also from the Promenade Pier, Plymouth, the Cattewater and Chelson meadows. Quite recently large numbers were found on the bottom of a gunboat moored at the mouth of the Lynher river. At Chelson meadows the specimens are small, but have been taken several hundred yards up a ditch from the river.

Dr. J. H. Orton tells me that he found this species at the mouth of the Blackwater River (Essex) in December, 1920.

In 1913, Dr. Van Der Sleen found a few specimens on *Fucus* at Helder, in Holland, where it has, as he informs me, since become common. Finally it was taken, in 1920, at the Zoological Station at Büsum, on the west coast of Holstein.*

Here we have a species of which the original home is, I believe, still unknown, not only establishing itself on the coast of the United States but, within a few years' time, also reaching Europe.

In Norfolk I have found a few specimens on *Ulva* in Wells Harbour, and it is possible it may have been introduced there also by ships; but how it can have got into the Salthouse ponds is something of a mystery.

This Anemone is barely a centimetre long when fully extended. When contracted it is of a dark olive-green colour with a variable number of orange vertical stripes, but when expanded the colour becomes much paler and the stripes scarcely visible. The tentacles and the distal part round the

† Walton. Journ. M.B.A., VIII. 1908.

* F. Pax. Zool. Anz., LI. 1920. p. 161.

mouth are quite colourless and translucent. The orange stripes vary in number from none to twenty, and have been made the subject of statistical study by Davenport, who gives twelve as the most frequent number.

The animal is said to be very tolerant of changes of temperature and salinity, and it can easily be kept alive for long periods in an aquarium. It readily leaves the stones on which it is found and moves up the glass sides of the aquarium. I have frequently seen it floating attached to the surface film of the water.

The situation in which the Anemone occurs at Salthouse is peculiar. Until recent years there existed on the landward and also in some places on the seaward side of the bank enclosing the Salthouse marshes, a series of rather deep, narrow ponds full of brackish water and having no direct communication with the sea. The whole of the reclaimed marshes are now flooded and the ponds are not separately distinguishable, but, so far as I know, the *Sagartia* occurs only on the shingle in the deeper water where these ponds once existed. The water here is brackish, but the salinity probably varies largely according to the season. On Aug. 31, 1922, the salinity was 14.56 grm. Cl. per litre (1019.2 grs. per gallon). The fauna is that of brackish water, the most important species being:—*Palæmonetes varians*, *Neomysis vulgaris*, *Idotea viridis*, *Corophium volutator*, and the Copepods *Nitocra spinifera* and *N. typica*. In places there is abundance of an encrusting Polyzoan, *Membranipora monostachys* Busk, and of *Cordylophora lacustris*.

It is impossible to say how long *Sagartia lucia* has been established in the Salthouse ponds, but, to judge from its present abundance, it must have been introduced there some years ago. The ponds themselves, I believe, date back to the time, some sixty years ago, when the banks reclaiming the Salthouse marshes were breached by a tremendous tide. On Nov. 29, 1897, there was another exceptionally high tide, which overtopped the banks and flooded the marshes, and it seems quite probable that it was this flood which brought

in this Sea-Anemone. I do not know of any similar tide since that date until that of the winter of 1921-22, when the bank enclosing the Cley marshes was also breached. If this supposition is correct, *Sagartia luciæ* must have arrived in Norfolk at about the same time as it was introduced to Millbay Docks at Plymouth.

XI

GREAT YARMOUTH AUTUMN HERRING FISHERY

1922

BY HARRY H. JAY

THE past Herring Fishery concluded during the month of December, and whilst proving not such a failure as that of 1921, the quantity of fish landed was far below that of any season (with the exception of those during the war) of this decade. Thus, although the catcher cleared his outlay and obtained profit, yet a very considerable volume of trade was lost—with the consequent diminished earnings of shore-workers engaged in all sections of this vast industry.

The season opened with a very disquieting and depressing outlook.

Following upon the disastrous 1921 season, the northern fishings had not proved so satisfactory as was anticipated, notwithstanding the fact that the Shetland voyage was undoubtedly better than usual; whilst the fluctuation in foreign currencies was so erratic as to render any trade negotiations impossible. Such was the position, that curers could not make definite arrangements for their opening at the East Coast until the herring had actually arrived; whilst boat-owners remained dubious as to their own action until the curing section had shewn their inclination to proceed with the venture.

Thus towards the end of September Yarmouth was without its usual cargoes of fishery stock and salt, the pickling plots remained without tenants, whilst the appearance of the whole port led one to believe that the Autumn Fishery had been abandoned.

Several Scottish vessels abandoned the herring fishery upon arriving at Grimsby and returned to their home ports to engage in seining. This state of uncertainty continued until the last week of September, when the approach of herring gave rise to a certain activity in the fresh herring export trade. But this activity proved short-lived since the exchange rates proved too fluctuating to be conducive to successful business.

October's fishing proved very successful, the landings far exceeded those of the previous October, whilst, although the fish were extremely small, their quality was superior to those of 1921 season. Values did not prove very remunerative and on many occasions only a few shillings per cran could be obtained. On such days the "overday" fish had to be disposed of for manure. The October fish were not well suited for curing for export as "red" herring; neither could the kipperers handle them—preferring to obtain their supplies from the West Coast ports, where trawling for herrings was being carried on. To those outside the trade it hardly seems feasible for merchants to import herrings whilst hundreds of tons of fish were being landed daily at the wharves.

The weather remained fine until the last week of October, and then a series of gales rendered operations difficult and landings became light, with a consequent increased demand and higher prices. Bad weather continued with a few intermittent fine spells, but such were of little value. Numbers of vessels experienced loss of gear, and towards the end of November a large proportion of the Scottish fleet returned home, since weather conditions had resulted in the vessels losing contact with the shoals. The depletion of the landings had the effect of causing Continental merchants to buy existing stocks and shipments were made much earlier than was the case during the preceding three years. By the end of November the Scottish fleet had left and curing (pickles) ceased, and the "crews" had entrained for Scotland. Following this exodus the weather moderated, and by diligent search the local fleets established contact with the herring on the Southern Grounds, Hinder, Gabbards, and later, Sandettie, and many a good "shot" was made. In

many instances drifters kept in touch with the shoals to within a few days of Christmas. The majority of these catches were landed at Dutch and Belgian Ports, since to bring such hauls to local ports would have entailed the "blowing away" of too much costly coal.

Thus the last three weeks turned defeat into victory for those vessels that stayed out the fight. Many grossed £2,000; few failed to reach the £1,000 mark, whereas the Scottish vessels abandoning the herring in late November grossed between £400 and £1,200 only.

It is estimated that over 300,000 barrels of herrings were cured for export to Germany, and the Baltic Ports of the New States. Russia made two direct shipments to Petrograd. The Mediterranean trade was exceptionally poor, there being practically no call for the English herrings. The "Freshing" Trade proved very successful, and towards the end of the season the demand from Germany and Holland was far above the normal.

The demand for herrings for home consumption did not amount to the normal.

The following figures shew the comparison of the 1922 season with that of 1921—

	1921	1922
No. of Boats engaged ...	857	874
Fishermen ,, ...	8,500	8,700
Fish workers ,, ...	6,500	6,200
Shore workers ,, ...	2,800	2,720
Barrels (cured herrings) ...	268,000	310,000
No. of crans landed ...	365,150	342,922
Value of catch	£351,971	£320,339

It is to be hoped that our fishermen have seen the last of bad seasons caused entirely through the unsettled conditions prevailing in Europe, and that they may now swing on the turn of the tide to brighter days and prosperity.



XII

SOME NOTES FROM GREAT YARMOUTH,
1920-23

BY ARTHUR H. PATTERSON

BIRD NOTES

My last Bird and Fish-notes appeared in the *Transactions* of 1919-20. A short selection from subsequent entries in my Note-Books, up to date, may not be unwelcome; and of some small interest.

1920

LAPWINGS MIGRATING.—A very large flock of Lapwings came in from over-sea on January 3rd, flying due E. to W. Shortly after, when coming to Norwich, the train passed through acres of these birds. Wet puddles dotted the marshes; and moles were busily throwing up earth—evidently a combined onslaught was being made on worms and “leather-jackets.”

HOODED CROWS.—A large concourse of “Hoodies,” mostly paired birds, mustering on Breydon mudflats, prior to leaving the East Coast for their nesting quarters over sea, March 28th. On June 10th I saw half-a-score of these birds at Winterton, near a woodland, where I have reasons for believing they had stayed to breed.

YOUNG WOODCOCKS.—Towards the end of June, the Rev. J. G. Duberly, of Caister, informed me that two young Woodcocks, about three days old, were found in the potatoes in a field, a short way from a small wood. The nest was not discovered, but the old birds were seen to return to their young.

CURLEWS.—About 250 Curlews on Breydon on Sept. 8th; it would seem that this bird frequents Breydon quite as numerously as ever in my recollection.

GOLDEN-CRESTED WRENS.—On October 6th, Gold-crests were trooping in, and swarming local gardens. Many were killed by town-cats and left dead, owing to the fluffiness of the bird's plumage. On the 10th some boys were seen stoning wing-weary birds.

BLACK-TAILED GODWIT.—A fine male Black-tailed Godwit was shot on Breydon, Dec. 18th.

1921

WAXWINGS.—From Belton I received two young Waxwings, shot on Feb. 2nd. Ten had been seen there on the 30th of January. In November, of this year, they were again about in some plenty. I watched several feeding upon the ripe berries on a tall rose-bush. They were “shockingly tame,” and chirped to my whistling. Two engaged birds fed greedily on raisins, sultanas, and asparagus berries.

ROOKS NESTING.—In the churchyard in the rear of St. Nicholas' Church, on April 2nd, I counted 79 rooks' nests; and in some forlorn elms near the Market-place, 17. For some reason they have been gradually forsaking the latter roost.

WIGEON FEEDING.—On April 2nd, at a very low tide, 100-odd Wigeon walking Breydon flats plucking the *Zostera marina*. They usually feed sitting upon the water.

JACKDAWS AND SWALLOWS.—In May two Jackdaws (nesting with several others in St. Nicholas spire) alighted to rest upon the gilt hands of the clock, which stopped, to the puzzlement of folks below. [In late September of 1923, when a host of Swallows had gathered upon the roof, on migration bent, two perched upon the railway clock at Southtown, with a like result.]

GULLS AND EXPLOSIVES.—In June and July divers were exceedingly busy blowing up sunken wrecks off Yarmouth. After each explosion many broken fishes came to the surface, until the gulls not only ceased to be frightened, but at length, associating these loud reports with an abundance of food, would hasten to the disturbed areas for the sea-anemones, and small whittings that had been killed by the shock and thrown up.

SWIFTS MIGRATING.—During the third week in August large companies of Swifts, moving southwards, crossed along the sand-dunes and beach.

LITTLE OWLS.—These birds are reported to me as becoming a nuisance around Belton, Fritton and Herringfleet. Lord Somerleyton's keeper caught two on Sept. 23rd; one had been regaling on a partridge. I have seen three others. A Belton gardener complains of the noisy “mewing” of this owl at night.

WILD GEESE.—Year by year the Wild Geese (contingents from Holkham?) increase in numbers; and from September-end, until early spring, feed upon marshland grasses near Acle, mostly at night; often by day. Crossing over the town by day and night, their huge skeins of hundreds of noisy birds have become quite a familiar sight. At low water they very frequently rest on Scroby Sands, within sight of Yarmouth.

1922

CUNNING OWLS.—A friend caught two Barn-Owls one day in February, whereupon both drooped their heads, and to all appearances became as dead. Knowing that birds occasionally sham death, he tossed them in the air, when they gathered themselves together and immediately took to wing.

ROOKS AND JACKDAWS.—Very large numbers passing over in March, but, rather curiously, flying N. to S. These were undoubted migrants wearied by adverse winds.

GOLDFINCHES.—Thanks to better protection, and a knowledge of the usefulness of the Goldfinch, these birds are again becoming common. A southward "movement" was observed late in April.

SHELD-DUCKS.—Two or three pairs of Sheld-ducks nested on some rough bracken-land south of Yarmouth this year. I passed a pair, with several young ones, in a half-gale of wind on Breydon on June 25th. [Nests again known in 1923.]

DROWNED MIGRANTS.—In October many remains of Red-wings and other perching birds were washed up by the sea, from Yarmouth to Hemsby—and probably beyond. I sent two or three small boxes of wings and sternums to the late Mr. John Henry Gurney, who, in his last illness, wrote: "You have given me a splendid morning's amusement, but I think the wings are all made out now. . . . I judge her [Miss Ferrier's] specimen to be the Continental *Prunella m. modula* . . . if so, it is the second for Norfolk and the sixth for England."

WHOOPEE SWANS.—Fifty on Breydon, November 28th. Also a Bewick's Swan, which was shot, and made me an excellent dinner. Others seen later.

CORMORANTS.—Cormorants are probably being much persecuted on some coasts. In 1921, several frequented Breydon, and on December 13th, 1922, eleven were seen together.

1923

OWL AND CROW.—An interesting quarrel on a Breydon flat in January, 1923: a Short-eared Owl and a Hooded Crow disputed the possession of a dead wader. There was a great show of ruffled feathers and angry passions, but the Crow was glad to desist, leaving the Owl an evident victor.

WIGEON AND BRENTS.—On February 12th six Brent Geese (a much diminished visitor in late years) on Breydon; and quite 1000 Wigeon on the 14th.

PIED WAGTAILS.—On March 9th over 100 Pied Wagtails had dropped into a garden on the beach front.

WOOD PIGEONS.—A large flock reported to me in the Fleggs, middle of March. Many shot birds in the Market on 17th. Were they migrants?

CUCKOO AND EGG.—A friend at St. Olaves assured me that in his garage a Cuckoo laid an egg in a Wagtail's nest, herself turning out the young ones, which were a few days old. He handled the dead young, as he did also the single egg of the Cuckoo. A rather unusual occurrence?

SWIFTS AND ST. MARK'S FLY.—On the 3rd and 4th May, *Bibio marci* (the St. Mark's Fly) was abundant on those two warm days, near my houseboat at St. Olaves. I have always associated the appearance of these velvety, black flies with that of the Swift. On the 5th, as I expected, the Swifts came.

SANDWICH TERNS.—In the gloaming of August 4th I watched several Sandwich Terns feeding on Breydon. They fly and plunge, I think, more like a small gull than a tern.

BEARDED TITS.—When trespassing on Lord ———'s marshes after mushrooms, one Sunday in September, I was exceedingly pleased to hear the tinkling notes of two or three Bearded Tits, in and around a dense clump of reeds. On this date I also observed that, notwithstanding the flood-tides carry an increasing volume of salt water up the Waveney, a clump of reed-mace was flourishing in an unexpected spot; and on a root of common reed I found three very large acorn-barnacles.

FISH NOTES

1920

SURMULLETS.—An unusual catch of nearly 300 Surmulletts was landed on May 27th by a local trawler. When the Pagets in 1834 wrote their *Sketch of the Natural History of Yarmouth*, these fish were quite a common take with mackerel.

EELS AND ROACH.—Noted thousands of very small Roach in a ditch connected with Fritton Lake. Day after day, in June, a swarm of small Eels were ravenously feeding upon them, heedless of onlookers who passed by frequently.

STURGEON.—A 3 ft. example taken on July 22nd in a wolder's trawl-net, off the coast. By mid-August several Sturgeon had been netted in the North Sea.

1921

VIVIPAROUS BLENNY.—On January 4th an "Eel-pout" was brought to me, recently dead. On dissecting it I discovered 53 young, each $1\frac{1}{4}$ inch long. They were so near parturition that a number lived for two hours in a dish of fresh water; others handled by forceps swam excitedly for a few inches, then turned over and died, with a kick or two.

PIKE AND ROACH.—A $9\frac{3}{4}$ lb. Pike, caught at Fritton in February, was found packed from stomach to mouth with Roach fry. Another dashed at a large shoal, which rose in the air, like a big splash of water, and fell on the ice around the hole.

LAMPREY.—In May two large Lampreys had been caught in an eel-set on Hickling Broad.

EEL-FATALITY.—Owing to the August drought, low tides, and the decay of subaqueous vegetation; and warm, almost tideless streams, polluted by carbonic acid gases, thousands of large Eels died in the rivers, as well as ditches. Down the Waveney to Breydon they floated in an appalling procession, to the joy of the Great Gulls, which flocked to Breydon and gorged themselves with carrion, to rest, like vultures upon every post, awaiting a return of hunger. Since then Eel-catching locally has been an entire failure.

RAY'S BREEM.—A fine *Brama Raii*, twenty-two inches in length, was washed up on December 14th, at Happisburgh.

TUNNY.—At the same period an 8-foot Tunny was stranded at Wells. This species appears to have been noted in some numbers in the North Sea.

1922

BLONDE SKATE.—For the first time I recognised, in January, an example of this rather obscure Ray, hitherto unrecorded for Norfolk. It is the *Raia blonda*, of Holt and Calderwood; and *R. brachyura*, of Lafont.

STRANGE SKATE.—In July I examined an example of *Raia clavata* (Thornback) with two well-defined but useless fin-structures upon its back.

1923

BLACK SEA-BREAM.—Early in January I had brought me a large example of the Black Sea-bream, a rare local species.

PAINTED RAY.—On Feb. 7th a trawler that had been fishing near the *Galloper* lightship brought in an example of *Raia microcellata*. The *Galloper* is in Essex waters, but this appears to be the first of this species recognised for the East Coast, from the Forth to the Thames.

BLACK FISH.—A very nice specimen of the Black-fish (*Centrolophus Pompilus*), washed ashore at Happisburgh on April 10th, was sent to me for identification. Length 17 inches, and is the second recorded for Norfolk. Now in the Tolhouse Museum.

PORBEAGLE SHARKS.—Two or three young (4 ft.) Porbeagles caught off Yarmouth in August. I took from the tail end of one several parasites known as *Dinemoura producta*. These parasites make a very visible bite where they anchor themselves, like the bite of a flea, only the skin turns white around the puncture.

XIII

METEOROLOGICAL NOTES, 1922

(From observations taken at Norwich.)

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

JANUARY

This month opened with two very mild days, on each of which the thermometer rose to 56° . A sudden drop of temperature occurred on the 3rd which was 17° colder than the previous day, and the weather changed from spring to winter at a bound. Very heavy snowstorms, accompanied by thunder on the 4th, occurred upon that and the following day, covering the ground to the depth of 5 ins. and yielding .98 in. of water when melted. On the 9th the thermometer again mounted to 55 deg., but was followed by further wintery weather on the 13th with more snow and sharper frosts. On the 18th the sheltered thermometer fell to 17.2 and that on the surface of the snow to 10 deg. On the 24th the temperature did not exceed 25 deg. throughout the day. There was much fog and rain during the remainder of the month. Mean temperature was 0.4 deg. below the average. The total rainfall was 5.20 ins. and the Norwich records do not disclose so heavy a total for January back to 1865.

FEBRUARY

Torrential rains fell on the 2nd and 3rd, amounting in the aggregate to 1.38 ins., including a fall of snow on the morning of the 4th to a depth of 2 ins. on the level and which remained on the ground for about twelve days. To the 14th the weather was bright but very cold, but the last week of the month was very fine and warm, the thermometer rising above 50 deg. on each day and to 59 deg. on the 24th. Mean temperature of the month was 1.3 deg. above the normal, and the month's rainfall 1.06 ins. above.

MARCH

On March 1st there was a gale from the w.s.w. in the morning and a thunderstorm in the afternoon, which were succeeded by several days of mild weather with rain at intervals. On the 8th there was a hurricane which swept the South Coast of England, the force of which reached 108 miles an hour at Scilly, but although the accompanying barometric pressure fell here to 28.72 ins., there was comparatively little wind in this neighbourhood. From the 20th to the end of the month a depression passing from the south of Iceland to the English Channel brought with it winterly conditions with frost and snow. The mean temperature of the first fortnight was 44.5 deg., that of the last fortnight 37.2 deg. The month's rainfall was slightly in excess of the average.

APRIL

This month was a cold and unkindly one nearly throughout, the only warm days having been Good Friday and the following day (14th and 15th), with maxima of 65.4 deg. and 60 deg. respectively. Temperature failed to reach 50 deg. on as many as 15 days, and frost occurred on 9 nights in the screen and 21 nights on the grass. The mean temperature of the month was the lowest in any April since 1917, and was 3.2 deg. below the normal. Snow fell on the 3rd, 4th, and 5th, and the month's rainfall was about three-quarters of an inch above the average. By the end of the month the countryside presented an almost mid-winter appearance and a great contrast to the forward seasons of the two previous years.

MAY

This was a remarkable month. Entering with some chilly days the temperature on the 7th suddenly rose to 75 deg., and on the 8th to 76.8 deg., to be quickly followed by a change to cold. On the 20th a heat wave of unusual intensity for May, set in, and continued until the end of the month. On the 22nd and 23rd the extremely high shade temperatures of 88.7 deg.

and 88 deg. were registered, beating all previous May records, and on other days the thermometer reached or approached 80 deg. The mean temperature of the last twelve days of the month was 65.1 deg., or $3\frac{1}{2}$ deg. higher than the mean for the month of July. Rainfall was very deficient, the total having been just over half-an-inch. Although rain fell on 12 days, not one day's fall equalled the tenth of an inch. Sunshine was abundant, the total having been 280 hours, only three hours less than the brilliant May of 1919. Thunderstorms occurred on the 22nd, 24th, and 25th, but the accompanying rainfall here was trifling.

JUNE

The heat wave of May continued over the first two days of June, with maxima of 82 deg. and 78 deg., but was followed after a severe thunderstorm on the evening of the 2nd by cooler, though generally dry weather till the 22nd, broken by a fall of .57 ins. of rain on the afternoon of the 13th. The second half of the month was much cooler than the first half, and from the 22nd rain fell daily till the end of the month though the falls were chiefly very light. The number of hours of sunshine during the first half of the month was 142 against 82 hours only in the second half. Thunder occurred on the 2nd, 23rd, 29th, and 30th, but, with the exception of the storm on the 2nd, which was much more severe to the south of the city (1.32 ins. of rain having fallen at Keswick as against .21 ins. here), these storms were generally very slight.

JULY

This month was as remarkable for its rain as May was for its heat. On the 6th the barometer fell to 29.05 ins. (a very exceptional reading for July), and was accompanied by a gale from the south veering to west, more in common with the close of autumn than with the height of summer, and the roads and gardens were strewn with boughs and twigs torn off the trees by the strong gusts. Considerable rains fell in the early days of this month, but the climax was reached on the 14th, on which day no less

than 2.70 ins. (exceeding the average for the whole month), and on the two following days .38 ins. and 1.12 ins. fell respectively, making 4.20 ins. in the three days. On the 21st a heavy thunderstorm added .85 ins. to the total, and by the end of the month the aggregate amounted to no less than 7.33 ins., which is the largest amount recorded here for July, during the last forty years, and constituted the wettest month since the "Flood," August of 1912. Temperature was low throughout the month, the thermometer reaching or exceeding 70 deg. on only four days, and did not once approach 80 deg., whereas in the previous July it exceeded 70 deg. on 27 days, and 80 deg. on 12 days. Sunshine was 73 hours deficient, the total having been 137 hours as against 272 hours in the previous July, and 310 hours in 1911.

AUGUST

August was another disappointing month. While much less rainy than July, the mean temperature was 3 deg. below the normal, and the amount of sunshine 25 hours deficient. The thermometer exceeded 70 deg. on four days only, and there was a great prevalence of cloud. Great darkness occurred on the afternoon of the 25th, causing artificial light to be resorted to. Frequent depressions coming in from the Atlantic caused the weather to be continually unsettled and damp, and but little progress had been made with the harvest by the close of the month.

SEPTEMBER

As in the two previous months, the weather of September was unsettled and cool, with much cloud at times. The thermometer only once touched 70 deg., and the mean temperature was 2 deg. below the average. Following a deep depression, when the barometer fell to 29 ins., there was a heavy gale from the north on the night of the 14th, which did considerable damage on the coast. The total rainfall of the month was rather less in Norwich than in adjacent places, but was about half-an-inch above the normal fall. Harvest operations were much hindered by the cool, damp weather, and the ripening of the fruit crop, which was a fine one, was much retarded by the deficiency of sunshine and want of warmth.

OCTOBER

October was a dry month for the third year in succession. The total rainfall for the month was less than half the average. During the first 18 days only one-fifth of an inch fell, but after the 18th rain fell daily, although the quantities were, for the most part, trifling. On the 27th and 28th there were showers of large hail or granular snow which lay on the ground as in winter. The weather of the month was generally very fine and bright to the 19th, with much sunshine on most days, and although there were no hot days as in the previous October, a very fair average temperature was maintained till the last week, which was quite winterly in character. A remarkable feature of the month was the persistence of easterly and north-easterly winds owing to the prevalence of an anticyclone, which took up its position to the north of these islands and remained stationary for several days.

NOVEMBER

Variations of the barometer were frequent and sudden in the early days of the month, but after the 8th pressure was mainly anticyclonic, and the barometer did not once fall below 30 ins. during the remainder of the month. On the 15th it reached the high level of 30.74 ins. There were heavy rains in the first week amounting to more than an inch, with some snow on the 4th. Subsequently the weather was very dry for the time of year till the 26th, when the overlapping of a Continental depression produced some heavy rains and some snow. There was but little frost, and while there were many dull days and some fogs in the middle of the month, there were several bright and pleasant periods. A noteworthy feature of the month was the almost constant north-westerly direction of the wind.

DECEMBER

The first half of the month was dry, but after the fifteenth day to the end of the month cyclonic storms followed each other in rapid succession. There were some remarkable depressions of the barometer, 28.77 ins. being recorded on the 20th, and

28.57 ins. on the 30th. The month's rain (2.68 ins.) nearly all fell in the second half of the month. There was no snow and but little frost. The thermometer reached 50 deg. on two days only, but on no day failed to reach 40 deg. Mean temperature was 3 deg. above normal, and sunshine in close agreement with the average.

THE SEASONS

Tables of Mean Temperature and Rainfall of the four seasons of 1922, (including December, 1921, but excluding December, 1922) and compared with those of the five previous years and with the average.

TEMPERATURE

Seasons	1917.	1918.	1919.	1920.	1921.	1922.	Average	Departure of 1922 from average.
	degrees	degrees	degrees	degrees	degrees	degrees	degrees	degrees
Winter -	35.4	38.7	38.7	41.2	41.7	40.2	38.4	+ 1.8
Spring -	44.9	47.5	46.9	50.0	49.6	46.9	46.7	+ 0.2
Summer -	62.2	60.0	58.9	58.9	62.1	57.9	60.2	- 2.3
Autumn -	50.0	48.6	46.8	50.2	51.3	48.4	50.1	- 1.7
Year - Jan. to Dec.	48.0	49.4	47.6	50.0	51.5	48.3	48.8	- 0.5

RAINFALL

Seasons	1917.	1918.	1919.	1920.	1921.	1922.	Average	Departure of 1922 from average.
	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.
Winter -	6.55	5.63	10.29	8.12	5.58	9.86	6.21	+ 3.65
Spring -	6.27	5.10	4.98	6.61	4.17	5.32	5.55	- 0.23
Summer -	8.61	6.03	6.15	7.34	2.57	10.54	6.89	+ 3.65
Autumn -	8.03	9.62	7.49	3.76	4.65	6.05	7.83	- 1.78
Year - Jan. to Dec.	27.82	28.88	29.99	24.00	15.71	32.49	26.48	+ 6.01

It was the coldest summer since 1907, the wettest winter since 1919, and the wettest summer since 1912. The other seasons did not show a great departure from the normal, either in temperature or rainfall, the coldness of the early spring being compensated for by the great warmth of May.

THE YEAR

The mean temperature of the year (48.30 deg.) was 0.5 deg. below the normal, and was 3.2 deg. lower than that of the previous year. The only months which gave a mean temperature in excess of the averages was February, May, and December. Each of the other months were below, July as much as 3.6 deg. below, and April and August 3.2 deg. below. There was only one night which could be called exceptionally cold, viz. January 18th, when the thermometer sank to 17.2 ins. in the screen, and to 10 deg. on the surface of the snow. The outburst of heat in the latter part of May was remarkable, some of the days being hotter than ever before known in that month. After June 1, the thermometer did not again reach 80 deg. during the rest of the summer. The torrential rains of July were somewhat local. The summer was a disappointing one after such a torrid start. It seemed almost as if the abnormal heat of May upset the equilibrium of the season. The total of the year's rainfall was more than double that of the previous year, but notwithstanding the heavy rainfall of 1922, shortage of water is still complained of in some districts. If, however, the combined rainfall of the 21 months, October, 1920, to December, 1922, is taken, it will be seen that at Norwich the total for that period was 8.29 ins. deficient, and demonstrates the severity of the drought of the previous year and the reason for the present shortage of water. The year's sunshine approximated the normal. May was the brightest month, with 280 hours of sunshine

The fruit crop was a very fine one, chiefly owing to the ripening of the wood by the heat of the previous summer. Harvest commenced in this neighbourhood about August 17th, and concluded at the end of September.

Mr. J. H. Willis again kindly supplied the sunshine readings.

The writer of these notes would like to remark that 1922 concluded the fortieth year of his observations, which were commenced on the 1st January, 1883.

MR. PRESTON'S METEOROLOGICAL RECORDS FOR 1922

MONTH.	BAROMETER.				THERMOMETER.			HYGRO-METER.	SUN-SHINE.	RAINFALL.		WIND.										
	Highest	Date	Lowest	Mean.	Highest	Date	Lowest			Date	Mean.	Inches.	No. of Days.	N	E	S	W	N	Mean estimate			
1922.																						
JAN.	30.27	10	28.92	29.763	56.4	2	17.2	18	37.3	91	22.4	5.20	25	4	0	6	3	8	1	6	3	3.1
FEB.	30.46	10, 11	29.09	29.852	59.0	24	24.3	7	40.0	87	106.1	2.70	14	0	1	5	2	8	4	8	0	3.0
MARCH	30.44	13	28.72	29.833	59.0	3	25.6	31	40.9	83	96.6	2.25	19	4	8	5	0	1	6	3	4	3.4
APRIL	30.38	19	29.14	29.717	65.4	14	27.4	3	43.1	74	175.9	2.49	15	5	7	3	2	3	2	5	3	3.5
MAY	30.46	7	29.65	30.072	88.7	22	33.2	2	56.6	68	280.5	0.58	12	5	3	2	2	8	7	3	1	3.1
JUNE	30.21	4	29.59	29.951	82.0	1	41.7	16	57.9	69	224.7	1.67	13	4	4	4	3	1	5	6	3	3.4
JULY	30.24	11	29.05	29.860	75.5	29	44.0	26	58.0	74	136.7	7.33	20	3	2	2	2	6	6	4	3.1	
AUG.	30.21	19	29.40	29.900	73.0	20	42.2	26	57.8	79	159.4	1.54	17	2	1	2	2	2	9	6	7	2.7
SEPT.	30.34	8	29.00	29.933	70.0	21	37.8	12	54.9	83	144.9	2.62	17	6	5	3	4	2	3	3	4	3.5
OCT.	30.28	7, 8	29.52	30.044	64.0	4	31.2	29	48.3	82	137.7	1.42	16	1	9	13	1	1	2	3	1	3.0
NOV.	30.74	15	29.15	30.128	53.0	29	27.0	14	42.1	89	58.0	2.01	15	1	1	0	0	3	1	7	17	2.5
DEC.	30.38	4, 11	28.57	29.760	52.6	13	28.4	9	42.0	87	42.4	2.68	19	2	1	0	0	8	10	4	6	3.5
MEANS				29.902					48.3	79												3.1
EXTREMES & TOTALS	30.74	Nov. 15	28.57		88.7	May 22	17.2	Jan. 18			1585.3	32.49	202	37	42	45	21	51	56	60	53	

XIV

MISCELLANEOUS NOTES AND OBSERVATIONS

Sonchus palustris IN E. SUFFOLK AND E. NORFOLK.—About ten years ago I noticed some very tall Sowthistles near the Suffolk bank of the Waveney in Lothingland. There were not many individual plants, and at the time I was under the impression that the leaves of the Marsh Sowthistle were amplexicaul.

During the last few years the dyke has become more choked, and the water more polluted. Perhaps because of this, the plants became more numerous, and an improvement in my library enabled me to identify the species. In the summer of 1922 the plants grew very luxuriantly, and the flowers showed up with quite a different yellow (sulphur, not orange) and were smaller in size. One of the plants I measured, and, besides six inches of stem in the water, there were seven feet of straight upright above.

The photograph shows *palustris* and *arvensis* growing side by side; the leaves of *palustris* look paler because they are more glossy. On the Norfolk side of the river I have also found a patch containing about 100 plants.

P. E. RUMBELOW

Sonchus palustris AT HORSEY.—On August 31st, 1923, Mr. James Vincent, of Hickling, sent over to me a specimen of this plant, with the information that a number were growing at Horsey. A few days later I visited the spot and found the plants growing in considerable numbers on a low bank alongside the dyke, the colony extending for perhaps 100 yards or more. None were growing in the water or on the marsh itself, where it would no doubt be unable to establish itself, owing to the annual mowing. The great height of the plants—some of which were eight feet high—made them most conspicuous, but others were very much smaller, and not greatly different from the common Sowthistle, which was also to be found here. As the plants were in seed, the difference in the colour of the flowers was not seen. The specimen which was sent to me measured



Photo

P. E. Rumbelow

Sonchus Palustris IN A DITCH ON THE SUFFOLK SIDE
OF THE WAVENEY IN 1922

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seven feet six inches, the stem being five and a quarter inches in circumference at the base.

The arrangement of the leaves was rather curious. The midrib runs down the stem as a conspicuous ridge which dies out just above the leaf immediately below it, this leaf being the fourth in the spiral series. Each leaf may have one or two pairs of lateral lobes, but often one of the lobes is not present, so that the leaf is asymmetrical. The leaves form a series of vertical rows along the stem and, commonly, all the leaves in each row are of the same form. That is to say, the whole of the leaves in one row may be exactly alike in having in every case the same lobe, on the right or left hand, suppressed. This may be a common phenomenon in plants, but is a matter of which I have no special knowledge.

ROBERT GURNEY

A NEW NORFOLK BEETLE.—Specimens of *Anthicus humilis* were taken on Scolt Head Island by Mr. H. J. Thouless on the occasion of the Society's visit to the island on June 11th, 1923. This beetle is new to the Norfolk list.

GREAT GREY SHRIKE (*Lanius excubitor*) IN NORFOLK.—This bird is an occasional visitor to the County, especially during the autumn and early months of the year, but its occurrence is of sufficient rarity to warrant the record in our Transactions. On March 26th, 1923, Mr. K. O. Nash had a good view of one of these birds for about ten minutes on some roadside trees between Castle Rising and Sandringham. Beneath the trees he found castings of wing-cases, hair, etc., which were later examined and found to be "undoubtedly shrike castings." A month later, on April 28th, Sir Hugh Beevor and his son saw at Hargham "a grey shrike promenading on a sandy hill and giving us a fine close view with glasses." The bird remained in the same locality all the day, but had gone by the next day. It may be that this was the bird seen by Mr. Nash, but if so, we have not heard of its having been identified in its passage across the county.

EDITOR

NORWICH ROOKERIES.—Norwich is proverbially a city of gardens, and there still remain many fine old elm trees within its boundaries. Up to recent years rooks have annually resorted to some of these for nesting purposes, though the number of rookeries in the city at the present time is small. Up to a few years ago, when they were deserted, there were always a few nests in the tall elms in the grounds of the Norfolk and Norwich Hospital, and this year these trees were found to be so rotten that it was considered advisable to fell them. It is often asserted that rooks have a premonition of commencing decay in the trees used by them for nesting, and the birds using the hospital trees may have deserted for this reason. The small colony of three or four nests in Chapel Field Grove was deserted when this ground was cleared for Caley's factory during the War. Up to last year there have been two or three nests in the elms in Miss Bignold's garden in Surrey Street, but although the birds returned to prospect for their old nests in the early spring, they did not remain to breed this year.

We believe that there are only three remaining rookeries within the boundaries of Norwich, and that these are at (1) Heigham Hall, where Dr. Pope recorded twenty-two nests this year, an increase of seven over last year; (2) Bracondale Woods, where Mr. Hore-Ruthven reports two nests only this year; (3) Earlham Hall. This last is a very old rookery, and is just within the city boundary, and Mr. Sydney Morris informs us that it is now divided into two, one being at either end of the wood bordering the river, in the park. There is a large number of nests in each of the two rookeries.

EDITOR

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JOHN HENRY GURNEY

XV

JOHN HENRY GURNEY, F.L.S., F.Z.S.

1848-1922

It is with a sense of very deep regret that we have to record the death of Mr. John Henry Gurney, which occurred at his residence, Keswick Hall, near Norwich, on November 8th, 1922.

He had undergone a serious operation in the autumn of 1921, and afterwards spent part of the winter in the South of France, whence he returned apparently in his usual vigorous health, and it was hoped that ten years had been added to his life. However, he was again taken ill at the end of October, and the daily bulletins indicated that his condition was very grave, so that the news of his death was not unexpected by his large circle of relatives and friends.

The late Mr. Gurney came of a family which had been prominent for some generations in the public life of Norfolk. They have been noted for their philanthropy, integrity, and in some branches of the family for their love of natural history. His father was John Henry Gurney of Keswick and Catton Hall, a Justice of the Peace for Norfolk, and M.P. for Lynn in 1857 and 1859. He married Mary Gurney, of Thickthorn, and died in 1890. He entered the service of Gurneys' Bank in 1836, and in 1840 became a partner. He lived first at Easton and then at Catton; but his estate at the latter place he afterwards sold to Mr. S. Gurney Buxton, and then resided at Northrepps Hall. He was a noted ornithologist, one of the leading authorities in the world on birds of prey, and for many years his collection of these birds, which is now in the Norwich Castle Museum, was second only to the collection in the British Museum. His son, John Henry, was born at Easton Hall, on July 31st, 1848, so that he was 74 years of age. He was educated at Harrow, and spent most of his life in Norfolk, doing his duty as a large landowner and country gentleman, and taking a prominent

part in local religious, philanthropic, and scientific activities. He was High Sheriff of Norfolk in 1894, and had been for many years a Justice of the Peace, sitting on the Swainsthorpe Bench, and was also a Deputy Lieutenant. He married Margaret Jane, daughter of Henry Edmund Gurney (who survives him), and leaves one son, Gerard Hudson Gurney, and three daughters, Mrs. E. A. Ruggles-Brise, Mrs. E. R. Meade-Waldo, and Miss Cicely Gurney.

The late Mr. Gurney was, however, most widely known as an ornithologist, and as such he had an international reputation. In this respect he followed in his father's footsteps, and from his boyhood received a thorough grounding in the ornithology of the field as well as of the study. His first contribution to the literature of the subject appeared in the *Ibis* when he was eighteen years of age, and referred to a variety of the Swallow. The next year he wrote a pamphlet on the Grey Phalarope, and when he was twenty contributed articles to the "Zoologist" on the Great Auk, and on Little Gulls on the Yorkshire coast. The product of his travel years is seen in his papers on a "Natural History Tour in Spain," "The Ornithology of Algeria," "Continental Notes on Ornithology," and his volume on the "Rambles of a Naturalist in Egypt." Not a year has passed since 1866 without some contribution from his pen to the science of ornithology, and his longer articles total nearly 120.

For twenty-eight years his annual "Ornithological Notes from Norfolk"—up to 1917 in the "Zoologist" and since then in "British Birds"—put on record, with the aid of numerous correspondents, almost everything of permanent value relating to the bird-life of the county. Nearly every ornithologist who has resided in Norfolk during that period was proud to be his collaborator, and he was always generous in his acknowledgments of assistance rendered. He was a valued contributor to a number of scientific publications, and his opinion on any ornithological matter always commanded respect. For a generation he was the foremost ornithologist in Norfolk, and the friend and correspondent of most of the leading students of birds in this and in other countries. He contributed in 1884 "A Catalogue of the Birds of Norfolk"

to "Mason's History of Norfolk"; in 1895 he published "A Catalogue of the Birds of Prey"; in 1913 a brilliant monograph on "The Gannet, a Bird with a History"; and last year an attractive volume entitled "Early Annals of Ornithology."

His last published important paper, completed only a few days before his death, was on "Bird Migration as observed on the East Coast of England," which appeared in the *Ibis*, October, 1923. As far as can be made out, his total contributions to ornithological literature number nearly 600—surely a unique record for any one man. A list of these is appended to this Notice. He was a Fellow of the Linnæan Society and of the Zoological Society, a member of the British Ornithologists' Union, and a vice-president of the Norfolk and Norwich Naturalists' Society.

Mr. Gurney was one of the original members of the Norfolk and Norwich Naturalists' Society, founded in March, 1869. With the subsequent death of Mr. T. E. Gunn, the number of these is now reduced to four. He was President of the society in 1881-2, 1888-9, 1898-9, and in the jubilee year 1919-20. His presidential address on the last occasion was devoted to his memories of Norfolk and other naturalists, including Henry Stevenson, Thomas Southwell, Alfred Newton, F.R.S., Sir Edward Newton, F. C. Newton, Joseph Wolf, Abraham Bartlett, Frank Norgate, and the Rev. Richard Lubbock. With the late Mr. Thomas Southwell he recorded the various additions to, and notes about, the birds of Norfolk at the end of each volume of the Society's Transactions. He had been for many years a generous supporter of the local wild bird protection societies, and when these all came under the supervision of the Norfolk and Norwich Naturalists' Society, in 1921, Mr. Gurney was unanimously elected President of the Norfolk Wild Birds' Protection Committee.

For many years he was associated with the work of the Norwich Museum in St. Andrew's, and when in 1894 the collections were transferred to the Castle, he was co-opted on the Museum Committee, as a member of which he rendered valuable service up to the time of his death. His father had made the collection of raptorial birds in the Norwich Museum one of the finest in the world, and the son steadily

followed in his footsteps, sending his lists of *desiderata* to numerous correspondents in remote countries, and obtaining new specimens as they became available. His wide knowledge of birds was of the greatest assistance to the Museum Committee and his generous contributions to the collection have materially assisted to bring the Museum to its present proud position.

He was a generous supporter and faithful friend of most of the philanthropic institutions and societies in the county. At one time he was one of the largest landowners in Norfolk, having inherited estates in many parts of the county, but several of these have been sold in recent years. During the year that Mr. Gurney served the office of High Sheriff the burial ground at Keswick was re-consecrated. He had partially restored the ruins of the old church which was dismantled three centuries ago, and re-conveyed to the rectory the old churchyard, which was fenced off for a cemetery.

The late Mr. Gurney was a man of striking appearance, a notable personality in any gathering, and a careful speaker whose words always carried weight. He sometimes had a certain brusqueness, due to concentration of thought, but ordinarily he was a delightful, well-informed companion, always ready to give of his store of knowledge to those who sought his assistance. In Keswick and the neighbourhood he was respected and revered by all classes, his sole aim in life being to do as much good as he could for his fellow men.

The funeral took place at Keswick Church on November 11th, 1922, and was largely attended.

We cannot conclude this account more appropriately than by quoting the following from a friend of many years' standing :—

“ It was a misfortune that his eyesight did not, of recent years, permit him to use field-glasses, but this limitation did not apparently affect his keen enjoyment of a day spent in the observation of birds, and he never gave the impression that he was conscious of any loss in this respect. For the same reason he was obliged also to restrict both his reading and writing, and it is a tribute to his industry and persistence that he was able none the less to accomplish so much.

“ He was a most cautious and accurate observer and recorder, and did not lightly accept records from any but the best sources. His confidence, on the other hand, once given, was given wholly. I well remember how, when a boy, he would test by question the truth of any observation which I reported to him, and, in particular, how he convinced me that my evidence that a wagtail I had seen was a white wagtail, was not sufficiently sound.

“ On the tendency of modern ornithologists to concentrate on structural details and the discrimination of local races and sub-species, he steadily refused to express any opinion. He took himself no part in this work, but was content to rely on the authority of those engaged upon it, and to accept the new nomenclature without criticism or discussion.

“ I myself owe much to the inspiration of his example and look back in particular to a week spent with him in the New Forest in my boyhood as something of a landmark in my life. I started then, in imitation of him, a diary of natural history observations which I have continued ever since.

“ It was a rare treat to me in those days to pay a visit to Keswick and to be taken to the skin room. The visit nearly always ended with a peep into the duplicate box and a gift of some specimen to add to my collection.”—R.G.

LIST OF PUBLISHED ARTICLES ON ORNITHOLOGY
AND ORNITHOLOGICAL REPORTS FOR THE
COUNTY OF NORFOLK BY JOHN HENRY GURNEY,
F.L.S., F.Z.S.

	1866	
Variety of the Swallow	1867	Ibis, Ser. 2, Vol. II., p. 423
Summary of the Occurrences of the Grey Phalarope	1868	Svo. London, 1867, pp. 24, published by Van Voorst
Rare Norfolk Birds	1868	Land & Water, Dec. 26th, 1868
Rare captures for May, 1868		Zoologist, 1868 p. 1293
Rare Sea Birds		id. p. 1295
Snowy Owls in Shetland		id. p. 1374

Little Gull at Flamborough	Zoologist, 1868	p. 1379
Great Snipe near Christ Church	id.	p. 1422
Little Gull near Bridlington	id.	p. 1424
The Great Auk	id.	p. 1442
Fawn-coloured Snipe	id.	p. 1459
Fulmar Petrel at Flamborough	id.	p. 1483
Notes on Yorkshire Skuas and Gulls...	id.	p. 1462
Nutcracker near Christ Church	id.	p. 1481
Little Gulls on the Yorkshire Coast ...	id.	p. 1482
Pomarine Skua at Flamborough	id.	p. 1482
Fulmar Petrels near Filey	id.	p. 1483

1869

List of the rarer birds obtained by Mr. Hart in the vicinity of Christ Church, Hants.	Zoologist, 1869	p. 1510
Great Gray Shrike at Dover	id.	p. 1513
Great Black Woodpecker in Leadenhall Market	id.	p. 1515
Fulmar Petrels at Scarborough and Whitby	id.	p. 1518
Parasite of Sabine's Snipe	id.	p. 1562
Long-tailed Duck near Lynn	id.	p. 1563
Lesser Kestrel near York	id.	p. 1598
Black Kite at Alnwick	id.	p. 1598
Calandra Lark near Exeter	id.	p. 1599
Dartford Warbler at Lyme Regis	id.	p. 1599
Great Auks for sale, Food of the Fulmar	id.	p. 1603
Notes on the Great Auk	id.	p. 1639
Bewick's Swan at Flamborough	id.	p. 1645
Fire-crested Regulus near St. Leonards	id.	p. 1683
Bridled Guillemot at Bridlington ...	id.	p. 1684
The Great Auk	id.	p. 1684
Occurrences of the Crane in 1869 ...	id.	p. 1841
Fulmar Petrel at Saltburn	id.	p. 1868
Miscellaneous notes published in the Zoologist, 1869.		
pp. 1685, 1799, 1802, 1803, 1844, 1846, and 1916		

1870

Natural History Tour in Spain and Algeria	Trans. N. & N. Nat. Soc. Vol. I., p. 35	
Great Auk	Zoologist, 1870	p. 1982
Black Montagu's Harrier	id.	p. 2305
Reparation of a maimed beak in the Chough	id.	p. 2306
Lesser Kestrel near York	id.	p. 2342
Woodcock and Godwit	id.	p. 2345
Spur-winged Goose	id.	p. 2346
Dabchicks in Kensington Gardens ...	id.	p. 2347
Gray-headed Wagtail at Gateshead ...	id.	p. 2382
Quails in Norfolk, Gray Plover at Blakeney	id.	p. 2384
Pied head in the Common Skua	id.	p. 2386
Leadenhall Market, London	id.	p. 2393

1871

The Ornithology of Algeria	Ibis. Ser. 3, Vol. I., p. 68	
List of British Birds, Gray's Arrangement		August, 1871.
King Duck in Leadenhall Market ...	Zoologist, 1871	p. 2443
Nesting of the Gray-headed Wagtail near Newcastle	id.	p. 2483
Continental Notes on Ornithology ...	id.	p. 2506
Aquatic Warbler at Dover	id.	p. 2521
Albatross in Derbyshire	id.	p. 2563
Gray-headed Wagtail at Brighton ...	id.	p. 2639
On the gular pouch of the Bustard ...	id.	p. 2641
White Storks near Lydd	id.	p. 2643
Wholesale destruction of Manx Shear- waters	id.	p. 2646
Golden Oriole in confinement	id.	p. 2681
Ortolan Bunting at Yarmouth	id.	p. 2682
A Natural History Tour in Spain and Algeria	id.	p. 2712
Birds at Rannoch, Birds of the Malvern district	id.	p. 2725
Hooded Crows at Flamborough in June	id.	p. 2728
Ringed Guillemot near Flamborough	id.	p. 2729
Immigration of Great Bustards	id.	p. 2770
Pied Ring Ouzels	id.	p. 2805
Great Black Woodpecker	id.	p. 2806
Notes from Instow, N. Devon	id.	p. 2845
Dipper at Rye and Bridlington	id.	p. 2848
Dotterel at Dungeness	id.	p. 2851
Ruffs	id.	p. 2852
Spoonbill near Yarmouth	id.	p. 2871

1872

The Great Black Woodpecker	Dresser's 'Birds of Europe,' Vol. V., p. 12	
Ortolan Buntings at Yarmouth	Trans. N. & N. Nat. Soc. Vol. I., p. 61	
Snowy Owl at Southrepps	id. p. 63, and Zoologist, 1872, p. 2912	
Birds attracted at Cromer Lighthouse	Trans. N. & N. Nat. Soc. Vol. I., p. 63	
Lapland Bunting at Cley	id.	p. 65
Red-legged Partridge nesting in a tree	Zoologist, 1872	p. 2944
Birds attracted by Lighthouses	id.	pp. 2990, 3144
Clustering of the Long-tailed Tit ...	id.	p. 2993
Cuckoo near the Sea	id.	p. 3022
Purple Herons, Squacco Herons, and Night Herons in Norfolk, Plumage of White-fronted Goose	id.	p. 3023
Variety of Missel Thrush	id.	p. 3044
Great Auk on Disco	id.	p. 3064
Whimbrel near Stratford and Dunlin near Leamington	id.	p. 3273
Sabine's Gull at Bridlington	id.	p. 3316

- 1873
- Osprey at Hempstead Zoologist, 1873 p. 3367
- 1874
- Shore Birds at Cley and Blakeney ... Zoologist, 1873 p. 4196
- Records of the Rose-coloured Pastor
in Norfolk, in 1747 Trans. N. & N. Nat. Soc. Vol.
II., p. 225
- On some Norfolk Birds in the late
Mr. Henry Doubleday's collection id. p. 225
- The first British-killed Red-crested
Whistling Duck id. p. 225
- The Gray-capped Wagtail a Norfolk
bird id. p. 226
- 1875
- Glaucous Gulls and Goosander near
Yarmouth Field, Dec. 11th, 1875
- Miscellaneous Notes Zoologist, 1875 pp. 4666
and 4695
- Herring Gulls carrying off Wounded
Dunlins id. p. 4666
- Pomatorhine Skuas and Black Guille-
mots at Flamborough id. p. 4667
- The Red-backed Shrike as a butcher
American White-winged Crossbill in
the North Sea. The White-backed
Woodpecker a British Bird id. p. 4691
- Red-throated Diver, Audacity of the
Common Skua id. p. 4695
- The value of Natural History Specimens,
Bird's Nest in fleece of
Living Sheep id. p. 4698
- Supposed occurrence of the Jugger
Falcon, *Falco jugger*, Gray, off the
coast of Yorkshire id. p. 4721
- Waxwings without wax id. p. 4723
- The last native Great Bustard id. p. 4724
- Sun-fish at Overstrand, in Norfolk id. p. 4725
- Supposed occurrence of the Squacco
Heron in this Country in Winter Trans. N. & N. Nat. Soc. Vol.
II., p. 487
- 1876
- Rambles of a Naturalist in Egypt ... 8 vo., London, 1876, 307 pp.
- Rough-legged Buzzard near Cromer ... Field, Jan. 29th, 1876
- The Coal Titmouse of the Continent Zoologist, 1876 p. 4761
- Macqueen's Bustard id. p. 4763
- Black Stork at Lydd in Kent id. p. 4764
- Avocet and Pectoral Sandpiper in
Durham. Ducks and Partridges
laying in the same nest id. p. 4765
- An Adam's Diver in England id. p. 4767
- A Catalogue of the Birds of Northum-
berland and Durham, by John
Hancock id. p. 4793

Peregrine in the City of Norwich ...	Zoologist, 1876	p. 4795
Crossbills alighting on ships ...	id.	p. 4796
The Calandra Lark a British Bird ...	id.	p. 4835
Lesser White-fronted Goose ...	id. (pp. 4930 and	5006
Flight of the Hoopoe ...	id.	p. 5006
Crossbill on Fair Island ...	id.	p. 5043

and one hundred and eight Ornithological notes are published in the Zoologist, 1876.

1877

Varieties of the Skylark ...	Zoologist, 1877	p. 181
The Pine Grosbeak to be regarded as a British Bird ...	id.	p. 242
Birds impaled by the wind on weather vanes ...	id.	p. 259
On Flamborough Head ...	id.	p. 259
Kite at Northrepps ...	id.	p. 260
Cuckoo in reddish-brown plumage in Spring ...	id.	p. 230
Singular variety of the Hedge Sparrow ...	id.	p. 298
The Collared Duck ...	id.	p. 341
Hooded Crow in Norfolk in August ...	id.	p. 443
Purple Gallinule at Hickling Broad ...	id.	p. 447
Partridge coming in collision with a train ...	id.	p. 448
Greenshanks in Norfolk ...	Field, Sept. 29th, 1877	

1878

Birds on Flamborough Head ...	Rowley's: Ornith. Misc., Vol. III., p. 29	
Attractive power of light on birds ...	Zoologist, 1878	p. 27
Purple Gallinule in Norfolk ...	id.	p. 29
Notes on the Farne Islands and some of the birds which are found there	Proc. Nat. Hist. Soc. Glasgow. Vol. III., p. 268	
The Gannet City ...	Trans. N. & N. Nat. Soc. Vol. II., p. 528	
License for Shooting, A.D. 1554 ...	id.	p. 614

1879

Little Auk near Norwich ...	Zoologist, 1879	p. 31
Slavonian Grebe near Cromer ...	id.	p. 181
Ornith. notes from St. Leonards ...	id.	p. 376
Green-backed Porphyrio at Barton ...	id.	p. 458
Shore birds on the Norfolk Coast ...	id.	p. 460
Extraordinary assemblage of Short-eared Owls ...	id.	p. 490
Summer Birds at Hastings ...	Field, April 12th, 1879	
Pomatorhine Skua on Norfolk Coast	id. Nov. 8th, 1879	
Birds of the district ...	Jarrolds': Illustrated Handb. to Cromer, 1879	

1880

Notes from St. Leonards ...	Field, Oct. 10th, 1880	
Autumnal migration of the Siskin	id. Oct. 30th, 1880	

- Notes on "A Catalogue of the Accipitres in the Brit. Mus." by R. Bowdler Sharpe (1874) Ibis. Ser. 4, Vol. IV., p. 195
- Ornithological notes from Lowestoft Zoologist, 1880 p. 22
- Late nesting of the Barn Owl and Waterhen in Norfolk id. p. 71
- Bewick's Swan in Norfolk id. p. 139
- Heron nesting at Hempstead, Norfolk id. p. 366
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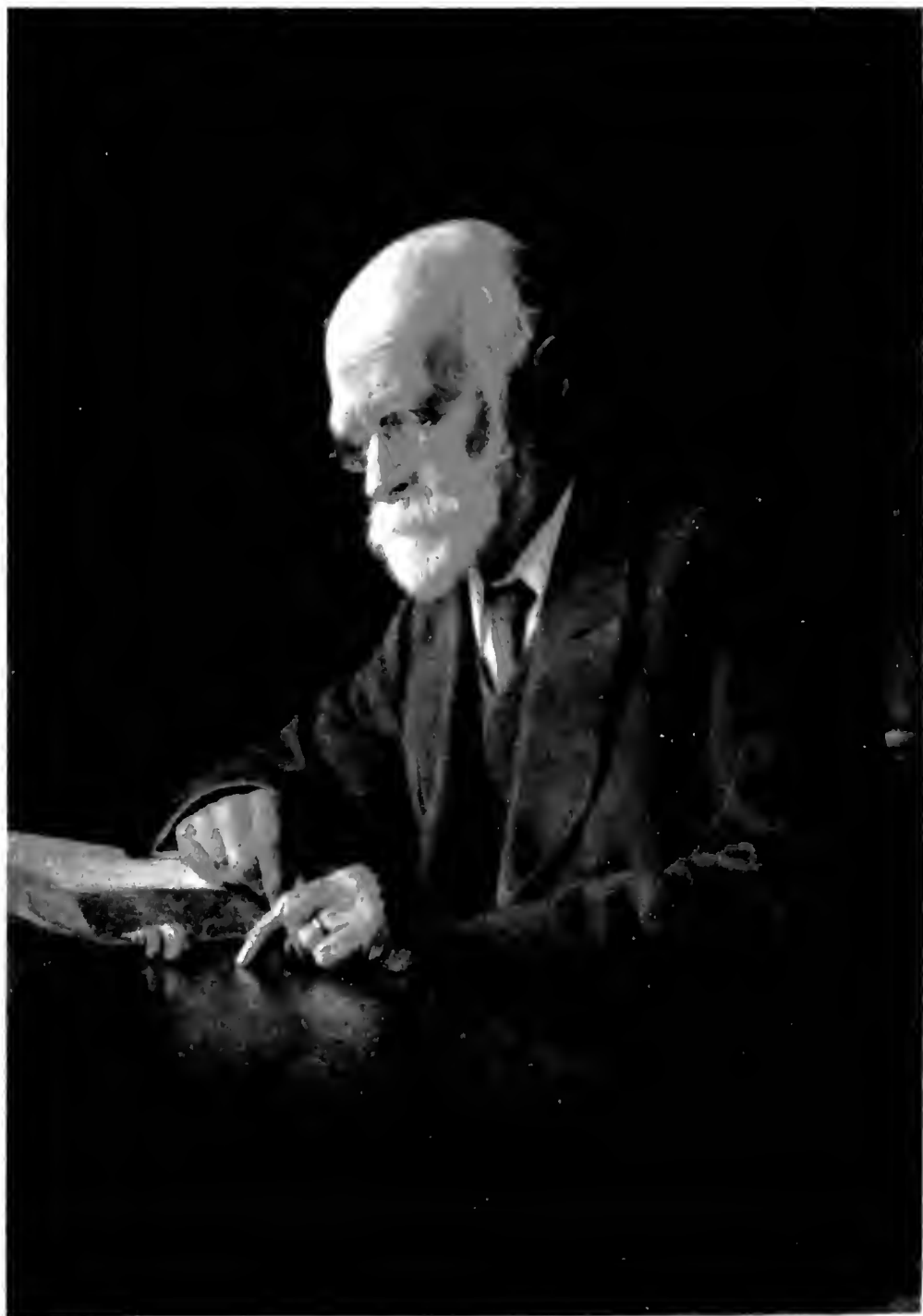
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BRITISH
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NATURAL
HISTORY



Frederic William Harmer

1835-1923

XVI

FREDERIC WILLIAM HARMER, M.A., F.G.S.

1835—1923

We regret to have to record the death of Mr. F. W. Harmer, which took place at his residence, Oakland House, Cringleford, on Wednesday, April 11th, 1923. He had been in declining health for some time, and the end was not unexpected. Having been born on April 24th, 1835, he had nearly reached the age of 88.

Frederic William Harmer, J.P., Hon. M.A. (Cantab.), and member of various scientific societies, was the only son of the late Thomas Harmer, and was born at Norwich on April 24th, 1835. He was the descendant of a family named Hermër, which held manors in Norfolk at the time of the Norman Conquest, and which, from the beginning of the 14th up to the 18th century, were landowners in Shipden, Antingham, Mundesley, and the adjoining parishes.

Mr. Harmer was privately educated, and at the age of 15 he entered the house of business which had been founded in 1825 by his grandfather in conjunction with the late Mr. Rivett for the manufacture of clothing, &c. Many years previously one of Mr. Harmer's ancestors came to Norwich to seek his fortune, taking up the Freedom of the City in 1701. Since that date the family has been continually associated with the manufacturing trade of Norwich. Mr. Harmer's father largely increased the business, and Mr. Harmer himself followed on similar lines. The Mancroft works in Bethel Street, where the factory was carried on, became much too confined for the ever-increasing trade which Mr. Harmer's activities created, although the firm had factories in Heigham and in other parts of the city. In 1890 the factory and warehouse which form one of the features of the city were erected in St. Andrew's Street on the site of a number of houses and workshops which had been pulled down. The firm, which now bears the name of F. W. Harmer & Co., is one of the oldest firms of clothing manufacturers in the country. For half a

century Mr. Harmer maintained an unbroken connexion with the business, and no figure was more familiar in the streets of Norwich.

Immersed as he was in the direction of his factory, Mr. Harmer found time for a good deal of public work, especially that of an Educational nature. In 1908 he made a gift of £1,000 for the foundation of a scholarship at the Norwich Grammar School, of the governors of which he was vice-chairman.

Long before the days of Technical Institutes Mr. Harmer was an advocate of technical education, and for many years was an active member of the local Committee of the Cambridge University Extension Scheme. During his Mayoralty he inaugurated a scheme of popular scientific lectures for working men, the first of which was delivered by Sir Robert Ball. It was doubtless the educational instinct in him which led him for 36 years to engage actively in Sunday School work at Prince's Street Congregational Church, for theologically, as an evolutionist, he held advanced views. He was one of the original founders of the Young Men's Christian Association, of which he was for long a vice-president. Prior to the commencement of the sewerage works in 1870 Mr. Harmer strongly opposed the carrying out of the scheme, and he also deprecated the building of the Agricultural Hall, as he objected to parting with any portion of the Cattle Market site. He did excellent work as a member of the Museum Committee before it came under the Council, and as a member of the Free Library Committee his scientific knowledge was of the utmost value in the purchase of books in that section. He was very keen, too, on music, and was a member of the Norwich Festival Committee, and of the committees responsible for the Saturday evening popular concerts. Whilst he was Mayor, Mr. Harmer, desiring to give the working classes an opportunity of hearing such music, arranged for the performance of the "Messiah" in St. Andrew's Hall with the aid of the members of the Festival Chorus and the band of the Norwich Philharmonic Society, and himself conducted one of the choruses. He acted for a time as organist at Cringleford Church.

In 1880 he was elected by the Liberal party as an Alderman. The election was made without his having sought it, but he

accepted the appointment, and threw himself with interest into the work, especially into the financial business of the city. He was appointed J.P. in 1884, and in 1887-8 he served the office of Mayor.

Mr. Harmer was certainly not least in the long line of distinguished Norfolk geologists. He set out to study the earth's crust at a very early age. When he was quite a young man there was a Norwich Geological Society in existence which published "Proceedings." He became an active member of it. In 1864 he met accidentally on Mundesley beach Searles V. Wood, Jun., the geologist who may be said to have laid the foundation of the systematic study of the glaciology of East Anglia, the son of the equally distinguished man of the same name, whose monograph of the Crag Mollusca will always remain one of the classics of geological literature. As Mr. Harmer tells us in his "Glacial Geology of Norfolk and Suffolk"—

"Although the glacial drifts of this district had been previously studied by Lyell, Trimmer, Gunn, and others, comparatively little had been ascertained at that time [1864] as to the distribution or stratigraphy of the various beds of clay, sand, and gravel of which they are composed, or of the conditions under which they originated. The only geological map of the county then in existence was that published by Samuel Woodward in 1833, in which, however, the relation of the Crag and of the 'Diluvium' of the coast between Cromer and Yarmouth to the underlying chalk had been correctly shown, but no attempt had been made to map the glacial deposits over an extended area, either in Norfolk, or, as far as I know, in any other part of the world. Wood saw clearly, not only that no real progress was possible until this was done, but that the glacial drifts of the East of England could only be studied satisfactorily as a whole. He consequently set before himself the gigantic task of a detailed survey of these deposits, on the inch scale, from the Humber to the valley of the Thames, and from the Midland counties to the Suffolk coast. Although, alas, his premature death prevented its full accomplishment, he was able, with the help of one or two younger men who were proud to work under him, to complete a great portion of it. The district

he allotted to me was the county of Norfolk and the northern portion of Suffolk, in the mapping of which I spent the leisure of eight or ten years."

In 1868 the British Association met in Norwich. It was at this meeting that Huxley read his famous paper on "Chalk." By this time the work of Mr. Harmer and of Mr. Wood was sufficiently advanced to justify the publication of a preliminary statement of their results. At the meeting of the Association a geological map on the one-inch scale was exhibited, which, drawn by Mr. Wood's own hand, showed with more or less accuracy the distribution of the glacial beds over an area of 2,000 square miles. Copies of this map, the first of its kind ever published, were placed two or three years ago in the Norwich and Ipswich Museums. The issue of further instalments was arrested by Mr. Wood's failing health, and at Mr. Wood's death Mr. Harmer withdrew for a time from active geological work. He had already made a special study of the local crag deposits, the main beds being the Norwich Crag and the Suffolk Crag, and it was largely due to his efforts then and later that the wonderful series of mollusca preserved in these beds was so fully investigated. From a study of these shell deposits he was able to estimate with a reasonable amount of accuracy the climatic conditions that prevailed throughout the period during which the crag was being deposited. When he returned to the subject which his service in the Town Council had arrested he further developed this, and in a valuable paper which he read before the Geological Society, he showed from the deposit of shells what the prevailing winds must have been during the Pleistocene epoch. In his efforts to obtain full and accurate knowledge of the deposits of East Anglia he did a great deal of original work on the opposite side of the North Sea, and was as well known to the Dutch and Belgian geologists as to those of this country, some of his papers having been published by learned societies on the Continent. The results of Mr. Harmer's continued study of the glacial deposits of East Anglia were published from time to time in the "Quarterly Journal of the Geological Society" and elsewhere. These later investigations, as he himself has told us, were only rendered possible by the invention of the motor. With this aid he undertook the astounding task of mapping the boulders or

“erratics” in the whole of the glacial deposits of England, and in pursuit of this object he visited practically every known section in Southern and Eastern England and the Midland counties, and on Ordnance maps he indicated by colours the characters of the various boulders met with. By this means he was able to obtain the most accurate evidence of the courses which the various great glaciers had followed, as to which there had been many theories, but little definite knowledge. He travelled many thousands of miles in his car for this purpose. As far as Norfolk and Suffolk are concerned, a summary of his conclusions was published in the “Quarterly Journal of the Geological Society,” and they were then summarised in the “Transactions” of the Norfolk and Norwich Naturalists’ Society. The view taken was—

“That the glacial deposits of Norfolk were due in the first instance to the invasion of the county by the western edge of an enormous ice sheet like that of Greenland, which, originating on the Scandinavian Uplands, then standing, in all probability, at a higher level, filled the basin of the North Sea, and overspread, in the opinion of most of our best authorities, the plains of Northern Europe. At a later stage of the Pleistocene epoch, however, the North Sea ice retreated from East Anglia, and there are no indications that it ever re-appeared subsequently, and apparently, separated from the earlier glaciation by a considerable interval, the district was invaded by an inland ice stream from the North-West, for which in 1904 I proposed the name of “Great Eastern Glacier.”

His largest work, on which he was engaged almost up to the time of his death, was his monograph of the Pliocene Mollusca, an elaborate and profusely-illustrated work which will long remain indispensable to all students of the subject. He had quite recently passed for the Press the final proof sheets of what he intended to be the final part of this work.

The British Association met in Norwich in 1868, and as a result of this visit the Norfolk and Norwich Naturalists’ Society was founded in the year following. Mr. Harmer was one of the original members of the Society, and filled the office of president in 1877-8 and in 1878-9. He was subsequently elected a vice-president, a position which he held at the time of his

death. He did a great deal of valuable work for the society, though most of his papers were presented to a wider public through the "Quarterly Journal of the Geological Society," and the publications of the Palæontographical Society. He, however, contributed to the "Transactions" of the Naturalists' Society two valuable presidential addresses, in one of which he advocated evolution, when evolution was unpopular, and he also dealt with the geology of Corton, a flint implement from Hellesdon, the Marine Mollusca of Norfolk (of which he published the first list), and "Tellina balthica and the Norwich Crag." In 1870 he published an address on the "Testimony of the Rocks in Norfolk." In it he maintained that Darwin's theories were not antagonistic to revealed religion. His views were combated by Dr. Bateman and by the Rev. W. P. Lyon, and a newspaper controversy followed.

His reputation as a geologist brought him many distinctions. He was a member of the Council of the Geological Society of London, 1896-1900; Murchison Medallist, 1902; a member of the Council of the Palæontographical Society, 1878-82 and 1905-6; Membre Associé Etranger, Soc. Belge de Géol., 1900; Membre Honoraire, 1904; and Membre Soc. Géol. de France, and F.R.Met.S. In 1918 the University of Cambridge conferred upon him the Honorary Degree of M.A. Recognition was pleasant, and had been well earned, but it may be doubted whether Mr. Harmer was ever happier than when in some local pit with a few kindred spirits surrounding him he could enlarge on the lessons to be learned from the particular beds exposed. His services in this respect were enlisted on many occasions by the Norfolk and Norwich Naturalists' Society, the Norwich Science Gossip Club, and, more recently, by the newly-formed Prehistoric Society of East Anglia, whose inaugural meeting he attended, and in which he took a deep interest. He was also of great assistance to the London Geologists' Association, more especially when they visited the Eastern Counties, on the geology of which he was, of course, the recognised authority. Most of the leading geologists of Europe had been entertained at Oakland House at one time or another, finding much to interest them in the glacial deposits of the district, deposits which in some respects were unequalled

in Europe. No trouble was too great for him in helping young students of the science in which he was so deeply interested.

In his younger days Mr. Harmer had studied botany, and though he never obtained the distinction in this subject that he did in geology he was a very good botanist. He was a member of the Norfolk and Norwich Horticultural Society, of which he was President in 1904, and had a beautiful garden at Cringleford, the ferns and rock garden being special features. At local horticultural shows he always did extremely well.

In 1860 Mr. Harmer married Mary, daughter of Mr. Adam Lyon, by whom he had four sons and one daughter. Mrs Harmer died in 1908. Two of Mr. Harmer's sons were associated with him in the business. The other two have had distinguished careers. One, Sir Sidney Frederic Harmer, K.B.E., Sc.D., F.R.S., Hon. Fellow of King's College, Cambridge, is now Director of the Natural History Departments of the British Museum. Mr. William Douglas Harmer, M.Ch. (Cantab.), F.R.C.S., the remaining son, is surgeon in charge of the Throat Department in St. Bartholomew's Hospital.

XVII

THOMAS EDWARD GUNN, F.L.S.

1844-1923

We regret to have to record the death of another of our original members, Mr. T. E. Gunn, the well-known naturalist and taxidermist, of 86, St. Giles' Street, Norwich, who passed away after a long illness on July 20th, 1923.

Mr. Gunn was born at Norwich and was a son of Mr. Robert Gunn, a carriage builder, of King Street. He was educated at the old Blue Coat School, and was the first boy to gain an apprenticeship premium from the school. On leaving he became apprenticed to the late Mr. John Sayer, who carried on a taxidermist's business in premises opposite those which the late Mr. Gunn came to occupy about 46 years ago. When Mr. Sayer died Mr. Gunn took over the business, and became noted all over the country for his skill and knowledge in setting up birds, fish, &c. He was a leading prize-winner for taxidermy at a large number of exhibitions held in various parts of the country, and took all the chief awards at the National Fisheries Exhibition in London, in 1883. He did work for many important museums at home and abroad, and for numerous well-known private collectors. He held a high place as an authority on ornithology, and added several new species to the Norfolk list of birds. His important discovery of the presence of double ovaries in certain British birds was described by him in a paper read before the Zoological Society.

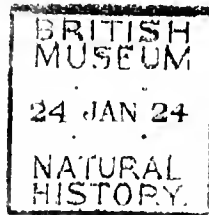
Mr. Gunn did much work for the late Mr. Fergus Mentieth Ogilvie, of Sizewell, Suffolk, who died five years ago. Mr. Ogilvie's vast collection of British birds, beautifully mounted by Mr. Gunn, carefully catalogued, and formerly arranged in the museum especially built at Sizewell, was lately presented by Mrs. Ogilvie to the Ipswich Museum. Many of the

specimens were not only mounted, but obtained by Mr. Gunn, to whom a generous tribute was given by Mr. Ogilvie, in his "Field Observations on British Birds" (1920). In a chapter on "The Food of some of our Commoner Falconidæ, as ascertained by dissection," Mr. Ogilvie says:—"I am very greatly indebted to Mr. T. E. Gunn, of Norwich, my bird stuffer. Practically all the dissection notes are his; perhaps I am responsible for two or three per cent., and any interest the paper may have is really due to his work, not mine."—This was written in 1916 and it may not be out of place to mention here that both Mr. Ogilvie and Mr. Gunn had from their investigations found the Little Owl, about which so much controversy has arisen, a thoroughly undesirable importation.

Mr. Gunn was one of the original members of the Norfolk and Norwich Naturalists' Society, and his death leaves only four surviving of those who joined in 1869, namely, Dr. M. Beverley, the Rev. J. A. Laurence, Mr. H. S. Robinson, and Mr. S. W. Utting. In his younger days he was a first-class field naturalist and wildfowler, and as his business coincided with his hobby, he was enabled to make many valuable records on the ornithology of Norfolk and Suffolk. His first notes relating to Norfolk appeared in the "Naturalist" in 1864, and those relating to Suffolk in the "Zoologist" for 1865. Numerous notes thenceforward appeared in the "Zoologist," practically without a break until 1888, and he was also a contributor to the "Naturalist," "Naturalists' Circular," "Field," and "East Anglian Handbook." After 1888 his literary activities decreased, but he had a note on "Tufted Duck in Norfolk" in the "Zoologist" for 1892, on the Great Bustard in the "Transactions" of the Norfolk and Norwich Naturalists' Society for 1894 and 1898, and on the Aquatic Warbler in Norfolk in the "Field" for 1902 and 1904. He rendered valuable assistance to Mr. Henry Stevenson when he was writing the "Birds of Norfolk," and since 1864 almost every writer on the ornithology of the county has materially benefited by his published records, and the verbal information he would always generously supply. His services to ornithology were recognised by his election as a Fellow of the Linnæan Society, a distinction of which he was justly proud.

Mr. Gunn was a great lover of all forms of outdoor sport, and was particularly fond of shooting and angling. He was the oldest member of the Norwich Angling Club, and was very skilful with the rod and line. Some very fine catches stand to his credit, his largest haul being a pike weighing $28\frac{1}{2}$ lbs. Very fond of bowls, he became a member of the Mitre Bowling Club a good many years ago.

Mrs. Gunn died 1889, and there now survive him three sons and four daughters. One of the sons, Mr. F. Ernest Gunn, is in his father's business, and has been practically carrying it on for the last four years.





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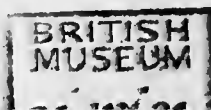
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NATURAL
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TRANSACTIONS
OF THE
Norfolk and Norwich
NATURALISTS' SOCIETY

PRESENTED TO MEMBERS FOR
1923—24

VOL. XI.—PART V

EDITED BY THE HONORARY SECRETARY

NORWICH
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NOVEMBER, 1924

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 1895 Andrews W. H. M., Hethersett
 1883 Aplin Oliver V., Bloxham, Oxon.
 1912 Astley Major D. G., Wroxham, Norwich
 1895 Atmore E. A., F.E.S., King's Lynn

B

- 1922 Back C. W., 139, Newmarket Road, Norwich
 1919 Back H. W., The Firs, Hethersett
 1923 Bacon Clifford, 4, Riverside Road, Norwich
 1923 Bagnell Mrs., Oulton Lodge, Aylsham
 1923 Bainbridge F. A., Coltishall
 1921 Baker E. C. Stuart, O.B.E., F.Z.S., 6, Harold Road, Upper
 Norwood, S.E. 19.
 1922 Baker Miss E. F., 49, Mount Pleasant, Norwich
 1923 Ball Dr. C. R. H., Minna Lodge, The Green, Hunstanton
 1901 Ballance Sir Hamilton, K.B.E., C.B., M.S., F.R.C.S., All Saints'
 Green, Norwich
 1887 Barclay Francis H., F.G.S., The Warren, Cromer
 1919 Barclay Colonel H. A., Hanworth Hall, Norwich
 1875 Barclay H. G., F.R.G.S., Colney Hall, Norwich
 1922 Barclay Miss Margaret, Hanworth Hall, Norwich
 1924 Barnard G. W., 4, Surrey Street, Norwich
 1921 Barnard Miss G. V., Castle Museum, Norwich
 1923 Barnes A. C., Oxnead Hall, Norwich
 1921 Barrow Miss E. J., The Red House, Drayton, Norwich
 1924 Barton Mrs., 7, Queen's Road, Beccles
 1883 *Becher Major Edward F., R.A., F.Z.S., Sherwood, Dominica, W.I.
 1915 *Bedford Her Grace the Duchess of, F.Z.S., F.L.S., Hon.
 M.B.O.U., V.P., Woburn Abbey
 1922 Bedwell E.C., "Bruggen," Brighton Road, Coulsdon, Surrey
 1912 Beevor Sir H., Bart., Hargham Hall, Norfolk
 1921 Bell R. C., Wrotham Old Hall, Norwich
 1911 Beloe E. M., F.S.A., 27, New Conduit Street, King's Lynn
 1882 Bennett Arthur, A.L.S., *Hon. Mem.*, 5, Thanet Place, High
 Street, Croydon
 1924 Benson E. F., Lamb House, Rye
 1911 Berners Geoffrey, Woolverstone Park, Ipswich
 1921 Berney F. L., R.A.O.U., Barcarolle, Longreach, Queensland
 1920 Berney R. G. G., The Grange, St. James, Halesworth, Suffolk
 1869 o.m. Beverley M., M.D., V.P., Overstrand, Norfolk
 1877 Bidwell E., 12, Woodberry Grove, Finsbury Park, London, W. 4.
 1921 Bignold C. R., N.U. Fire Office, Surrey Street, Norwich
 1882 Bird Rev. M. C. H., M.A., M.B.O.U., Brunstead Rectory,
 Norfolk
 1895 Birkbeck H., High House, Westacre, Norfolk
 1901 Birkbeck H. A., King's Lynn
 1921 Birkbeck Oliver, Little Massingham House, King's Lynn
 1887 Boardman E. T., How Hill, Ludham, Norfolk
 1896 Boileau Lady, Ketteringham Park, Wymondham, Norfolk
 1896 Boileau Sir M. C., Bart., Ketteringham Park, Wymondham,
 Norfolk

Elected.

- 1902 Booth H. B., Ryhill, Ben Rhydding, Yorks.
 1919 Borrer Clifford, 6, Durham Place, Chelsea, W. 3.
 1924 Boyd Capt. A. W., Frandley House, Near Northwich, Cheshire
 1923 Breton Mrs., Gresham, Holt
 1884 Brittain H., Newmarket Road, Norwich
 1924 Britton Eric, 43, Cambridge Street, Norwich
 1924 Broderick Miss, Cathedral Close, Norwich
 1912 Brooks J. R., North Walsham Wood, Norwich
 1921 Brown Mrs. Du Puis, Chedgrave Manor, Loddon
 1921 Bruton M. S., The Post Office, Aylsham
 1922 Bulwer Lt.-Col. E. A., Heydon Grange, Aylsham
 1922 Burlingham S. S., 80, High Street, King's Lynn
 1923 Burnand L. B., Bushy Place, Aylsham
 1895 Burrell W. H., F.L.S., 44, West Vicw, Horsforth, Yorks.
 1923 Burton Miss Amy, Newmarket Road, Norwich
 1923 Burton Arthur, M.D., Cromer
 1923 Burton Mrs. Arthur, Cromer
 1882 Burton S. H., F.R.C.S., St. Gils Strcet, Norwich
 1900 Bussey A., Reydon House, Harleston
 1921 *Buxton Anthony, Knighton, Buckhurst Hill, Essex
 1884 Buxton A. F., Fairhill, Tonbridge
 1887 Buxton E. G., F.Z.S., Catton Hall, Norwich
 1874 Buxton Geoffrey F., C.B., F.Z.S., Hoveton Hall, Norwich
 1906 Buxton R. G., Petygards, Swaffham, Norfolk
 1906 Buxton W. L., Bolwick Hall, Marsham, Norwich

C

- 1924 Cain George, Wells-next-the-Sea
 1909 Calvert E. M., Thorpe Road, Norwich
 1901 *Campbell Donald F., F.G.S., 119, Adelaide Road, London, N.W.
 1909 Campbell-Taylor J. E., Mavisthorpe, High Street, Southover
 Lewes
 1909 Cann Miss F. A., Norfolk and Norwich Hospital, Norwich
 1923 Carruthers Douglas, Barmer Hall, King's Lynn
 1923 Cater Capt. A. Parker, Norfolk Club, Norwich
 1907 Caton Rev. R. B., Great Fakenham Rectory, Thetford
 1902 Cator John, Woodbastwick Hall, Norfolk
 1923 Cator H. J., Woodbastwick Hall
 1922 Cator Miss Diana, Happisburgh, Norfolk
 1911 Chamberlin Rev. C. M., Witton Rectory, Norwich
 1924 Chambers Miss M. H., 32, College Road, Norwich
 1881 Chase R. W., Herne's Nest, Bewdley, Worcestershire
 1919 *Chasen F. N., The Raffles Museum, Singapore
 1924 Chittock A. T., Sheringham
 1924 Chittock Mrs. A. T., Sheringham
 1907 Christie J. A., M.P., Framingham Manor, Norwich
 1923 Citters A. van, Broadlands, Wroxham
 1923 Claridge Mrs., St. Giles' Plain, Norwich
 1894 Clarke W. G., F.G.S., 12, St. Philip's Road, Norwich
 1923 Clayton J., Cecil Road, Norwich
 1911 Cleather Rev. W. S., Barningham Rectory, Norfolk
 1923 Clodd Mrs., Strafford House, Aldeburgh, Suffolk
 1887 *Cocks A. H., M.A., F.Z.S., Poynetts, Skirmett, Henley-on-Thames
 1909 Coke Right Hon. Viscount, Holkham, Norfolk
 1924 Colbeck Major Roper, Lenwade Lodge, Norwich
 1923 Cole Lowry A. C., The Lodge, Sprowston
 1923 Cole Mrs. Lowry, The Lodge, Sprowston
 1923 Collin J. F., 419, Unthank Road, Norwich
 1924 Collings Dr. D. W., The Mount, Southend
 1921 Colman Capt. Geoffrey, Bixley Lodge, Norwich

Elected.

- 1903 *Colman Miss, Carrow Abbey, Norwich
 1903 *Colman Miss H. C., Carrow Abbey, Norwich
 1881 Colman Russell J., *President*, Crown Point, Norwich
 1919 Copeman W. O., 5, Claremont Road, Norwich
 1906 Corder John, London Street, Norwich
 1923 Coward T. A., M.Sc., Brentwood, Bowdon, Cheshire
 1921 Cozens-Hardy A., Oak Lodge, Sprowston, Norwich
 Crane W. C.
 1871 Cresswell Col. George, C.V.O., The Garden House, Hunstanton
 1886 Cross J. M., Acle
 1923 Crosse H. W., 7, Aylsham Road, Norwich
 1919 Currie Lt.-Col. J. W., Old Catton

D

- 1910 Dalby Rev. Alan, M.A., The Vicarage, Leamington-Hastings,
 Rugby
 1922 Dallas Chas. C., Eastley Wootton, New Milton, Hants.
 1920 Davey Guy, Aldborough, Norwich
 1914 Davies H. C., Old Lakenham, Norwich
 1923 Daukes Maj. A. H., 22, Egerton Terrace, London, S.W. 2
 1901 Day Donald D., F.R.C.S., Surrey Street, Norwich
 1917 Deacon G. E., Hethersett, Norwich
 1924 Dewing J. R., 48, London Road, King's Lynn
 1891 Digby A., Cley-next-the-Sea.
 1918 Donnison H., Boston, Lincolnshire
 1916 Doughty Chester G., 7, Upper Cliff Road, Gorleston-on-Sea
 1889 *Duleep Singh H.H. Prince Frederick, F.S.A., Blo' Norton Hall,
 Norfolk

E

- 1911 Easter W. C., 99, City Road, Norwich
 1877 Edwards J., F.E.S., *Hon. Mem.*, Colesborne, Cheltenham
 1924 Elliott T. B., 8, Brunswick Road, Norwich
 1923 Evans A. H., 9, Harvey Road, Cambridge
 1897 Evans H. Muir, M.D., Turret House, South Lowestoft
 1919 Evans-Lombe Major E., Marlingford Hall, Norwich

F

- 1885 Falcon Michael, Horstead, Norfolk
 1922 Ferrier Miss J. M., Hemsby Hall, Norfolk
 1922 Ferrier R. F. E., F.S.A., Hemsby Hall, Norfolk
 1923 Finch Alfred, The Red House, Old Catton
 1924 Fisher K., The School, Oundle, Northants
 1923 Fisher Sidney, Oaklands, St. Clement's Hill, Norwich
 1922 Fitzgerald Mrs W. H., Framingham Earl, Norwich
 1924 Fleming James M., "Pildawn," Queen Edith's Way, Cambridge
 1880 *Fletcher W. H. B., Aldwick Manse, Bognor
 1922 Fonnereau Miss Hilda, The Old Farm, Walcot-on-Sea, Norfolk
 1883 Forrester J. B., Thorpe Road, Norwich
 1924 Fowler E., Gunton Old Hall, Lowestoft
 1924 Fowler Mrs. E., Gunton Old Hall, Lowestoft
 1922 Frere Sir Bartle H. T., South Walsham Hall, Norfolk
 1877 Fryer H. F., The Priory, Chatteris

G

- 1914 Gadesden Miss F., White Gates, Gresham. Holt
 1902 Garstang Walter, D.Sc., The University, Leeds
 1924 Gay Miss Ellen, Thurning Hall, Guist, Norfolk
 1922 Gaze R., 105, Earlham Road, Norwich
 1903 Geldart Miss Alice M., Cotman Road, Norwich
 1908 Gilbert R. T. E., Ashby Hall, Norfolk

Elected.

- 1923 Gill S. T., Rupert Street, Norwich
 1921 Glover T., Cliff House, Norwich
 1909 Goodchild Herbert, The Chestnuts, Unthank Road, Norwich
 1924 Gooch Sir Thos., Bart., Benacre Hall, Suffolk
 1924 Gooch Brian, Benacre Hall, Suffolk
 1924 Gooch Richard, Benacre Hall, Suffolk
 1901 Goose A. W., 10, Sandringham Road, Norwich
 1922 Gossage Mrs., Leet Hill, Kirby Cane, Norfolk
 1922 Gossage W. W., Leet Hill, Kirby Cane, Norfolk
 1921 Graves Mrs., Oulton Lodge, Aylsham, Norfolk
 1919 Greatorex H. A., Witton, Norwich
 1921 Green Capt. S. V., Sutton Lodge, Ipswich Road, Norwich
 1924 Green Sir E. A. Lycett, Bart., Ken Hill, Snettisham, King's Lynn
 1922 Greene, Dr. A., 4, Theatre Street, Norwich
 1918 Gresham School The, Holt, Norwich
 1913 *Grey of Fallodon, The Rt. Hon. Viscount, K.G., Fallodon,
 Lestbury, Northumberland
 1920 Gudgin S. H., "Homeland," Cley Road, Swaffham, Norfolk
 1918 Gurney Major C., Berry Hall, Walsingham
 1902 *Gurney Miss Cicely, Keswick Hall, Norwich
 1896 *Gurney Sir Eustace, M.A., F.Z.S. V.P., Walsingham Abbey,
 Norfolk
 1893 *Gurney Gerard H., F.Z.S., Keswick Hall, Norwich
 1901 Gurney Q. E., Bawdeswell Hall, Norfolk
 1894 *Gurney Robert, M.A., F.L.S., F.Z.S., *Hon. Treasurer*, Ingham
 Old Hall, Norfolk
 1918 Gurney Mrs. Robert, Ingham Old Hall, Norfolk

H

- 1924 Hadfield Travers, Stoneleigh, Knutsford, Cheshire
 1892 *Haigh G. H. Caton, Grainsby Hall, Great Grimsby
 1905 Halls H. H., 130, Hall Road, Norwich
 1908 Hamond Lieut.-Com. C.E., R.N., 40, Lyndhurst Road, Lowestoft
 1906 *Hamond Major Philip, D.S.O., Morston, Holt, Norfolk
 1923 Hankin E. H., Sc.D., "Lanbeever," Wroxham, Norfolk
 1923 Harbord Miss P., Mousehold House, Norwich
 1919 Harker Miss Sylvia, Blofield Hall, Norwich
 1908 Harker William, Blofield Hall, Norwich,
 1923 Harmer Russell T., St. Andrew's Works, Norwich
 1881 *Harmer Sir Sidney, K.B.E., F.R.S., 20, Courtfield Gardens,
 London, S.W. 5
 1906 Harris Rev G. H., St. Paul's Vicarage, 47, Trafalgar Road,
 Moseley, Birmingham
 1923 Hastings Lord, Melton Constable Park, Norfolk
 1923 Hibberd Rev. H., Burnham Thorpe Rectory, King's Lynn
 1893 *Hill Alexander, M.D., F.R.S., Highfield Hall, Southampton
 1919 Hinde Dr. E. B., Gurney Court, Magdalen Street, Norwich
 1891 Hinde F. C., *Hon. Librarian*, 4, Quebec Road, Norwich
 1923 Hines E. S., 10, Parker Road, Norwich
 1915 Hitchcock Arthur, Tamworth House, Tennyson Road, King's
 Lynn
 1921 Hoare Miss Marjorie, 17, Camberley Road, Norwich
 1922 Home Miss H. M. Logan, Runton Hill, West Runton
 1919 Horsfall Charles, Stody Lodge, Melton Constable, Norfolk
 1923 Hoskins Maj. Gen. Sir Reginald, Army and Navy Club, London
 1919 Howard Miss D. D., West Parade, Norwich
 1919 Howard H. J., 6, College Road, Norwich
 1887 Howard R. J., M.B.O.U., Shear Bank, Blackburn
 1924 Howes Miss Alice, 26, Cathedral Close, Norwich
 1923 Hunter Miss E. M., Mattishall Hall, East Dereham

Elected.

- 1923 Hunter H. M., Mattishall Hall, East Dereham
 1899 Hurrell H., 25, Regent Street, Gt. Yarmouth
 1915 Hutchinson Donald, M.D., 2, Gordon Road, Lowestoft

I

- 1922 Ives R. D., Erpingham Grange, near Norwich

J

- 1921 Jarrold T. H. C., Pine Banks, Thorpe St. Andrew
 1891 Jarrold W. T. F., Thorpe St. Andrew, Norwich
 1923 Jay H. H., 28, High Road, Southtown, Great Yarmouth
 1896 *Jodrell Sir Alfred, Bart., Bayfield Hall, Norfolk
 1909 Jickling Colonel C. M., Smallburgh Hall, Norfolk
 1923 Jolly T. L., Church Farm, Aylmerton, Norfolk
 1885 Jones Sir Lawrence, Bart., 39, Harrington Gardens, London, S.W., 7.

K

- 1897 Kerrison Colonel E. R. A., C.M.G., Burgh Hall, Aylsham, Norfolk
 1912 Ketton-Cremer W. C., Felbrigg Hall, Norfolk
 1904 Kinder Rev. E. H., Kirby Bedon Rectory, Norfolk
 1898 Knight Edward, Keswick Old Hall, Norwich
 1921 Knight John, East Walton, King's Lynn

L

- 1918 Lascelles Miss Susan, Swanton Novers, Norfolk
 1915 Laurence H. L. B., King's Lynn
 1869 o.m. Laurence Rev. J. A., Dilham Rectory, Norwich
 1921 le Strange C., Hunstanton Hall
 1889 Lee Warner Henry, Swaffham
 1909 Leicester The Right Hon. the Earl of, G.C.V.O., C.M.G., V.P.,
 Holkham
 1899 Leney F., Castle Museum, Norwich
 1923 Lipscomb R., Hannington House, Fakenham
 1923 Lipscomb Mrs., Hannington House, Fakenham
 1924 Little J. E., 19, The Avenue, Hitchin
 1923 Livesay Surg. Cap. R.N., St. Andrew's Hospital, Thorpe,
 Norwich
 1922 Livesay Mrs., St. Andrew's Hospital, Thorpe St. Andrew
 1922 Lloyd Capt. L., Taverham Mill, Norwich
 1924 Lloyd Miss, Taverham Mill, Norwich
 1881 Long F., The Close, Norwich
 1899 Long S. H., M.D., F.Z.S., M.B.O.U., *Hon. Sec.*, 31, Surrey Street,
 Norwich
 1907 Long Mrs. S. H., 31, Surrey Street, Norwich
 1919 *Long Miss E. M., 31, Surrey Street, Norwich
 1924 Long Miss M., 10, The Close, Norwich
 1923 Long G. S. B., St. Giles Plain, Norwich
 1921 Lucas The Baroness, Hickling, Norfolk

M

- 1924 MacKenzie Miss G., The Cottage, Ingworth, Norwich
 1923 Mackey, Mrs., The Red Cottage, Berghapton, Norwich
 1923 *Macpherson A Holte, 21, Campden Hill Square, Kensington, W.8
 1923 Mann Miss, Thelveton Hall, Scole, Norfolk
 1905 Mann Sir Edward, Bart., Thelveton Hall, Norfolk
 1906 Marriott F. W. P., 11, Queen Street, Norwich

Elected.

- 1892 Marsham Major H. S., Rippon Hall, Marsham, Norfolk
 1912 Mason A., Bank Plain, Norwich
 1911 Master George, M.D., Bury St. Edmunds
 1893 Mayfield A., F.L.S., Mendlesham, Stowmarket
 1922 Mc Kenna Mrs. Reginald, 36, Smith Square, Westminster, S.W. 1.
 1898 Meade-Waldo Edmund G. B., Hever Warren, Hever, Kent
 1924 Middleton W. H., 4, Caenarvon Road, Norwich
 1877 Miller Henry, Bosmere House, Norwich Road, Ipswich
 1922 Miller Osborne, "Heathlands," Fakenham, Norfolk
 1923 Minns Mrs. E., Hammond's Wood, Frensham, Surrey
 1923 Moppe Lewis E. van, Cliffside, Overstrand
 1924 Mortimer Ernest, The Red House, Wrentham, Suffolk
 1922 Mountfield Rev. D., Horsford Rectory, Norwich
 1922 Mountfield Miss M., Horsford Rectory, Norwich
 1921 Moxey J. G., Framingham Hall, Norwich
 1919 Moxey Llewellyn, Framingham Hall, Norwich
 1923 Moxham M. C., Aldborough, Norwich
 1920 *Mullens Major W. H., Westfield Place, Battle, Sussex
 1921 *Murton Mrs., Cranbrook Lodge, Kent
 1920 Myhill Miss M., Church Farm, Hethel, Norwich

N

- 1904 Napier A. J., *Hon. Mem.*, Teviotdale, Netley Abbey, Hants.
 1910 Nash J. T. C., M.D., D.P.H., Shirehall, Norwich
 1922 Nevill Rev. R. W., Beighton Rectory, Norwich
 1911 Newman L. F., St. Catherine's College, Cambridge
 1893 Newton E. T., F.R.S., *Hon. Mem.*, H.M. Geological Survey
 Office, 28, Jermyn Street, London
 1913 Newton W. C. F., The Meadows, Saham Toney, Watton
 1889 Nicholson W. A., *Hon. Mem.*, 81, Surrey Street, Norwich
 1915 Nightingale S. R., Scratby Hall, Great Yarmouth
 1915 Norwich Public Library
 1919 Norgate Philip, Swanington, Norfolk

O

- 1921 Offord Miss Georgina, St. Giles' Plain, Norwich
 1914 Oliver Prof. F. W., F.R.S., *Hon. Mem.*, University College,
 London
 1924 Orgill Miss M. A., Garboldisham, Diss

P

- 1889 Page G. W., Walsingham, Norfolk
 1919 Pain Percy, Dersingham, King's Lynn
 1913 Paine Rev. N. W., Great Melton, Norfolk
 1919 *Palmer Mrs. P. Hurry, "Red Roofs," North Drive, Great
 Yarmouth
 1912 Parker H., 10, Aspland Road, Norwich
 1921 Parker R. E. Easton Hall, Norwich
 1883 *Parkin Thomas, M.A., F.Z.S., High Wickham, Hastings
 1873 Partridge Rev. W. H., M.A., St. Peter's, Sandown, I. of W.
 1923 Partridge F. H., St. Helier, Hunstanton
 1889 Patterson Arthur H., *Hon. Mem.*, 32, Lichfield Road, Great
 Yarmouth
 1920 Patteson Mrs. F. E., Great Hautbois House, Norfolk
 1901 *Paul J. J. Dawson, Eaton Grove, Norwich
 1911 *Paylor Donald, Castle Museum, Norwich
 1923 Peed John, Aylsham
 1924 Pelham Miss Thursby, Gunton Cliff, Lowestoft
 1920 Pelham Mrs. Sidney, 85, Newmarket Road, Norwich
 1903 Petre Col., Westwick Hall, Norfolk

Elected.

- 1872 Pigott Sir T. Digby, C.B., F.R.G.S., Sheringham, Norfolk
 1923 Pope Dr. G. Steven, Heigham Hall, Norwich
 1880 Preston A. W., F.R.Met.Soc., Christ Church Lodge, Norwich
 1919 Preston Sir E., Bart., Beeston Hall, Norwich
 1900 Preston F., Thorpe Mansions, Norwich
 1913 Purdy T. W., Woodgate, Aylsham
 1887 Pycraft W. P., A.L.S., F.Z.S., British Museum (Natural History),
 London, S.W.

R

- 1924 Richmond H. W., F.R.S., King's College, Cambridge
 1924 Rippingall Neale F., Langham, Blakeney, Norfolk
 1911 Rising A. P., The Manor House, Ormesby, Great Yarmouth
 1908 Riviere B. B., F.R.C.S., M.B.O.U., St. Giles' Plain, Norwich
 1893 Roberts E. T., 34, Carlisle Road, Norwich
 1919 Robinson F., Watton, Norfolk
 1869 o.m. Robinson H. S., Eaton, Norwich
 1908 Rogers Commander F. S., R.N., Ingham New Hall, Norfolk
 1909 Rogers Rev. Henry, Clarendon, Lowestoft
 1884 *Rosebery The Right Hon. the Earl of, K.G., 38, Berkeley
 Square, W. 1.
 1908 *Rothermerc Rt. Hon. Lord, Hemsted Park, Cranbrook, Kent
 1897 *Rothschild Rt. Hon. Lord, F.Z.S., Tring, Herts.
 1922 Rounce G. H., Chesterfield Villas, Cromer
 1879 Royal Microscopical Society, President of the, *Hon. Mem.*,
 20, Hanover Square, W.
 1918 Rudd A. J., F.Z.S., London Street, Norwich
 1906 Rumbelow P. E., 27, Rodney Road, Great Yarmouth
 1919 Russwurm Mrs., Scarning Grange, E. Dereham
 1901 Rye Walter, 66, Clarendon Road, Norwich

S

- 1922 Sargeant Miss K., Mulbarton Hall, Norwich
 1921 Sherlock A. F., 45, York Road, Great Yarmouth
 1922 Shepherd Dr. Samuel, Aylsham
 1924 Shepherd Miss A. M., Convalescent Home, Lowestoft
 1921 Sitcock Chas., 56, Southwark Bridge Road, London, S.E.1.
 1919 Simpson F. T., Sheringham, Norfolk
 1917 Smalley F. W., "Hawthorns," 193, Clapham Road, S.W. 9
 1919 Smith Col. H. F., Didlington Hall, Norfolk
 1915 Smith Mrs., Ellingham Hall, Bungay
 1891 Smith W. R., Harleston, Norfolk
 1909 Snow T., The Craig, Windermere
 1921 Soman A. E., 37, St. Andrew's Street, Norwich
 1917 Sowels Miss, Thetford
 1911 Spurrell J. T., St. Faith's, Norfolk
 1923 Spurrell Miss M., Manor House, Newton St. Faiths, Norwich
 1923 Spurrell Miss P., Manor House, Newton St. Faiths, Norwich
 1922 Spalding G., 9, St. Stephen's Street, Norwich
 1921 Stimpson Edward, Sall Moor Hall, Reepham, Norfolk
 1922 Sumpter Dr. B. G., Brancaster Staithe, King's Lynn
 1896 Sutton W. Lincolne, F.I.C., Eaton, Norwich

T

- 1921 Taylor Dr. Mark R., 49, Mount Pleasant, Norwich
 1921 Taylor Mrs. Mark, 49, Mount Pleasant, Norwich
 1878 Taylor Shephard T., M.B., The Mount, Edgefield, Melton
 Constable
 1921 Thain D., West Somerton, Norfolk
 1921 Thomson Mrs. D. G., Lingwood, Norwich

Elected

- 1886 Thouless H. J., " Corfe," College Road, Norwich
 1910 Ticehurst C. B., M.B.O.U., 46, London Road, N. Lowestoft
 1896 Tillett Wilfrid S., 2, Claremont Road, Norwich
 1920 Todd Lt.-Col. Eardley, Mundham House, Brooke
 1902 Todd R. A., B.Sc., Plymouth
 1913 Tomes Sir Chas., LL.D., F.R.S., Mannington Hall, Norfolk
 1923 Tomes Lady, Mannington Hall, Norfolk
 1923 Torbell C. J., 11, Essex Street, Norwich
 1910 Tracy N., 3, King Street, King s Lynn
 1921 Troubridge Sir Thos. H., Bart., 48, Gt. Cumberland Place,
 London, W.
 1896 True F. W., *Hon. Mem.*, U.S. National Museum, Washington,
 U.S.A.
 1906 Turner Miss E. L., F.Z.S., H.M.B.O.U., Langton Close,
 Girton, Cambridge
 1923 Turner Miss, The Lodge, Postwick
- U
- 1923 Upcher Rev. E. C. S., Great Dunham Rectory, Norfolk
 1921 Upcher H. E. S., The Gables, Upper Sheringham
- V
- 1880 Vaughan Matthew, The Limes, Marlborough
 1917 Vincent James, Hickling, Norfolk
- W
- 1921 Wallis Rev. M. C., The Vicarage, St. Faith's
 1875 Walter J. H., F.Z.S., Drayton Hall, Norwich
 1923 Walter Mrs. Cyril, Old House, Drayton, Norwich
 1921 Walton Miss, 17, Camberley Road, Norwich
 1923 Waterfield Mrs., Attlebridge, Norfolk
 1923 Waterfield Miss, Attlebridge, Norfolk
 1923 Waterfield Miss Penelope, Attlebridge, Norfolk
 1923 Wathan Mrs. Gerard, 83, Comeragh Road, London, W.14
 1923 Watson Miss Violet, " Miramar," Sheringham
 1923 Wenn Mrs., Ingham, Norfolk
 1923 Wenn Miss, Ingham, Norfolk
 1883 *Whitaker Joseph. F.Z.S., Rainworth Lodge, Mansfield
 1901 Wild Edward, The Hawthorns, Eaton, Norwich
 1922 Willett W. L., The Rosary, Metfield, Kent
 1913 Williams Miss Margaret, 28, The Close, Norwich
 1923 Wilson Gerald, The Thatch, Thorpe St. Andrew
 1923 Wilson Mrs., The Thatch, Thorpe St. Andrew
 1923 Wilson Miss Hazell, High House, Thorpe St. Andrew
 1909 Witherby H. F., M.B.E., F.Z.S., 326, High Holborn, W.C.
 1924 Wolsey Noel G., 15, King Street, Great Yarmouth
 1923 Woolsey G. E. W., Judge's Walk, Norwich
 1907 Wormald Hugh, M.B.O.U., Heathfield, East Dereham
 1922 Wortley Francis, " Congham," Sheringham
 1924 Wright B. D. Z., Hoveton St. John, Norwich
 1920 Wyllys Hugh, " Shrublands," Southtown, Great Yarmouth
- Y
- 1923 Young Lieut.-Com. E. Hilton, D.S.O., M.P., 18, Abingdon
 Street, Westminster, S.W.1.
 1915 Yarmouth Free Library, The, Great Yarmouth

TOTAL

Honorary Members	...	...	9
Life	"	...	33
Ordinary	"	...	351

 393

The Treasurer in Account with the Norfolk and Norwich Naturalists' Society, Year Ending April, 1924

I. GENERAL ACCOUNT

	Dr.	£	s.	d.		Cr.	£	s.	d.
1923-24.									
To Balance, April, 1923—									
On Deposit	...	13	5	5			122	2	6
On Current a/c	...	23	3	8			66	4	0
		36	9	1			190	15	0
Subscriptions	...	143	5	6			...	6	0
" Sale of "Transactions"	...	2	15	5			...	5	3
" Sale of "Flora of Norfolk"	...	3	1	4			...	8	10
" Special Publication Fund	...	80	7	6			...	5	0
" Payment by W. B. P. F. for printing Report	...	10	0	0			...	1	0
" Legacy from the late J. H. Gurney	...	50	0	0			...	0	13
" Interest on War Stock	...	2	16	4			...	11	15
" Interest on Deposit a/c	...	1	0	2			...	0	10
" Excess of Expenditure over Income	...	0	12	1			...	0	5
By Cost of "Transactions," vol. xi., part iv.						
Printing, Reprints, etc.
Illustrations
Wrappers and packing
" Norfolk & Norwich Library—Rent of Room
" Printing Circulars, etc.
" Expenses of Meetings
" Assistant Secretary
" Record Cards for Library
" Insurance
" Portrait of the late J. H. Gurney
" Wreath
" Cheque Book
" Postages
" 31 Savings Certificates (to Life Membership Fund)
" Balance on deposit
		330	7	5			330	7	5

KLV

Examined and found correct,
W. A. NICHOLSON, Hon. Auditor.

ROBERT GURNEY,
Hon Treasurer

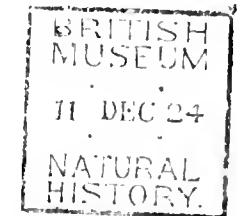
II. SPECIAL PUBLICATION FUND

1923-24.		£	s.	d.	Transferred to Current Account			£	s.	d.
To Donations—										
R. J. Colman	...	10	0	0	...	...	...	...	...	...
G. H. Gurney	...	10	0	0	...	...	...	...	...	...
S. H. Long	...	10	0	0	...	...	...	...	...	...
The late F. W. Harmer's Executors	...	12	17	6	...	...	...	...	...	...
Prof. F. W. Oliver	...	7	17	6	...	...	...	...	...	...
J. R. Brooks	...	5	0	0	...	...	...	...	...	...
R. Gurney	...	5	0	0	...	...	...	...	...	...
F. H. Barclay	...	3	0	0	...	...	...	...	...	...
E. G. Buxton	...	2	2	0	...	...	...	...	...	...
H.H. Prince F. Dhuleep Singh	...	2	0	0	...	...	...	...	...	...
J. Cator	...	1	1	0	...	...	...	...	...	...
S. H. Burton	...	1	0	0	...	...	...	...	...	...
Sir E. Gurney	...	1	1	0	...	...	...	...	...	...
Sir L. Jones, Bart.	...	1	1	0	...	...	...	...	...	...
Dr. E. B. Hinde	...	1	0	0	...	...	...	...	...	...
Dr. B. G. Sumpter	...	1	1	0	...	...	...	...	...	...
Miss Barrow	...	0	13	0	...	...	...	...	...	...
Rev. M. C. Wallis	...	0	11	0	...	...	...	...	...	...
Col. Bulwer	...	0	10	0	...	...	...	...	...	...
Mrs. Livesay	...	0	10	0	...	...	...	...	...	...
Rev. M. C. H. Bird	...	0	10	0	...	...	...	...	...	...
Capt. Lloyd	...	0	10	0	...	...	...	...	...	...
C. Borrer	...	0	10	0	...	...	...	...	...	...
Rev. H. Rogers	...	0	10	0	...	...	...	...	...	...
F. Long	...	0	10	0	...	...	...	...	...	...
Sums under 10s.	...	1	12	6	...	...	...	...	...	...
		£80	7	6						

III. LIFE MEMBERSHIP FUND

1923-24.					
To Balance at Savings Bank	£	s.	d.		
" Life Members' Payments	...	23	14	5	
" From General a/c	...	19	0	0	
" Interest on War Loan	...	24	16	0	
" Interest on Bank a/c	...	2	16	4	
	...	0	11	6	
		<u>£70 18 3</u>			
					£
					s.
					d.
					2 16 4
					24 16 0
					43 5 11
					<u>£70 18 3</u>

By Interest on War Loan transferred to General a/c
 ,, Purchase of 31 National Savings Certificates, dated July 17, 1923
 ,, Balance at Savings Bank



INVESTMENTS AND ASSETS

64 War Savings Certificates, dated 4 4.18	£	s.	d.
£56 8s. 5d. War Loan, 1929-47	...	64	0 0
31 National Savings Certificates, dated 17.7.23	...	50	0 0
Balance at Bank	...	24	16 0
	...	43	5 11
		<u>£182 1 11</u>	

Examined and found correct,
 W. A. NICHOLSON, Hon. Auditor

NORFOLK WILD BIRD PROTECTION FUND

Year ending December 31st, 1923

Balance from 1922	£	s.	d.		
Subscriptions	...	46	9	4	
Blakeney Collecting Box	...	133	9	8	
	...	2	16	6	
		<u>£182 15 6</u>			
					EXPENDITURE
Watches—Breydon	...	...	...	...	£
Salthouse	...	...	...	...	s.
Scott Head	...	...	...	...	d.
Blakeney Point	...	...	...	...	39 6 0
Wolterton	...	...	...	...	20 2 1
Horsey	...	...	...	...	24 9 2
Cheque Books	...	...	...	...	27 0 0
Armlets	...	...	...	...	10 0 0
Postages, etc.	...	...	...	...	4 0 0
Balance	...	...	...	...	0 7 0
	...	...	...	...	0 16 6
	...	...	...	...	3 11 2
					<u>£53 3 7</u>
					<u>£182 15 6</u>

Examined and found correct,
 W. A. NICHOLSON, Hon. Auditor

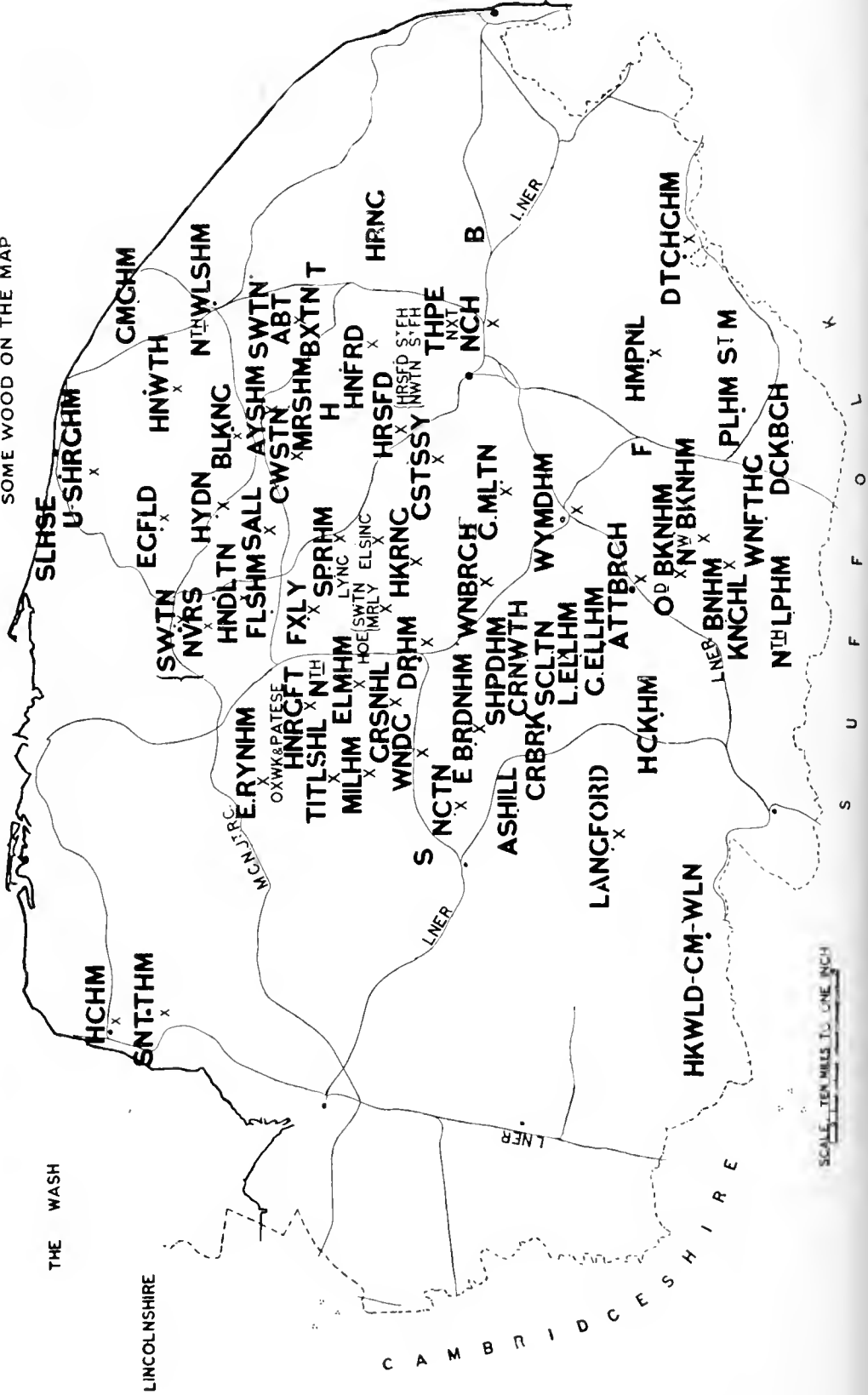
ROBERT GURNEY,
 Hon. Treasurer

BRITISH
MUSEUM
11 DEC 24
NATURAL
HISTORY.

NORFOLK - PARISHES OF DOMESDAY 1086. - WOOD FOR 100 PICS.

X. = FADEN. 1790.

SOME WOOD ON THE MAP



ADDRESS

*Read by the President, SIR HUGH R. BEEVOR, BART.,
to the Members of the Norfolk and Norwich Naturalists'
Society, at their Fifty-fifth Annual Meeting, held at the
Norwich Castle Museum, April 29th, 1924.*

LADIES AND GENTLEMEN,

Before proceeding to the subject matter of my Address I must refer in a few words to the position of the Society as I find it at the termination of my presidency.

Judging by the attendances at the monthly meetings during the past session and the interest shown in the subjects discussed, I think I may say that the Society is full of life. If our numerical strength is any criterion of our position, then we have just cause to congratulate ourselves. During the year we have elected fifty-three new members; two have died and four have seceded for various reasons. Our total membership is now 402—a record in our history.

Of the members who have been removed by death, Dr. Wheeler was well known to many of us as a good naturalist. He was our President in 1891-2, and was a regular attendant at our meetings.

During last summer we arranged two excursions which were evidently popular with members: the first was to Blakerey Point, where Professor Oliver and his staff received and welcomed us; the other was to our newly-acquired Nature Reserve, Scolt Head Island, where we were all hospitably entertained by our ex-President, Mr. Colman. In carrying out one of the objects for which we were founded, namely, the preservation of the fauna of the county, our Wild Birds' Protection Committee is gradually extending its field of operations. We have undertaken for the National Trust the responsibility for providing a watcher on Scolt Head—a much-needed action on our part; and we have set an example this year to other bird protection societies by appointing to this post one of the

best-known bird photographers—Miss E. L. Turner. We hold the opinion that the post of watcher on such a highly interesting and undeveloped area as is Scolt Head Island should be held, if possible, by an educated, scientifically-trained naturalist, and in the person of Miss Turner we have such an one.

May I plead for an extended support for our fund for wild bird protection in Norfolk; at the present time we receive subscriptions for it from less than one in five of our members.

With regard to our Transactions, I think you will agree with me that the last number fully maintained the high standard we have set ourselves in these publications. As you have heard from Mr. Gurney, the expense of bringing out the last Part was great, and without aid from the "Special Publication Fund" we should have been unable to foot the bill.

NORFOLK WOODLANDS, FROM THE EVIDENCE OF CONTEMPORARY CHRONICLES

I FIRST call attention to "The History of a Norfolk Manor," by Miss Davenport, a very valuable local history.

The Manor is that of Forncett, where the Bigods were the Lords almost continuously for two to three centuries after the Conquest. The Manor is not, so far as I know, an exceptional one except in its fullness of record. It had no more woodland than was common, but it gives us sufficient detail to see what was being done with it from 1270 to 1300 and 1375. The wood receipts are given every year, mainly from the underwood and the alder groves, and these were sold by the acre (probably ten or twelve years' growth). The price is the same as at different parts of Norfolk, such as Sheringham, Carleton Rode, and Colkirk, sold about the same date—1300. It was equivalent to the run of ordinary farm land, threepence and fourpence an acre, the same as the arable, better than the pasture, but much below the meadow. Receipts come sometimes from the bark of trees. The sum of 12s. 4d. probably implies 110 trees felled, three-farthings a tree being the probable price for bark. Whether these trees were felled in underwoods with standards in them, or belonged to high woods, there is no record.

In the year 1300, £35 is taken for timber, and this may be accounted for as the estate was to leave the family at this time.

The accounts give particulars of rebuilding of barns, mending of cider presses, making ploughs, hurdles for the hay cart, rizzors for the building of mud walls, mending of the vessels of the house—that is, by the cooper's aid (there was no crockery at that day), and thatching the roofs.

The cooper and the carpenter took twice as much pay as the labourer, that is, twopence for a day's pay. In winter the lord had at his disposal the winter works of his tenants, half a day only, which were often sold at three a-penny. With the ploughman barter took the place chiefly of money payments, his wage being 13s. a year and a quarter of barley every ten weeks.

There was evidence of work being done for the care of the woodlands at the fences of the wood at this date, but that the Bigods protected their woods is more distinctly shown in the good annual yield and income from the underwood every year.

The elder branch of the family of the lord died out in 1305. In the accounts for the year 1375, the black death having intervened, the estate income had fallen. Where the wood used to give five per cent. of the income it was giving almost nothing. Also at this time nearly all the timber must have disappeared, for when they began to build a cow-house and stable they had to go off to Ashwellthorpe to get the rafters and pay three-halfpence a-piece for them. The Manorial economy was changed. Most of the winter works of the tenants were redeemed. Wages were doubled. Ordinary labour was especially increased, the hedger getting as high a wage as the carpenter. Sheep were being farmed—a new stock on this Manor. They were run on the demesne and common land, and perhaps in the demesne woods too, for in Broome Wood pasturage was sold, and in Lound Wood fourpence is taken for the agistment of eight cattle. However, some woods remain which were not neglected, as in Gilders Wood six days were given to gap-stopping. Some new fences were being made by planting thorns and ash plants.

No large timber was growing upon the Manor, for when they required a centre-post for the windmill they fetched it from Winfarthing. The entry is made of the expenses of eight men and two carts and sixteen horses, a speaking comment of a want of roads and great difficulties and expenses of transport.

Except the church roof, I can imagine no other demand for arge timber than the mill, and one would imagine that the top of a felled tree was of more service to the dwellers of the Manor than its main timber. Their common requirements for house wood—that is, laths and resues (a large lath) for the plasterer, the swathes (bonds) and pricks (broches) for the thatching, the studs and rafters—would all come from the underwood. As with house wood, still more so was it with the firewood, hedge wood, and implement wood—demand was constant. Their houses were small enough, no doubt, and easily moved. Thus the carpenter agrees to new-build a house for 10s., and the dauber's account is 6s. 8d., the thatcher's account, 5s. 4d. the straw and carting, it 3s. 5d., food for men, getting laths, and works from men of the Manor bring the account up to £1 17s. 0d.—say a £2 cottage. I have seen a lower price than this in the next parish of Hapton—North Creake Abbey in 1360—paid for a house there, newly built, 10s.

Such are the kind of entries of account rolls which one has to sift out before we can find out what demands were made upon the woods. John Hall, poet and Bishop of Norwich, really described the villager's residence in the lines—

“Of one bay's breadth, God wot a silly cote!

Whose thatched spars are furred with sluttish soot,
A whole inch thick, shining like black Moors brows,
Through smoke that through the headless barrel blows
At his beds feete feeden his stalled team,
His swine beneath, his pullen o'er the bean.”

That was written about 1610. Lord Ernle remarks, it held good for the three previous centuries, supplanting a worse structure before it.

The Lady of the Manor of Forncett in 1383, now Countess Margaret of Norfolk in her own right, lived at Lopham, and she settled on herself for life in Lopham sixty acres of wood and the pannage and keeping of twenty-four swine and one boar in her park there, with liberty for gathering acorns for three days with twenty-five men.

Pannage or food for pigs is the profit of a wood, which profit forms the subject of assessment in the Domesday Record, and Domesday Record, when it states “wood for so many pigs,” is mentioning in pannage a profit it can tax because the fruit

of the trees as "acorns" are the property of the Lord of the Manor.

If the timber were ash or alder I see no reason that it should be assessed or mentioned. The commoners with their rights of house wood, hedge wood, hearth wood, and cart and implement wood, could fell the ash and the alder, the aspen and the willow, which might grow upon the waste, but as a question of fruit, the oak, beech, thorns, and crab-apples could not be felled in a common woodland.

In the Norfolk assessment the word "underwood" or its equivalent is not seen, though it is frequently mentioned in other counties, and that may well be due to the scope of the enquiry in the county, or it might be due simply to the copyist, for the abbreviation "silv." would do equally well for "silva" or "silvellum." The pannage no doubt referred to oak woods for the pig; such woods were as likely to be coppice with standards as high oak forest.

I have put upon a map the names of those parishes which have been assessed to 100 pigs or more. The round number of 100 is frequent and implies but rough estimate was made; in such a problem approximation alone is possible.

If a line is drawn in the map from Swaffham to Holt, north-east, and from Swaffham to South Lopham, south-east, while woodland was common on the eastern side of these lines, it was practically absent to the west of them. To the east is the stronger soil, the bean land, to the west is the sandy country, unclad with wood even in prehistoric times. It is remarkable that in the eastern sector nearly every parish has its own little wood, if estimated at only ten or twenty pigs to feed. This suggests great clearances of long ago, but it suggests something more, and that is that when the woodland fell to a low point it was being protected. These small woods may have been simply underwoods allowing food for but a very few pigs, at Brádeston two only (B. on map)

Of the pannage of oak woods we wonder how many acres there were to compare with a number of pigs. I find one direct reference to this problem in the county in the year 1279. Buckenham Manor—100 acres of wood—provided pannage for eighty-four pigs. In Cambridgeshire some hundred rolls dated about the year 1200 show in wooded parishes two acres

of wood to a pig was a common proportion. The commoners had to pay a fee which was one penny a pig at Doomsday, and rose to twopence and threepence by 1300, but this fee was not universal, for in a recital of the customs of the Manor of Blickling in the year 1307 the record runs:—

“ It is ancient domain and pays no pannage fee.”

No acreage of large woods is given in the few instances where acreage of wood is mentioned in Norfolk Doomsday. There are only two woods which are mentioned by name, Fangham Wood, which had been recently seized by the Bishop of Thetford and added to the Manor of Colkirk, and the other was part of a big wood at Hempnall called “ Schieteshaga,” which the Abbot of Holme claimed. This last shows by its name, as well as by its record, that the wood was divided, and the suffix “ haga ” tells us also it was fenced.

So soon as the written record of a wood is first seen the wood has often its name, and many Norfolk woods were called Hawe, sometimes alone, sometimes with that affix. This name occurs in Banham, Buckenham, Lopham, Shipdham, and Pulham, and the name of the wood with this Saxon affix may be as old as the name of parishes so named, viz: Strumpshaw, Ashmanhaugh, and Belaugh.

I find a prefix “ gress ” or “ grease ” given to woods in the parishes of Wymondham, Pulham, and Bradeston, a term of the Normans, meaning steps, and it suggests entry into a wood by step ladder, just as is now the entry into Richmond Park from the top of Kingston Hill.

Underwood needs the protection of fencing. It is reasonable to think that woods were commonly fenced when they were in private ownership, but it would apply equally to the commonable woods, and in the case of the parish of Blickling the commoners had to repair the fences round the wood lest damage should be done by defective enclosure in 1307.

When one calls to mind how old the cultivation of woods really is, and that Pliny was able to write that an acre of chestnut coppice at eight years old would supply twenty acres of vineyard with poles, we should not be surprised at some care of underwood being taken at the Norman Conquest..

It was not in every county that people could fence their woods as they chose. Norfolk, Suffolk, Cambridge, and Kent were

the only counties without any Royal forest. In the other counties, often containing forests which spread over half the county, the question whether you may fence either your wheat-land or your wood-land was very much dependent upon the opinion of the Forest Courts.

We hear occasionally in our lawsuits of to-day of some question of impeachment of waste of the woods. Now we may know what the forest law meant, and see the disabilities you laboured under according to what the Forest Officer might say as to your own woods being "wasted." All the test that he employed was to stand by a felled tree and look round, and if he saw five trees cut down, that was impeachment of waste. What was the sequel? Fine "according to the means of the offender," and annually re-current tax until the wood has grown up again. Norfolk was free from the Forest Law, and did not thus suffer. Such suffering was common according to Matthew Paris, and Maddox says, "as to fines and amerancements of the forest by the revenue rolls of King Henry II., Richard I., and John, they appear to be many and great, so that from the forest counties by trespass, defaults, purprestures, and otherwise, an ample revenue was yearly raised." Maddox cites these instances from the "Piperolls of John":—

Adam the Ape fined twenty marks for having set traps in his own wood, and Robert the Smith half a mark for making the traps. In 1205 Master Culumb is amerced 100 marks for eighty rafters taken in the forest by night—their value altogether being less than one mark, his fine was a savage one. The Abbot of Coggeshall pays forty marks for licence to enclose his wood with ditch, fence, pale, and gates, and make of it a park, and to fell in it whatever they wish, taking things green and dry whatever they wish, and having in the same Manor their own dogs, and dogs of their own men not expeditated as is contained in the King's Charter.

That the public must have felt their disabilities most severely is shown by the big payments they proffered to escape them, thus:

The men of Devonshire pay 5,000 marks for dis-afforesting Devonshire, and the Abbot of Peterborough 1,220 marks for disforested lands they held in Naseborough,

while about this time the only payment we hear of from Norfolk is that the county pays forty marks that it may be treated lightly.

A full and entertaining study of English forests is to be found in Turner's "Select Pleas of the Forest" and W. R. Fisher's "The Forest of Essex." I quote one sample from Turner from an enquiry held at Rutland Eyre in 1269 upon the extortions of the forester Peter de Neville, and the indictment starts off:—"When King Henry, a son of King William the bastard, " was on his way to northern parts he passed through a certain " wood, which is called 'Risborough' in the County of Leicester, " and there he saw five hinds, and he forthwith ordered a certain " servant of his, named Richard, to tarry in these parts until " his return, and in the meantime guard the hinds for his own " use, but it happened that in that year the said King did not " return there"

Peter was charged with thirty items in the past thirteen years. He owed the King for nuts, six and a half marks; after pannage eleven and a half marks; escapes in the park, half a mark; the sum he had taken from the Archdeacon for his greyhounds 100 shillings, for 7,000 oaks and fuel trees made into charcoal, 7,000 shillings. Then he made heavy fines and withheld them. For a hare 6s. 8d., for a rabbit 5s. The same Peter imprisoned Peter the son of Constantine for two days and two nights at Allecton, and bound him with iron chains on suspicion of having taken a certain rabbit, and put him in a jail with water at the bottom.

We may agree with the scribe who writes under each item, "For which let him answer to the Lord King and to Judgment with him." One can realise how much feeling could lay behind Magna Charta and Forest Charters, how much they were required. In this particular case let us note the date when these things were done. This Court was being held some fifty years after the time of the Charta, and nevertheless misdeeds so contrary to the Charta continued.

Although there were no forests in the Royal and English sense existing in this county, there were at Domesday plenty of wooded hunting places. These were chiefly to be found attached to the largest of the woods. Thorpe, Cawston, Mileham, Elmham, Necton, and Buxton provided woods with

pannage for 1,000 pigs. The first three belonged to the King's Manor, Elmham was the Bishop's, at Necton Harold had been lord, and Buxton belonged to five brothers. In other big woodlands we find great men, as at Winfarthing the very wealthy Monchesney, at Wymondham and Buckenham the Duke of Albini, the Bigods to Lopham, the Duke of Norfolk at Kenninghall. In or against such woodlands did the great man make his park or enclosure, and it was sanctuary to the game from all but the lord himself. The earlier parks enclosed a part of the woodlands; it is the woodlands that have survived where the parks have gone, as can be seen even now, though much diminished, at Thorpe, Cawston, Mileham, and Necton. At Elmham a park remains.

In the south-east of the county parks attendant upon nearly every wood that had 100 pigs have disappeared, and much of the woodland too, but fragments of the latter survive. If what remains cannot now be cherished for its utility, the time has certainly come when we should look to the preservation of the flora and fauna which belong to them alone, and will disappear upon their abandonment to pasturage.

Our original old woods may, I believe, be readily identified, because every wood containing the wild hyacinth I take to be such. Outside the wood, bluebells rarely appear in the hedgerow, if so they proclaim a woodland that has disappeared. They may be found, a last relic of woodland, continuing their existence underneath the protection of bracken. It is the trampling of the farm stock which will destroy them. The primæval woods had a natural co-ordination of the animals wandering about, the seeds being spread by their travels. The cattle are now fenced in, and the woods are fenced in, so it is impossible for the hyacinth seed to be conveyed and extended. You may meet a planted wood of hundreds of years old, but how much does it fail in charin compared with the primæval wood, with its glory of bluebells.

Evidence seems to appear just at and after Domesday that attention was paid even then to the cultivation of the woods—sylviculture. At Norwich there is a record from the letters of Bishop Herbert Lozinga, the great builder of our Cathedral, the foundation-stone of which he laid in 1096. Soon after he was writing a short letter to William the Monk. He writes,

“ As to making a present of Thorpe Wood to the sick or anyone else, I gave you no orders, nor do I give, nor will I give any, for I appointed you the custodian of the wood, not the rooter up of it. To the sick, when I come to Norwich, I will give, as I did last year, not logs of wood, but pence. Let this be your answer to them, not a word besides. As for you, do you guard the wood of the Holy Trinity, as you wish to be guarded by the Holy Trinity, and to continue in my favour.”

Further care for this wood is again seen in the Bishop's Charter of the foundation of the Cathedral Priory. He gives “ likewise the mediety of the Wood of Thorpe on the understanding however, that it be not lawful for any Monk to give or sell anything from thence without license from the Bishop, but that the Wood should be in the custody of the servants of the Bishop and the servants of the Monks for the use of the Bishop and his Monks.” “ The privilege of hunting game in the Wood and warren of the aforesaid township is in the guardianship and keeping of the Bishop.” This latter dual control was not eventually successful. At any rate the Bishop and Monks divided the woods a century later.

The Rev. W. Hudson, in his study of the Cathedral Priory Rolls, has given me a glimpse of the woods belonging to them at Thorpe, Eaton, Plumstead, Taverham, and chiefly Hindolveston.

The Sacrist Roll begins 1275, when the Priory was dealing with the repairs after the great incendiary riot of the City against the Priory, and Thorpe for the time may have been exhausted of timber, as it is not then referred to; but there are entries in the Roll then of “ Timber and carriage Holverston £7 11s. 4d. and 7s. for a beam from the Horsford Wood 1305 ” (Dacre property); also as much as eighteen shillings for a beam for a column. In 1343 “ Stock of seven trees and cutting down—seventy shillings ” is an item which may belong to Thorpe. The Communarius Roll 1289 tells of a receipt of £72 5s. 8d. from Hindolveston Wood timber which Mr. Hudson suggests was sold there and the money sent to Norwich. In 1375 Worstead church had trees from St. Leonard's Priory as a gift to aid the building of the church.

The chief items in the Rolls are those of the underwood. In 1341 they bought 1,000 astell for 7s. 6d., in 1354 they sold

1,000 astell for £1, and paid for the making of it 7s. 6d. It is the occasion of the "Black Death" intervening that allows this change of values. Astell were about half the price of faggots. They may have been a smaller faggot, or they may have been brotch wood for thatching, or laths. So fragmentary and unexplained are the various accounts I have seen that I have not yet found out for certain the meaning of the term. In 1363 at Hevingham they cut oaks for astell, and in 1368 one was cut for laths.

Although timber was evidently felled at Thorpe, as elsewhere, it rarely comes into the account. You can infer it was felled by such entries as "boot tymyr" and "wrong batell," which means timber for boat building from the curved limbs of the oaks. Also felled oaks can be inferred from the items of bark, crop, and crokells sold.

At Hindolveston there was plenty of beech, and beech was used for hoop wood. Maple was then in request for the "mazer bowl." "One quarter of mapeb—£1 13s. 4d." (1354). The keeper of the wood there was paid 6s. 8d. per annum. Probably his chief payment would be the right to every wind-fallen tree, which had been the perquisite of the woodward from before the Norman Conquest.

They had a market for holly, and for such items as spall and chip, hoop ware, fire logs, and faggots at Hindolveston, and the Court Roll there in 1377 reported that Dennis Barker and his mainfasts broke the gate of the wood in entering and issuing with their carts, and were carrying the lord's timber to his damage and in contempt, etc. So the wood there was enclosed.

The large religious houses had much of both the capital and the science of their time at command; more important even than these in dealing with woodlands they enjoyed a long continuity of ownership. So again information may be gathered from a religious house, the Abbey of St. Benets, and we find early evidence of their protection of their woods.

John of Oxnead described the constructive ability of Reginald, the Monk of St. Benets. He became their Abbot in 1213. John of Oxnead, almost a contemporary, describes him thus: "In all his actions, sacred as well as secular, a man of foresight and discretion, he built the great hall of the hospice, and caused it to be roofed with lead, and constructed many

places for strangers within his halls." The woods of Bastwick, Hoveton, Shotesham, and Tibenham, which were formerly open to all men, he enclosed with ditches which he laid down, and thorns and rows of trees. The Manor of Swanton, which was pasture in common to the inhabitants, he, by a fortunate contest with the justiciar, detached from its common rights and secured for it equality of tenure. These scattered possessions he manfully regained, and, when regained, preserved them without loss; he repaired ruinous buildings, reconstructed those in disrepair, and by his happy caution increased and multiplied the incoming rents."

Here first he speaks of enclosure of woods, and then of the contest at Swanton, nothing is said about fencing at Swanton. John of Oxnead later, speaking of Abbot Robert, who succeeded eight years after the death of Reginald, states: 'He found the wood of Swanton intact and preserved from all distant waste by his predecessors. He received no small money in his time out of the sales frequently held there.'" Swanton must have been enclosed.

The natural conclusion is that not only the four woods enclosed by Abbot Reginald, but all their woods of their forty Manors by this time were enclosed, and I believe, further, that the "Schieteshaga" that St. Benets claimed at Domesday was but a sample of woods enclosed then. Woodbastwick and others found unenclosed after 1213 are exceptions and not the rule.

The statute of Merton laid down "That Lords might make their profit of their woods, wastes, and pastures so long as feoffees had sufficient pasture for their tenements." An instance of this is cited in Tawney's "English Economic History." Jurors say that the wood was some time common in such wise that there were five sharers who had the wood in common. By their consent partition was made that each should have his part in severally. Assize decides it is lawful for each sharer to assart. Such an assart would probably be arable or pasture, and occurred in early days on the Forncett Manor and elsewhere, but not to any large extent in Norfolk until after the Reformation.

Professor Ashley points out from the Government Returns in 1517 of the enclosures of waste land (whether wood or not),

that enclosures had occurred largely in that part of Norfolk which was east of a north-to-south line through Norwich. This eastermost slice of the county includes little of Domesday county woodland and most of the woods in it can be proved to be standing at that time—1516: Many are still standing.

The woods in the eastern area were many and small. Reference has been made to Bradeston, which had two pigs in the eleventh century. Nevertheless, I have a good record of its woodland produce in 1500. For centuries, no doubt, as woods became smaller, their value appreciated, and they were the more carefully preserved.

There is at the present day at Blickling six acres of wood which is common wood, but no commoner can touch the timber on it—that belongs to the Lord of the Manor. This feudal custom made it impossible in Norfolk for the parish to make profit of their woods. There was a further time-honoured custom in the parishes, which was to reserve all the produce of the common wood for the parish, precluding the selling of it outside, as was the case with turves for fuel. This for fear of exhausting the supplies or enhancing their cost.

John of Oxnead has informed us as to the 13th century, and the 14th century has been illustrated previously by Forncett. Of the 15th century wood one may seek information from the Paston Letters.

In 1445 Agnes Paston writes from Paston to her son that he may send joists by water from London: "Joists nine inches by seven inches, that they be squared there and sent hither, for none such can be had in this country." Stout building timber, we have already seen was scarce in that country, when Worstead went to Blofield for its Church roof.

In 1462 Margaret Paston writes to her husband: "I have purveyed you of a man that shall be here in Barsamy's stead and ye will; the which can better cherish your wood, both in felling and fencing than Barsamy can, and he shall make you as many hurdles as you need for your fold of your own Wood at Drayton, and shall take as little for his wages as Barsamy doth, and he is holden a true man."

There was much correspondence in 1470 and after about Sporle Wood. Sir John was, as usual, wanting money, and he hoped to get it from the timber there. It was a

coppice wood of sixty-three acres, a tenant hired the coppice at a shilling an acre. It was very well stocked with timbers, about seven to the acre; over thirty inches girth at three feet up. First of all, Sir John's brother reported on it "The value of Sporle Wood passeth not 100 marks (£66) of no man's money that I can speak with, and I would not sell it for 100 marks more than it is worth." Sir John said, "He never more had need of money than now," so Osborne the bailiff took Shaw the carpenter, who spent a week there (5d. a day and costs), and Shaw reckoned 436 standards and the value £180. John Osborne wrote, "If it pleases you to take my advice in your wood sale, sell not in great, but make faggots and astell, and let all your great and good timber and trees stand and ye shall make reasonably money to your Worship." However, Saunders of Carbrooke came over in November, 1472. He made offer £143 for all wood and bark. Next April Sir John's brother was to offer it to Butcher, and he would be a good housewife if he could secure £133. It all sound quite modern, especially the conditions of sale.

- (1) Give buyer four years to clear.
- (2) Have surety for money.
- (3) See that standards below measure are reserved.
- (4) Get payment as soon as possible.

No sale was then effected, for Sir John writes, "Chapman would have bought it in whole three years before at £80." It is unfortunate that the sum paid for the timber is not recorded. If we average the trees at one load each, 90 would have given a price of one penny a foot. Two-pence a foot in London, and in Cambridge, in the hands of the merchant, not standing in the wood, was the price at this time. However, as this wood stood at the edge of the country, and there lies to the west of it the Champion part of Norfolk which carried no oak, it might well have been the trees were even smaller and produced a higher price than two-pence a foot.

There is a letter dated 1484 from the Prior of Bromholme, who wants seven of thirty-three feet beams for the Refectory, and he asks John Paston to approach the Queen for them through the Counsel of the Duchy of Lancaster. He tactfully writes, "I am not expert in making any application beseeching your mastership to take it upon you to do it. Make after your

advice, allege all poverty as your worshipful discretion can much better than I inform, and I remit all to your wisdom." This must refer to the wood at Tunstead, a neighbouring parish which belonged to the Duchy of Lancaster.

At this date, the end of the 15th century, I have been able to see many Bailiff Rolls which included accounts of the woods of Old Buckenham Priory, of Wymondham Abbey, of Hevingham and Bradeston Manors. They contained all one desired to know about faggots and underwood, but not very much information about the timber beyond allowing an inference that it is neither abundant nor of great size. No doubt money for timber passed usually directly to the owner, and not through the bailiffs' hands, just as would be the case nowadays, and thus we do not meet with it in these accounts.

In underwoods the crop may be sold by the acre, or the owner may convert the coppice himself. Sporre, we have seen, was let at a shilling an acre, but in all the above woods the price was eight-pence, which would be about the usual rent of the arable land. Sheringham in 1444 sold at a higher price—£1 an acre—and is an exception.

In the Bailiff's Rolls there is no varied product seen in the Sales account, it is almost entirely faggots. The prices are fairly constant. They cost six-pence or seven-pence a hundred to make, and they brought in, gross, two shillings to two shillings and sixpence a hundred sold. Thorold Rogers gives an instance from Norwich of 4s. a hundred, but 1s. of this cost was owing to carting them seven miles.

Small maple trees are culled and sold at one penny. For what purpose these were required I cannot tell. Perhaps for turning or for whips.

Bark seems to have had a high value. One-third of the value of small oaks at Old Buckenham and one-fifth of the value of good timbers at Hevingham. So high a value as this for the bark would have a great effect in accelerating the felling of small oak trees. I am seeking further evidence upon the subject, which I have seen no mention of in literature, for my data are insufficient.

Having no Norfolk instance of building accounts of this century, I will mention a contract outside. 1483. Gloucester.

A house 47 foot by 15 foot by 18 foot high. All timber to be of oak. Building contract £14. An architect tells me that 1s. 3d. per cubic foot is the price to-day for building a cottage ; in this above instance it is only one farthing.

No consideration of the supply and demand of Norfolk timber can be satisfactory without allusion to the oversea importation of timber, which seemingly was going on in the 11th century. The further we recede in time, the rarer becomes any record.

Anderson says that there is every reason to believe that the Netherlanders had our wool sent over to them in the 10th century, but no record survives. Aelfric's Colloquies tell us that the sea merchant was a well-known character before the Conquest. The building of Norwich Cathedral is evidence of great transport by sea. In 1137 the garrison at Norwich were ordered to send eight pilots and one hundred and sixty sailors to Sandwich fifteen days to keep the seas.

From Maddox' " History of the Exchequer " I read in 1179, " Aern, son of Mabel has leave to export ' bladum ' wheat from Norfolk to Norway." In 1190 the Coronation of Richard I. made a call upon the Sheriffs of Norfolk and Suffolk to bring a contribution of 1,000 oars (at four-pence a-piece) to help the boat traffic on the Thames at the Coronation feast day.

About 1240 the imports at Lynn receive more precise mention: " All manner of board of oak shall pay two-pence per 100. Other shall be quit of toll." In 1253 Henry III. orders " 200 Norway board of fir to wainscot the chamber of our beloved son Edward." The verb to wainscot comes in English record before the noun, and wainscot is later taken to refer to oak board.

In 1305 Commission of Complaint by Olaf Ivari, merchant of Norway, that whereas he made an agreement at the town of Holkham with Adam Silk of that town to send Norway logs thither and did so, Adam has paid £40 only out of the £147 8s. due. At this same date John Gurney of Harpley was building a barn and church house at Harpley, and he got all his timber from Lynn, though Harpley was nearer Fakenham and woodlands there.

North Creake Abbey imported estrich board in 1331 at 1¾d. Ely in 1335 bought at Lynn 500 at 1½d.

The Sacrist Rolls of Ely commence about 1300. They show us that the Priory got their great beams and oak rafters from Cambridge and Stourbridge fair, but all the boards, *sapo*, *hombre board*, *bords de regolt* ringolt, *estrich boards* or *hestery board* came in from Lynn. We may well think that the "wooden walls of old England" at that time were mainly of imported material. Certainly our county was a great importer, for in 1346 Norfolk is shown to be supplying more vessels to the Fleet than any other county. The North Fleet—viz. that from Bamburgh to Colchester—consisted of sixty-four vessels and 2,370 mariners. One-fourth of the vessels and two-fifths of the mariners hailed from this county. The larger proportion of mariners to a ship suggests also the greater size of their vessels. Lynn had recently been building big vessels. "La Philipe," in 1336, had a big mast that cost no less than £10. She had eighty oars at 1s. 6d., and her other timber cost about £50. The exports of England in 1354 were £212,000 value, which tells a tale of growing wealth.

In the 15th century when the Norwich Guildhall was being built, the *estrich boards* are imported and their low price of a half-penny each, I think, betrays the liberality of some timber merchants of that date. The Guildhall bought also wainscot at four-pence in 1410, and in 1443 St. Leonard's Priory bought wainscots for the pulpit at ten-pence each, showing, I think, they were not made at home. The word also in its foreign origin suggests a foreign source.

Thorold Rogers' "History of prices" discusses the rising price of wainscots at this period, and he considered it was a home-made material, arguing from these premises a progressive scarcity of home timber. The History of prices and agriculture is a valuable pioneer work, but the writer was not possessed of such information as the Sacrist Roll of Ely and much else published since he wrote. His inference from wainscot that the rise of the price of timber was general is belied by the records of the Carpenters' Company, and from St. Mary's Church at Cambridge, which show the price of timber at two-pence a foot to be constant through the 15th century and up to 1544.

There must have been great importations of timber, and though it is difficult to collect the precise data on the subject,

I think we may infer that at this time it was in full use, as is important a supply as the home-grown.

Before proceeding to consider the condition of the woods in the 16th century, it seems necessary that one should make a comment upon the greatness of the monetary disturbances which occurred in the middle of this century, 1545-1550. Any comparison of values in this century demands that we keep the date closely in mind.

Norfolk realised well enough that there was a crisis afoot when she suffered Kett's Rebellion in 1549. It was no mere agrarian discontent at the enclosing of commons, an explanation sometimes given, but the causes of that outbreak were more extensive and deeper.

A report "on the decayed port towns with number of good villages along the sea coast of this realme within this 20 or 30 years" describes "Lynne a towne only and chiefly maintained by Icelande and herring fishery. It hath been a town of great substance and wealth for there hath been men worth £4,000 and now there is not a house worth 2,000 marks. In time past there hath gone out of that town fourteen good sail of ships to Iceland and now there goeth but two. And where there hath gone to the North Sea for herrings sixteen sail, now there goeth none at all. The Prince hath had 300 mariners for service of the shippes at one time, and now twenty or thirty is the most that the Prince can have. If the Prince have so many there are none to send to Newcastle for coals to serve them for fuel. It was the properest town in this land, strongly walled, fair buildings, full of people, now there is scant neither shipping nor people."

Thorold Rogers explains the cause of the disturbances and the rise of prices in the fact that Henry VIII. had degraded the coinage by increasing the one to twelve alloy in silver to six parts in twelve. This we now call "Inflation." Miss McClenaghan in "The Springs of Lavenham," tells of heavy taxation and consequent unemployment in 1525 and after.

In the 16th century the woods and timber of England became a matter of some public attention. The legislature in 1483 had passed some permissive Acts, and Parliament in the time of Henry VIII. had endeavoured to insure the growth of timber, by enacting that at each fell of an underwood, at least twelve

saplings be left to stand and grow for timber, and that efficient closing of the woods afterwards by fencing to protect it should be carried out.

Queen Elizabeth in the first years of her reign wrote to the Marquis of Winchester to tell all officers in charge of woods to use henceforth as much husbandry as possible for the preservation of timber.

The great conservators of woods, the religious houses, had just been dissolved, and before their dissolution they had been anticipating the event by the realisation of their timber. Thus in Queen Elizabeth's time the Supervisor of all the woods of the Queen below Trent reports: "Not enough trees to repair the hedges of many lands derived from the religious houses." Again, in 1549, it is reported of the West Dereham former Priory lands: "All demesne lands be sold and granted by copy so that the underwoods be gone."

Where some timber had been left, as at the Priory of Beeston, the lands of which in 1546 were bought by Sir Edward Windham, of Felbrigg, a valuer reports: "In the late Priory Manors and tenements and other the lands aforesaid 500 oaks ashes and elms of sixty and eighty and one hundred years growth usually cropped or shred. Thereof 400 reserved for timber to repair the houses standing to the same, and for stakes for hedgebote to repair the hedges about the said lands, and for ploughbote and cartbote for the farmer. 200 valued at four-pence a tree, the residue at eight-pence a tree, altogether ten pounds." Then he sets to valuing the underwood and takes value at eight-pence per annum, and twenty years purchase, giving 13s. 4d. per acre the value. This same value we have seen in the fifteenth century, and the rents at both periods were also the same. The timber trees in this instance he has pronounced almost valueless.

In 1549 Nicholas Cutter valued seventeen underwoods at the same price, 13s. 4d. At West Bradenham, formerly belonging to the Abbey of Bury, he states only one tree as standing to the acre in the underwoods. In other manors apparently none, for the owners, no doubt, had been realising by felling. After this there are signs of higher annual values of the underwoods; thus Mr. Corbett has reported a valuation of Toft

Monks in 1562, which was let at 2s., but valued at 3s. Mr. F. Johnson tells me that Norton, Suffolk, was of similar value in 1574. These woods were being grown upon a longer rotation of about twenty years as though there was a demand for underwood poles.

The rise in price of timber from 100 to 250 must have accelerated in any case the clearance of better stocked timber woods after 1550, especially as all commodities were rising also, but rents remained stationary, and this was a further inducement. In addition there was fear lest the King's purveyors should remove timber at their own price.

How much demand for timber was due to an increase of demand from good trade as the century proceeded, and how much is to be referred to the supply of timber becoming scarce, is a problem beyond my computation.

Although I have recited that the number of timbers standing in the underwoods I have referred to was but a small one, there were woods that had a fair stock of trees standing. The best of these that I have record of is a little wood at Barningham which had forty trees to the acre, a figure this which will resemble closely the common average of our Norfolk oakwoods before the War. This wood was quite an exception. Next best is the 100-acre Grisehaugh Wood, Pulham St. Mary, twelve trees to the acre; Tunstead, eight trees to the acre; Sixty-three-acre wood at Acle, five; 100-acre wood at Dereham, five; and Ditchingham was also well stocked.

It would appear during this century nearly every wood was standing which was in the record of Domesday Book in 1086. I cannot profess to have traced the record of every wood upon this map, but at the same time I recognise in the 16th century the continued existence in Old Buckenham, Lopham, Pulham Fersfield, Kenninghall, Winfarthing, Wymondham, Shipdham, and Dereham of large woods that are, all of them, gone to-day.

The absence of these woods is less to be regretted because strong wheatlands take their place now.

To the north of Norwich there was more woodland than to the south, and there remains a much larger remnant. The explanation lies probably in their soil being less suitable for growing wheat. There was still a fair supply of timber north

of Norwich when Sheringham built their Pier in 1582 and bought 1,400 logs for £1,000. These came from Gresham, Thurning, and three woods of Sir William Heydon. The price was 6s. 8d. to £1 per tree. I estimate the logs to have been three-quarters of a load to two load, and in that case the payment per cubic foot would be three-pence. Heydon and Thurning are fourteen miles away. The felling and transport cost about one-quarter of the price of the timber.

Just after the end of the century the scarcity of timber becomes acute, and the destruction of woods is imminent. This is especially shown by royal proclamations at Thetford, 1604 :—

“ Timber is being destroyed in the Realm to such an extent that in London, builders are obliged to use beech. Timber is not to be used as fire-wood.

“ No new house to be built before April 29th.

“ After that no new house to be built within a mile of the suburbs, except the walls and windows be made of brick, or brick and stone.

“ Offenders to be brought into the Star Chamber.”

Legislation has been also passed to restrict any trees being converted into charcoal within eight miles of the coast, but Norfolk, and indeed all the Eastern Counties, I believe, made little use of charcoal compared with the South of England and Oxford.

One instance of possible charcoal making in Norfolk comes into view at the end of the 16th century, when Robert Buxton writes to Lord William Howard about the wood at Winfarthing : “ There is yet some spoil of wood and timber but not as was ; and now for lack of buyers of the wood (by reason of the suits pending) their purpose is to convert the same into charcoal, and so to make great spoil and gain thereof.”

The historical poet, Michael Drayton, had in 1613 been thinking over the iron works of Sussex and their great charcoal consumption, when he wrote his epitaph of the woods :—

“ Jove's oak, the war-like ash, veined elm, the softer beech,
Short hazel, maple plain, light asp, the bending wych,
Tough holly and smooth birch, must altogether burn,
What should the builder serve, supplies the forgers turn.”

Let this quotation close too condensed and too fragmentary an epitome of some five centuries of the existence of our Norfolk woods.

SOURCES OF INFORMATION—

From the Public Record Office, printed or manuscript,

Inquisit P.M.

Ministers' Accounts .

Exchequer Accounts.

Duchy of Lancaster's Accounts.

Calend Patent Rolls.

State Papers, Domestic.

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Besides Books referred to in the text, there has been consulted,

Bibliotheca Lindesiana.

Economie Forestiere, G. Huffel.

Domestic Architecture, Hudson and Turner.

Everyday Things, Quenell.

Early Britain, Collingwood.

Archæologia.

Sacrist Rolls and Bailiffs' Accounts.

Those of the Norwich Cathedral Priory, Wymondham Abbey, and Old Buckenham Priory have been communicated or read to me by the Rev. W. Hudson and Mr. F. Johnson.

II

SOARING FLIGHT

BY E. H. HANKIN, M.A., Sc.D.

LORD Kelvin, when asked his opinion of soaring flight, replied "That that puzzled Solomon puzzles me also." The facts that we are about to consider will be found to give ample grounds for such caution.

ASCENDING CURRENTS

The view that soaring flight is due to the bird taking advantage of ascending currents has been widely held for two reasons. First, since the bird has weight, it can only be supported in the air if something in the air pushes it upwards. The only

readily imaginable source of such a push is an ascending current. Ascending currents exist, and in many cases birds may be seen to make use of such currents. Secondly, the belief in ascending currents has been based on observations of vultures gliding half-a-mile or more overhead. Had the holders of this view had opportunities of studying soaring flight at close range, had they, as probably did Lord Kelvin, studied the air currents at the stern of a steamer where gulls can soar, they probably would have been less ready to accept this simple explanation of the phenomenon.

In a recent paper, Sir Gilbert Walker has shown, on meteorological grounds, that strong ascending currents must often be present over Agra, where many of my observations were made. He calculates that these currents are amply sufficient to explain the soaring flight of vultures.* He asserts also that descending currents must be roughly as much as the ascending ones, but he omits to tell us what happens to the birds when they get into such downward moving air. During the whole day a column of birds may be seen circling over the Jharna Nullah slaughter-house near Agra. Every few minutes a group of birds detaches itself from this column and forms a new column, which drifts slowly to leeward. These subsidiary columns diverge from each other during their course. After travelling thus for about a mile they glide upwind to their starting-point and again commence circling. This is what happens in the prevailing westerly wind. Should the wind be in the east, birds leaving the column over the slaughter-house first glide up wind to the usual distance and return by circling. Thus soaring flight is continuous, while the suggested cause for it is intermittent. Perhaps Sir Gilbert Walker's view is that the ascending and descending currents are so closely intermixed that for some unknown reason the bird gets more lift from the rising currents than drop from the descending ones. However this may be, it is obvious that there is room for doubt as to the exact conditions of flight of a vulture gliding at a height overhead, and we shall do well to lay more weight on the behaviour of sea-gulls at the stern of a steamer, on the flight

* "Meteorology and the non-flapping flight of tropical birds," *Proc. Cambridge Phil. Soc.*, Vol. XXI., Pt. IV., page 363.

of dragon-flies, and on that of flying-fishes, all of which instances of soaring flight can be observed from comparatively short range.

TURBULENCE AS CAUSE OF SOARING FLIGHT

A suggestion as to the cause of soaring flight that has commended itself to several aeronautical authorities is that it is due to turbulent motion of the air that, in some unknown way, supplies energy to the bird. This idea has merely been put forward as a suggestion without any evidence in its support, but certain facts of observation recorded by me appear to show that turbulent movement, or certain kinds of such movement, may, in certain cases, have something to do with the occurrence of soaring flight. At present it would be rash to make any more definite statement. Let us consider these facts.

In the first place, the stronger the wind the more turbulence is likely to be present. Measurements of the speeds of vultures made by me show that higher speeds are attained in stronger winds.* For instance, the following table is a record of some of the observations made on the 29th April, 1920 :—

Time.	Height of Bird, Metres.	Direction of Flight.	Earth Speed of Bird, m.p.s.	Wind Direction.	Wind Velocity, m.p.s.	Air Speed of Bird, m.p.s.
11.28	300	N.W.	6	N. 40 W.	5	11
11.29	300	N.N.W.	6½	N. 40 W.	5	11
11.30	300	N.W.	6	N. 40 W.	5	10½
11.57	600	N.	6	N. 60 W.	15	18
12.01	800	N.	16	N. 60 W.	19½	30
12.07	1100	N.	9½	N. 60 W.	16½	23
12.27	700	N.W.	6½	N. 60 W.	14	20

In these observations, as is shown by the figures, the vultures glided through the air in strong winds at speeds two or three times greater than their speed of gliding in light winds.

* For particulars of the method of making these measurements see "Observations on the flight of flying-fishes," *Proc. Zool. Soc., London*, 1920, page 467. For the data included in columns 4 and 6, I am indebted to Mr. J. H. Field of the Agra Aerological Laboratory.

Far more valuable data are obtainable from a study of the flight of sea-gulls at the stern of a steamer. At this point, air of exceptional turbulence is present, and in this air exceptional feats of soaring flight are performed.

AIR CURRENTS AT STERN OF A STEAMER

Let us consider the probable conditions of air currents at the stern when the wind is in such a direction that the smoke from the funnel is being left behind over the stern or over the quarter. As the vessel moves ahead it must tend to leave a vacuum behind. Currents of air rush in from all directions to fill this potential vacuum. One current flows along over the ship and may turn downwards at the stern. Along each side of the ship lateral currents exist which turn inwards when they reach the stern. Sometimes these two lateral currents appear to fuse and to form an ascending current of highly turbulent air immediately aft of the stern, in which case the stern descending current is usually still present but at a little distance from the ship. More often the descending current is immediately aft of the stern, and presumably the lateral currents fuse with it, forming a mass of highly turbulent air. The extent of the descending current may be revealed by letting loose pieces of paper or by trailing a thread astern.

Just as with a steamer, air currents must flow past a racing horse to fill up the vacuum that tends to be left owing to its movement relatively to the air. In a slow-motion cinema picture of the Zev-Papyrus horse race it was noticed by me that the hairs of the tail of Papyrus near the base pointed vertically downwards, with an oscillation from the vertical of very limited extent. Near the middle of the tail the hairs were also directed downwards but had oscillation of larger amplitude, thus proving the presence of turbulent motion in the descending air current. At the extreme tip of the tail the hairs kept changing in direction from directly backwards to backwards and upwards. This last movement corresponds to an ascending current that exists at a distance from the stern of the steamer to leeward of the stern descending current. In the case of the horse Zev, the hairs of the tail fortunately were tied up for the race, rendering it easier to see the up-and-down movement of the body of the tail that occurred at each stride. Assuming that the slowing

down was ten times, the strides were being made at the rate of about five per second. The range of up-and-down movement of the body of the tail was at least a foot. Consequently the tail was being moved up and down and the rate of at least ten feet per second. If one were to tie horse hairs on a stick and wave it up and down in still air at this rate, the hairs, owing to air resistance, would constantly trail behind. In other words, when the stick was descending the hairs trailing behind would be on a higher level than the stick. Since in the slow-motion picture there was no trailing behind of this nature, the hairs, on the contrary, being continually directed downwards, we may conclude that their downward direction was not due solely to their weight but also to their being in a downward current of more than ten feet per second.

Thus at the stern of a steamer we have air of an exceptional degree of turbulence. If, as has been suggested, turbulent movement of the air, in some unknown way, furnishes energy for soaring flight, we may expect that, in this air, exceptional feats of soaring flight should occur. The facts of the case appear to agree exactly with this anticipation.*

GULLS AT STERN OF STEAMER

A gull that has stayed behind to eat food that has been thrown overboard comes flapping after the ship, just skimming over the crests of the waves. As soon as it reaches the position of the turbulent descending air aft of the stern, it ceases flapping, it changes the direction of its flight and glides upwards at high speed without any loss of velocity usually to about the height of the top of the stern flagstaff. Its course during this upward glide may make an angle of from forty to eighty degrees with the horizon. The upward glide is sometimes accomplished with an apparent increase of speed. That this apparent increase of speed is a real increase of speed relatively to the air is made probable by the fact that at the commencement of the upward glide gulls have been seen by me to increase the flexing of their wings, thus assuming the disposition used in high-speed flight.

In the "soarable area" at the stern, not only do gulls show, on some occasions, steep upward glides, but they

*See "On the flight of sea gulls," *Aeronautical Journal*, No. 75, July-September, 1915, page 84, and "Soaring flight of gulls following a steamer," *Proc. Camb. Phil. Soc.*, Vol. XXI., Pt. IV., page 426.

may also show remarkably high speeds. During a dust-storm in the Red Sea, gulls at the stern gliding within a few feet of my head were seen to show very sudden and great increases of speed up-wind whenever they were struck by a gust. In a gale of wind coming from nearly ahead, near the Straits of Bonifacio, gulls were noticed occasionally to glide about a hundred metres to leeward from the ship. This they did with their wings in the low-speed disposition, namely, flat and fully extended. Then, making a sudden turn, they glided back to the stern, travelling at high speed with wings arched and flexed as usual for high-speed flight. During these glides their air speed must have approached thirty metres per second. This observation shows clearly how completely inadequate are popular theories of soaring flight based on ascending currents. It was a striking sight to see the birds gliding at apparently low speed to leeward and, on making a sudden turn up-wind, attaining instantly a high velocity and travelling towards me in a straight horizontal line. Attempts to explain such flight by assumptions of the effect of ascending currents in the gale of wind that was blowing are likely to do nothing more than serve for the edification of posterity. What we want at present is not explanation but research.

If an ascending current is present close to the stern it is avoided by gulls and, best by letting loose pieces of paper, it may be found that gulls soar in the neighbouring descending current.*

FLIGHT IN ASCENDING CURRENTS NEAR STERN

At some distance from the stern away from the ship an ascending current may be formed in which gulls may glide. They may be seen also, on some occasions, gliding in the ascending current formed on the windward side of the ship. In such ascending currents they make no steep upwards glides. When they gain height the long axis of the body is not tilted up. It remains, as far as can be seen, horizontal. The gull is lifted like a ship on a rising tide. In the soarable area, on the contrary, the axis is tilted up in the direction in which the bird glides and the bird shoots up as if fired out of a gun.

* See an account of observations of gliding in the descending current at the stern, by Mr. F. Clark, in *Flight*, March 9th, 1922.

An important point to notice is that usually near sea level gulls can only soar in the "soarable area" at the stern and that this area does not develop in the absence of wind. If the sea is smooth with a glassy surface, gulls near the stern are reduced to flapping. Supposing after a period of calm a light wind arises blowing from over the quarter, and supposing also that this wind is much less in velocity than the ship, so that the smoke trail is left behind over the other quarter, then it is clear that the coming of this wind must result in a decrease in the amount of turbulence at the stern due to the movement of the ship. In such cases a soarable area has been observed by me to appear. Gulls that previously had been flapping were now in continued gliding flight. This observation proves that turbulence due to the movement of the ship is not of itself sufficient to render the air soarable. Something present in certain winds, but not in all winds, is also required.

Thus we see that the study of sea-gulls at the stern of a steamer gives us a better insight into the nature of soaring flight than observations of vultures gliding half-a-mile or more overhead.

ALBATROSSES

Whereas the gull can only make steep upward glides on the leeward side of the stern of a steamer, the albatross, under some conditions, can do so anywhere. Mr. Parker Smith has described to me a form of flight of this bird in which it alternately glides with well-marked loss of height at slow speed and with steep gain of height at apparent high speed. When gliding downhill the course of the bird is slightly curved when seen in plan. When it gets near the water it flexes its wings, dives a little, turns quickly, and then glides steeply upwards facing the wind. In the upward glide it gains as much height as it had lost in the downward glide. Mr. Howard Flanders informs me that he has also observed the Parker Smith form of flight, but only in hot weather. The albatross can only soar in the presence of wind. In the absence of wind it is reduced to flapping flight.

SOARING OF DRAGON-FLIES

In view of what has gone before it will be of interest to see how dragon-flies behave in the presence of turbulent movements of the air.

Dragon-flies form a group of insects that are remarkable in being highly specialised for flight. On examining a dragon-fly, it will be seen that the points of attachment of the legs do not form a regular series along the underside of the thorax as in ordinary insects. They are pushed forward towards the head. The effect of this is that the legs are ill-adapted for walking. Owing to their position they act as a set of tentacles surrounding the mouth, thus enabling the dragon-fly the more easily to catch its prey, which consists of small insects caught while in flight.

Dragon-flies destroy more insects than they eat. Frequently a gliding dragon-fly has been seen by me to catch a small insect and drop it. The insect in each case fell vertically, thus proving that the energy for the gliding flight of the dragon-fly was not due to air currents capable of visibly affecting the fall of minute insects.

Dragon-flies are divided into two chief classes. Of these the first is the *Isoptera*. These are chiefly small dragon-flies that spend their time skimming or poising over water with their wings in rapid flapping flight. The fore and hind wings have the same shape—hence the name—and being narrow at the base are not suitable for gliding. The other group consists of the *Anisoptera*, in which the hind wings are somewhat wider than the fore wings. All the wings are broad at the base. Dragon-flies of this group have the power of gliding. Some species indulge in true soaring flight. My remarks will apply exclusively to members of the latter group.

The commonest dragon-fly in Agra is known as *Pantala flavescens*. During the day it flies at a little height (six to twelve feet) above the ground in groups, and therefore is very suitable for observation.

BEGINNING OF SOARING FLIGHT IN MORNING

If in the early morning one watches a group of these dragon-flies, the first thing one notices is that their flight consists of alternate periods of flapping and gliding. If one has had much practice in observation it may be possible to see that the flaps are of the hind wings only. As the sun gets stronger it will be seen that the flapping gradually decreases and is more and more replaced by gliding. At about nine o'clock it will be seen

that the dragon-flies have two methods of flight. Either they may glide with the abdomen horizontal, aided by two or three flaps of the hind wings every two or three yards distance, or, on the other hand, they may glide with the abdomen elevated, travelling horizontally for the most part, and apparently may glide in this way for very long distances. Glides of ten or fifteen seconds without a flap may be observed. In some cases I have noticed that flaps only occur when they happen to approach other dragon-flies, as if their use was a signal rather than a means of propulsion. We are dealing with a case of soaring flight.

DEPRESSED POSITION OF ABDOMEN

But the mode of flight continues to vary with the time of day. If there is strong sunshine and little or no wind, then, at about eleven o'clock, the dragon-flies may be seen gliding with the abdomens hanging down. This mode of flight goes on until about three o'clock. Then the abdomen will again be elevated above the level of the wings. Later in the afternoon more flapping occurs, till at sunset these dragon-flies will be seen in fast irregular flight caused by flapping of all four wings.

The hanging down of the abdomen is a phenomenon that anyone may easily observe for himself, and, as we shall see, is a matter of great interest. What is not easy to see, and can only be seen after much practice, is that the hind legs also hang down when the abdomen is depressed (Fig. 1). If one has exceptionally good opportunities for observation it may also be seen that the dependent legs are a little apart, as shown in the illustration. Before an audience of naturalists it is unnecessary for me to labour the point that one's power of seeing a phenomenon may be greatly increased by practice, also that a minute object if brightly illuminated as compared with its background may appear larger than it is. Owing to such conditions it has been possible for me to see a change in the position of the hind legs of a gliding dragon-fly from a distance of thirteen metres with the naked eye. Such minute details of wing structure as the apical spot and the node have also in some instances been visible to me when the insects were gliding near, furnishing a proof that the flight was, at the time,

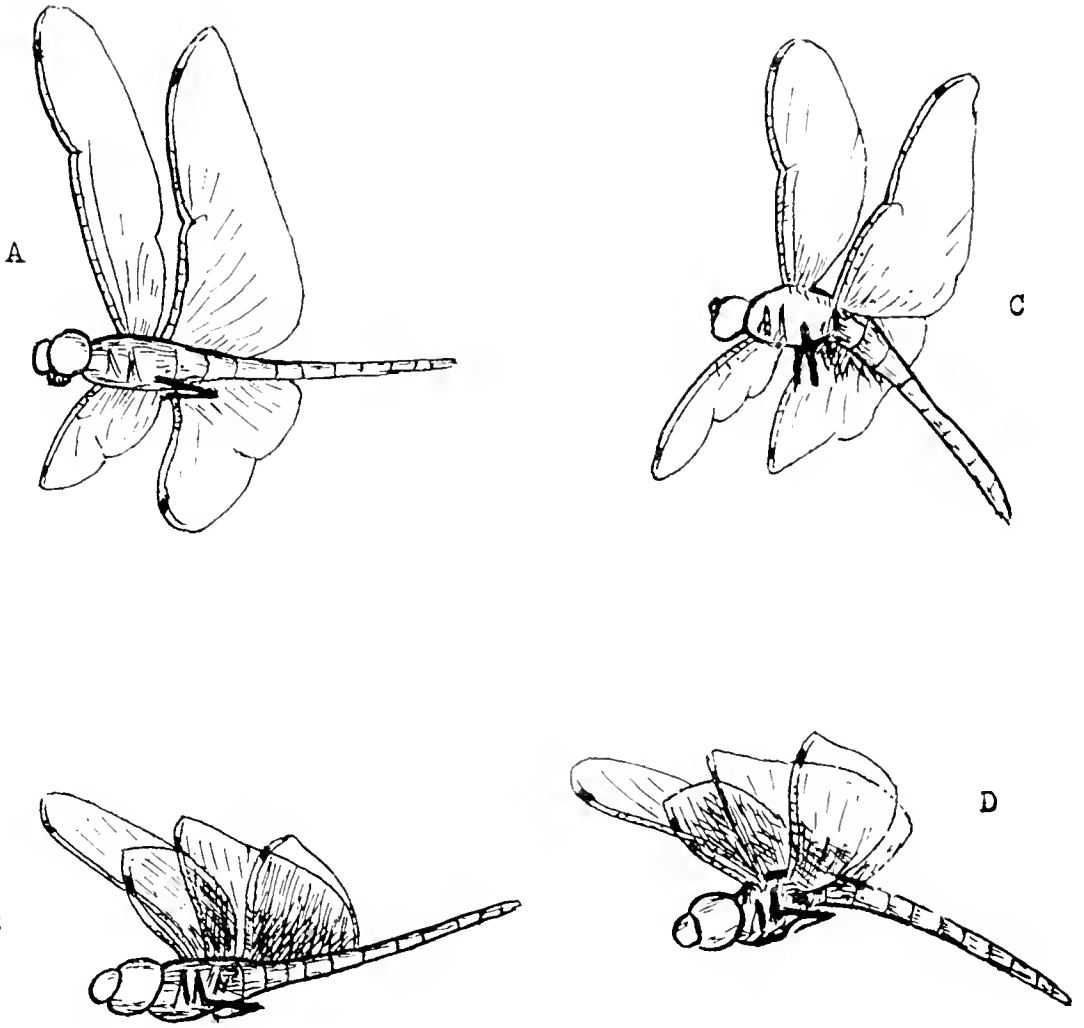


Fig. 1 Dragon-flies in soaring flight

A. Fast soaring flight
B. Slow soaring flight

C. Full brake
D. Half brake

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by gliding and not due to undiscovered wing movements. For making such minute observations it was my custom to leave my house wearing spectacles of neutral-tinted glass. These were changed for blue-glass spectacles at the time of actually observing the insects.

EFFECT OF CHANGES IN STRENGTH OF SUNSHINE

Now let us return to the depressed position of the abdomen. The first thing learnt about it was that this adjustment does not happen every day. My observations were recorded daily in my diary and it was soon found that depressed abdomen did not occur on days on which the presence of thin cirrus cloud had been noticed. Such thin cirrus has no known effect on the soaring of birds. It produces no appreciable effect on the intensity of sunshine and it is very remarkable that it should have an effect on the flight of the dragon-fly. Later observations fully confirmed the relation. If small cumulus clouds are rapidly crossing the sky, and if there is not much wind at ground level, dragon-flies will be seen with abdomens up when there is shadow and abdomens down when there is sunshine. After the sun comes out there is a short interval before the dragon-flies lower their abdomens. If the edges of the cloud happen to be sharp cut, this interval may be measured. This has been done by me on several occasions, and it has been found to be from twenty-two to thirty-five seconds. In the middle of the day changes from the up to the down position appear to occur as often as a small cloud passes over the sun. On one occasion the passing clouds were far too thin to throw appreciable shadows. Each time I saw abdomens up I looked at the sun through several layers of coloured glass, with which I had happened to be experimenting, and saw that a thin layer of cloud was passing over it.

Thus we are led to this interesting result that a slight variation in the intensity of sunshine, not otherwise appreciable, has a distinct effect on the flight of dragon-flies. As their soaring flight completely ceases in the presence of heavy cloud, we have a clear proof that, on these occasions, their soaring flight was dependent on energy derived from the sun's rays.

The next fact to notice is that the depressed position of the abdomen does not occur in the presence of strong wind. The

phenomenon only occurs in the hotter months of the year, as a rule, and then only when the sun is shining at full strength.

DEPRESSED ABDOMEN AS BRAKE

A clue to the meaning of the adjustment is found by observing cases in which the adjustment occurs in single individuals at a time when other individuals near by are not showing it. The first observation that offered any clue was made near the sea-shore in Bombay. Some *Pantallas* were gliding near a path. Most of them were facing the wind, a light sea breeze, and keeping near the edge of the path, which was slightly elevated. Dragon-flies in this position held their abdomens down. Those away from the edge of the path had their abdomens elevated and travelled faster. Next, on the border of a tank in Agra, it was noticed that dragon-flies poising in a very light wind had the abdomens down, while other dragon-flies gliding at speed over the water near by had their abdomens up. The depressed position, that is to say, appeared to be associated with lesser speed. The abdomen has also been seen by me to be lowered momentarily while catching an insect. Dragon-flies of several species have been watched by me gliding at low level over a pond, when it was repeatedly noticed that the abdomen was lowered, for a fraction of a second, when the insects needed to check speed, either to avoid another dragon-fly or when turning on reaching some obstruction.

It is obvious that when the abdomen and hind legs are hanging down the insect offers more resistance to speed ahead than is the case when these organs are held up. We are thus led to the conclusion that the lowered position of the abdomen is used as a brake.

SECOND FORM OF BRAKE

When thus using a brake the long axis of the thorax remains horizontal, as indicated at C in Fig. 1. For some years it has been known to me that dragon-flies possess another form of flight in which the abdomen is lowered while the hind legs are still held up against the thorax. The thorax also is inclined so that its front end is on a lower level than its hind end. This disposition is shown in Fig. 2 at D. My last observations,

made a day or two before I finally left India, had to do with this appearance. These led to the conclusion that the disposition was one used as a brake, and that probably, but not certainly, it was a brake not so efficient as that previously described.

Thus we arrive at the conclusion that in full sunshine dragon-flies find everywhere sufficient energy for their gliding flight, at least in the hotter months of the year in India. They even find more than enough energy, for, if they wish to remain flying in a group at one spot, they have to use a brake continuously to check their speed. If this conclusion is correct, it appears to involve as a corollary a strong proof that their soaring flight is not due to undiscovered wing movements.

SUN ENERGY AND SOARING

Thus we see that in the early morning at least, sunshine is the source of energy for the soaring flight of dragon-flies. It is very difficult to imagine how sun energy could be directly absorbed in the air for this purpose, for the rays of the sun have passed through miles of the atmosphere before they reach the air in which the dragon-flies are gliding. Any constituent of the rays, therefore, that could be absorbed, one may expect would have already been absorbed long before reaching the neighbourhood of the dragon-fly. The sun's rays may, on the other hand, furnish energy for soaring indirectly, for, as is known, on striking the earth they warm it; the earth thereupon warms the air in contact with it. The warmed air rises, forming what are known as "convection currents." Let us see how far the facts fit the idea that such currents are the source of the energy of the soaring flight of dragon-flies.

LATENT PERIOD BEFORE USING BRAKE

We have seen that on the passing off of cloud shadow an interval of twenty-two or even more seconds elapses before the abdomen is lowered to act as a brake to check the speed of the insect. If the increase of soarability thus indicated was due to something rising from the ground at a rate between one-fifth and one-tenth of a metre per second, then this latent period would be explained. If this is the explanation of the latent period, then the period should be shorter for dragon-flies

gliding at low levels than for dragon-flies gliding at a height. Observations to test this point are obviously required. My diary contains several instances of dragon-flies at one level having abdomens down while other dragon-flies at another level had their abdomens up, but no observations were made by me to determine whether there was any progressive change in this respect.

If, in a dead calm, dragon-flies soar owing to the help of convection currents, then it would not be surprising if the coming of a light draught of wind should disturb these currents and thus bring soaring flight to an end. This is, in fact, what appears to happen. In the early morning, as soarability is developing, it has been noticed by me that dragon-flies would glide with abdomens elevated in calm, but that on the coming of the slightest breath of wind they would put their abdomens horizontal and interrupt their gliding by flaps of their hind wings.

WING DISPOSITION AS PROOF OF ASCENDING CURRENTS

The wing disposition of dragon-flies at this time may be cited as an apparent proof that they are using ascending currents for the following reason. If a bird is in gliding flight it experiences a current of air rushing past it that is known as the "relative wind." The plane of the wings forms a small angle with this wind known as the "angle of incidence" Owing to this tilting up of the wings, the relative wind presses on their under surface and lifts the bird. So long as the bird is getting gliding support from the air this must always be the case, whether the bird is gliding horizontally or downhill. Supposing its course leads it into an ascending current, then, if the latter has sufficient strength, the bird, though still gliding downhill as steeply as before, relatively to the air, may be travelling horizontally relatively to the earth. The wings in such a case, while having the usual angle of incidence to the relative wind, would make a large angle with the flight path. An observer would see the hinder edge of the wings at a higher level than the front edge. In very strong ascending currents, as may occur in sunshine in tropical climates, the apparent "negative angle of incidence" thus observed may amount to twenty

degrees or even more. In less strong upward currents the negative angle of incidence may be so slight that it will be quite overlooked by the inexperienced observer.* Hence if any one asserts that a bird that is gliding horizontally is getting "gliding support" from an ascending current, he may be challenged to show that the wings have an apparent negative angle of incidence. If dragon-flies in their gliding flight also obey aerodynamical laws, then the same rule must apply to them. On referring to the illustration it is evident that the upward position of the abdomen may possibly be an indication of an apparent negative angle of incidence of the wings, that is to say, of the disposition appropriate for gliding in an ascending current.

CONVECTION CURRENTS

Thus the facts of the case, so far as dragon-flies are concerned, appear to fit fairly well with the idea that their early morning flight is due to their taking advantage of ascending convection currents. The question, however, remains whether such currents are always present when dragon-flies are soaring. The only proof available to me of the existence of convection currents is the appearance of shimmering that they produce. This appearance, in Agra, commonly begins about a couple of hours before soarability for dragon-flies is established. It frequently decreases during the daytime, when soarability is at a maximum, and may again increase and reach a very great intensity late in the afternoon, when soarability for dragon-flies is decreasing. In view of these facts it would be premature to conclude that the early morning soarability for dragon-flies is due to convection currents.

But during the day, as soarability increases, the behaviour of the dragon-flies becomes less consonant with the idea that their flight is due to ascending currents.

* In his paper already quoted, Sir Gilbert Walker treats this apparent negative angle of incidence with politely-expressed scepticism, not realising that its occurrence gives the strongest possible proof of his contention that soaring birds observed by me in Agra were in ascending currents. My own misunderstanding of the nature of the appearance was equally complete, and I owe the explanation to Mr. J. D. North. See a paper by us in *Proc. Camb. Phil. Soc.*, Vol. XXII., Part II., p. 186, entitled "The angle of incidence in soaring flight."

AVOIDANCE OF KNOWN ASCENDING CURRENTS

Let us consider their relation to known ascending currents. During the day dragon-flies of the species we are considering may glide together in a group. More usually, if the sky is cloudless, they scatter over a large area. But if isolated cumulus clouds are crossing the sky, these dragon-flies are apt to collect in the neighbourhood of a convenient ascending current and to glide into it whenever there is cloud shadow and to glide out of it as soon as sunshine returns. On one occasion a number of dragon-flies were gliding near an ascending current reflected up from the terrace of my house at Agra. They entered the current when there was cloud shadow, but glided away, just beyond its range, in periods of sunshine. I had with me a box of aerial seeds (of *Calotropis*) with which I had been investigating the limits of the current. After my observations had been carried on for some time, suddenly all the dragon-flies went into the region of the ascending current during a period of full sunshine. On throwing into the air a handful of aerial seeds, it was found that a descending current now existed in place of the ascending current. A second or two later the current reversed to its normal direction, as shown by the movements of the seeds, upon which the dragon-flies at once went away to a distance.

SOARING AIDED BY WIND

It has been stated above that in the early morning even the lightest wind seems to exert a harmful effect on the flight of dragon-flies. Later in the day, as the sun gets stronger, no such effect of wind can be observed. On the contrary, in some winds the dragon-flies face even the strongest gusts. If when gliding up wind they meet a gust their speed relative to the earth may be seen to increase. They fly so fast in certain winds that their flight is difficult to follow. In such cases it is probable that their speed through the air may approach twenty metres per second.* In this form of soaring flight the abdomen is horizontal, as shown in Fig. 1 at A. If Fig. 1 is admitted to represent the disposition adapted for flight in

* For more detailed description, see "The soaring flight of dragon flies," *Proc. Camb. Phil. Soc.*, Vol. XX., Pt. IV., page 460. Also *Animal Flight*, Chapter XX.

an ascending current, it appears to follow that the disposition we are now considering is not so adapted.

SOARING OF DRAGON-FLIES AIDED BY TURBULENT MOTION

The next question to consider is whether turbulent motion in the air has to do with the soaring of dragon-flies. The following evidence is to the point.

On one occasion, in a fairly strong wind, the air currents at the back of the stables of my house were investigated by means of a smouldering greasy rag tied to the end of a bamboo. It was found that the general air current was occasionally descending, owing to the current that came over the top of the roof. But horizontal currents came round the ends of the stables and mingled with the roof descending current, with the result that a highly turbulent mixture of varying air movements was produced. Several dragon-flies, of two different species, were observed gliding in this turbulent air with abdomens down, that is, using a brake, while at the same time other dragon-flies in the windward ascending current at the other side of the stable had their abdomens up. That is to say, when using the ascending current they had no need to use a brake, but they had to do so in turbulent air. One dragon-fly was seen gliding with abdomen down within two feet of the stream of smoke from the rag, which at the time was travelling downwards at an angle of at least thirty degrees with the horizon. The insect remained in this position for only a fraction of a second, and there are no grounds for asserting that it was included in the descending current that existed at the position of the rag.

An entry in my diary records some dragon-flies being seen gliding in a wind with abdomens down, some fifty yards to leeward of a small building and some trees where conditions appeared favourable for existence of turbulence and perhaps a descending current. Though using a brake, twice a dragon-fly was seen to make a gain of height of two or three metres with gradual ascent while gliding up-wind.

In Agra an isolated small gust sometimes descends steeply and strikes the ground, raising a mass of dust that has been described by me as a "dust curtain."* When probably

* "On dust-raising winds and descending currents," *Memoirs of the Indian Meteorological Dept.*, 1921, Vol. XXII., Pt. VI., p. 569.

enveloped in such a descending current a dragon-fly (*Tramea burmeisteri*) was once seen by me gliding upwards, in an up-wind direction, for about three metres. Its course while doing so made an angle of about forty degrees with the horizon. Such long upward glides are never made by dragon-flies under ordinary conditions.

TWO KINDS OF SOARING FLIGHT

Thus we see that for the dragon-fly there are two kinds of soaring flight. One kind resembles that of the soaring of sea-gulls at the stern of a steamer, in that it happens in the presence of turbulence caused by air currents of appreciable size mixing together. In the other kind of flight such turbulence is certainly absent, but proof has been obtained that this flight is closely dependent on sunshine. The former kind is certainly not due to ascending currents. In the latter kind the dragon-flies behave somewhat as if they were using ascending currents of air. The proof that they are doing so is not, however, complete.

FLYING-FISHES

We have now to consider the most important of all kinds of soaring flight, namely, the gliding of flying-fishes. If one has watched flying-fishes darting like arrows over the surface of the sea, and if afterwards one examines one of them in a museum one is surprised at the small size of their wings, considering the weight of the fish. On making detailed measurements it is found that the loading of the flying-fish, that is, the number of pounds weight lifted per square foot of wing area, is about eight times as much for the flying-fish as it is for a bird of similar span.*

HIGH-SPEED SOARING FLIGHT OF FLYING-FISHES

Like dragon-flies, flying-fishes have two kinds of flight. One kind depends on the presence of wind. In this form of flight they may glide, at a uniform height above the water, in their longer flights usually for distances of two hundred to four hundred metres, and rarely they may glide for longer distances and even

* "Flying-fishes and soaring flight," *Proc. Camb. Phil. Soc.*, Vol. XXI., Pt. IV., 1922, p. 421.

till they are out of sight. In this form of flight flying-fishes occasionally keep their hind wings (pelvic fins) directed downwards to act as a brake during the whole of the glide. In this respect they resemble dragon-flies, who, as already stated, may fly continuously with a brake consisting of depressed abdomen when the air is fully soarable.

Sunshine is unnecessary for this form of flight of flying-fishes.

LOW-SPEED FLIGHT OF FLYING-FISHES

In another kind of flight, carried out at lower speeds, and with a different wing disposition, the presence of sunshine appears to be indispensable. If, owing to the presence of thin cirrus cloud, the sunshine is not at full strength, then, at intervals during the glide, the fish lowers its tail into the water and wags it to and fro for a fraction of a second. By this sculling action it gets an increase of speed that may easily be observed. The presence of wind is unnecessary for this form of flight. There are grounds for suspecting that in some instances the coming of a light wind may interfere with such gliding, thus offering a further resemblance to the flight of dragon-flies.

An instance has been described by me in which, in the absence of wind and the absence of sunshine, flying-fishes trying to glide fell back into the water, travelling not more than a few inches after the sculling action of the tail came to an end.

SOARING NOT DUE TO FLAPPING

Ample proof exists that the flight of flying-fishes is not due to undiscovered wing movements.* In view of the weight of the animal and the small size of its wings, very powerful flapping would be necessary to keep it in continued flight. In colder months of the year and in the presence of wind a small amount of flapping occurs sometimes as the fish leaves the water. Observers are practically agreed that such flapping is not maintained during flight.

In view of the heavy loading of the flying-fish, and in view of the fact that it may glide for considerable distances at a uniform height above the water in the complete absence of wind, it is

* "Observations on the flight of flying-fishes," *Proc. Zool. Soc. of London*, 1920, p. 467.

very difficult to imagine how either turbulence of known nature or convection currents can yield an explanation of its soaring flight.

INLAND SOARING FLIGHT OF GULLS

It is obvious that soaring flight is a subject on which further research is urgently required before we can hope to understand its nature. A matter in which members of this society can give valuable help is in determining the conditions under which sea-gulls flying inland can indulge in soaring flight. During some months this winter gulls were only seen soaring by me when clouds of ragged irregular surface were present. But recently soaring has been observed by me in the absence of such clouds. It is necessary to distinguish between true soaring flight in which there is continued gliding without loss of height, and gliding interrupted by periods of flapping, as one may expect to occur when the air is full of ascending currents.

CONCLUSIONS

There is but little chance of discovering the nature of soaring flight by studying birds gliding a mile or more overhead. Neither can reliable conclusions be drawn from observations made in a mountainous region such as the Himalayas, where the prevalent winds blow up the valleys, and where, accordingly, it is difficult to find a place where the birds are not in an ascending current. We stand a better chance of learning something of the nature of the phenomenon if we study instances where it can be observed at close range or under conditions where various suggested causes can be excluded.

On examining the early morning soaring of dragon-flies, we found reasons for suspecting that it was due to ascending currents, for the wing disposition employed appears to be similar to that used by birds when in known ascending currents, and also the soaring came to an end when an influence intervened that was likely to check ascending currents.

But our hope for an explanation was disappointed, for, as the day goes on, we found that changes occur in the mode of flight and—stretch the facts as we like—it becomes very difficult to reconcile them with the idea that the soaring is due to ascending currents.

We were thus led to consider a suggestion that has been put forward by various aeronautical authorities, namely, that soaring flight is due to energy derived, in some unknown way, from turbulent air movements. We found some support for this view in the fact that both with dragon-flies and sea-gulls the most remarkable feats of soaring flight take place in air having an exceptional degree of turbulence.

But in the case of sea-gulls, on examining the facts of the case in detail, we found that the turbulence of the air at the stern of a steamer is not of itself sufficient to maintain soaring flight. Something present in wind (which may be some form of turbulence) is also necessary. All that the turbulence produced by the movement of the steamer does is to render the energy in the wind available for a bad soarer like the sea-gull. The albatross can make steep upward glides, under certain conditions, in wind, without the added turbulence that seems necessary in the case of gulls.

With flying-fishes, as with vultures, higher speeds are attained in stronger than in lighter winds, as if turbulence is the source of the energy involved. But on examining the facts more closely we find that again an explanation eludes us. The soaring of flying-fishes resembles that of dragon-flies in several respects. Each animal has two kinds of flight, in one of which sunshine and in the other of which wind appears to be indispensable. Both animals when soaring are apt to show lateral instability late in the afternoon and not at other times of the day, and so on. Thus it is reasonable to imagine that the cause of soaring flight is the same in both animals. Now if a dozen pieces of thistledown are let fall in a sheltered place in sunshine, we may anticipate that one piece may fall slightly faster than another; perhaps one may show some rotation in falling that is not shown by neighbouring pieces. An upholder of the ascending current theory perhaps might find it easy to believe that such feeble air movements, thus revealed, may possess enough energy to sustain the soaring flight of the light-weight dragon-fly. In the absence of any evidence to the contrary it is also reasonable to anticipate that pieces of thistledown would show similar feeble movements if liberated a few inches above the surface of a tropical sea in sunshine and in the absence of appreciable

wind. How can such feeble movements be invoked to explain the gliding of the flying-fish, an animal that is about eight times as heavy as a bird of similar span ?

On telling an eminent scientist that gulls soar in the descending current at the stern of a steamer, he replied, " Then that current must have had an ascending component." Another scientist of distinction has been heard by me to quote with approval Langley's dictum that soaring flight is due to the bird taking advantage of the internal work of the wind. Such phrases may be perfectly correct as statements of fact. But it appears to me that those who use such phrases take on themselves a certain responsibility in that such language may dissuade others from following up a promising line of research.

Thus all attempts at explanation fail, and we see that Lord Kelvin had good grounds for believing that there is something about soaring flight that is outside the scope of our present knowledge.

III

SPRING MIGRATION AT SCOLT HEAD

BY E. L. TURNER acting as Watcher, assisted by T. A.

COWARD during the first half of May, 1924.

SCOLT Head viewed from the Head itself during the high Spring tides consists of a backbone of sand dunes running more or less from east to west for a distance of three miles. About half-way across the island, a lateral ridge of dunes intersects the salt marshes, and, from the point of view of the ornithological observer, cuts the island in two.

The western half consists of mud flats, shingle beaches, patches of *suæda* (*Suæda fruticosa*) bushes, and salt marshes, the latter covered mostly with sea purslane (*Obione*) and sea lavender. Here Waders may be found.

The eastern side of the lateral ridge of dunes embraces a wide plateau of coarse grass known to us as the Tundra ; beyond it, reaching to the Overy channel, lies a beautiful marsh covered

with a varied flora. Wide stretches of *suæda* bushes, for the most part thin and stunted, abound in this area. Formerly, so the older wild-fowlers tell me, these bushes were tall and thick; always they have been resorted to by passerine birds on migration. It was amongst these *suæda* bushes that we found more small birds than elsewhere on the island. On the eastern side of the lateral ridge, and on these dunes, there are a few elder bushes, sweet briars and brambles. There is also a large and vigorous clump of privet, enclosing an elder bush. All these taller bushes were easier to examine than the wide stretches of *suæda*; they always produced some bird worth seeing.

Roughly speaking therefore, the western half of the island was good for waders, and the eastern half for passerine birds. As during half the month these salt marshes are dry, the observer is best repaid by hunting along the narrow fringe of mud alongside Norton Creek. But the spring tides sweep almost up to the hut, and leave wet patches in their wake for several days after the tide has regained the normal. The waders follow the tide.

By April 1st Skylarks, Linnets and Meadow Pipits had taken up their residence and were all singing gaily in the vicinity of the hut. Throughout the month however, and during the first half of May, small parties of Linnets moved about the dunes and marshes; but as they did not fly with steady east to west flight, it is difficult to say if they were, or were not, passage birds. Those Linnets which came in during the first half of April clearly only dropped into the bushes to rest.

On April 16th the marshes at the Overy end were alive with Skylarks and Meadow Pipits; one seemed to kick them up at every step. Later the *suaeda* bushes all over the island abounded in Linnets' nests, and the marrams were full of the nests of Skylarks and Meadow Pipits. We found the first Linnet's nest with eggs on May 11th, and two with day-old young as late as July 8th.

Skylarks were very abundant as nesting birds; they were the sole choristers at dawn, but later the Linnets and Pipits joined in. These were the only songsters on the island throughout the summer, though the notes of the Cuckoo and Nightjar floated over on still evenings from the mainland.

Tree Pipits passed at intervals. The first was noted on May 5th, and on the 7th, about 6 a.m., eight were perched on or hovering over the largest elder on the Tundra. About 9, when we visited the bush again, they had gone. On May 1st and 4th, single Roek Pipits were on the shore, but one or two largish Pipits were not satisfactorily identified.

Several species of Wagtails were observed. On May 1st, a single White Wagtail was on the shore near the hut. Two or three pairs of Pied Wagtails nested on the dunes where the marram grass overhung the outside edge. One pair we hoped would nest on the hut, but after a week of indecision it left us.

Yellow Wagtails passed almost daily, one or two at a time. The largest number that we saw on any day was six on May 3rd. On the 5th we saw and heard four or five, and some were going through as late as the 15th. These birds flew steadily westwards over the marsh or along the dunes, heading for the Wash and Lincolnshire coast. Their flight calls attracted attention as they came over in steady bounding flight. It is not possible to say if these were referable to *M. flava rayi* or to the Blue-headed *M. flava flava*, but as the latter was noticed at Hiekling between the 2nd and 6th, it is likely that some of the Scolt Head birds were Blue-headed Wagtails.

Two nests of the Yellow Wagtail were found at the Overy end; one in a suæda bush with 4 eggs on June 3rd, and another on June 14th at the base of a suæda bush, with 5 young ready to fly. Single passing birds were noted on July 17th and 18th. These crossed the sea in a westerly direction.

The *Turdidæ* were represented by several species, but single Song Thrushes seen on May 7th and other days, and two Blackbirds seen on April 6th, were the only members of the genus *Turdus*. On July 8th, there was a Blackbird in the elder bushes; a bird of the year.

On May 5th, a female common Redstart was in the bushes, and on the 14th a female Black Redstart remained for some hours in the immediate vicinity of the Hut. Indeed it frequently perched on the roof, the rain-tubs and clothes props. No Redbreast was noted, but on May 3rd, when Wheatears and Chats were about, a female Bluethroat was on a bramble bush. It was active and restless, but gave a good view of the

characteristic tail with ruddy bases to the outer feathers. On this day several Whinchats had come in ; their habit of perching on the tops of the bushes rendered identification easy. Six or seven were flitting about one large patch of bushes. On the 4th, 5th and 6th we saw single birds, but as the wind was strong and rough others may have been skulking for shelter. On the 17th and 21st, Whinchats were again sheltering in these bushes.

Greenland Wheatears, large, brightly-coloured birds, passed frequently ; some may have lingered for two or three days. We noticed the first pair, for the birds were mostly in pairs, on May 1st ; the female had the most upright pose of any Wheatear that we have seen. Three or more pairs were about on the 2nd and 3rd. On the 4th we did not see any. On the 5th, 6th and 7th the birds were less scattered, and seemed to be travelling in parties. We saw others between the 8th and 12th, but on the 9th, 13th and 15th a few smaller Common Wheatears were about. Two or three pairs nested on the ridges at the Overy end ; two females at least were feeding young on June 14th, and later a good many young Wheatears spread over the island. There was a large influx of young birds on and about July 17th, when for three days there was considerable movement of various species of birds.

Neither Goldcrests nor Tits were seen. On the afternoon of May 12th, a warm day when the wind in the morning was light from the N.E., a female Red-backed Shrike was perched on the top of the privet bush, from which she made sallies into the air or to the ground after bees, beetles or other insects. A little later we came across a male on a bramble a few hundred yards to the east. After a time it moved to a bush nearer to the female, but though we did not see them together it is probable that they had travelled in company.

Two of the *Muscicapidæ* were noted. A female Pied Flycatcher was in the suæda bushes with some small warblers on the evening of May 7th, and on the 14th, another day when several birds were about, a Spotted Flycatcher was in the large elder, and remained until the 15th ; perhaps it objected to travel against the westerly wind. On May 20th a Spotted Flycatcher rested on the shelter by the Ternery before passing up the coast.

The *Sylviidæ* were well represented in species, though numbers were never great. On May 3rd several Common Whitethroats were in the suæda, and we noted them on the 5th, 7th, 11th and 14th. Lesser Whitethroats were more frequent and in slightly larger numbers; we saw them on the 3rd, 4th, 5th, 7th, 12th, 13th and 14th, but may, of course, have seen certain birds on more than one day. The habits of the Common Whitethroat, diving towards the bottom of the bushes and showing itself for a moment only, make this species more difficult to see than the Lesser, which frequently comes to the top or the side of the bush, as if to look at the intruder. On the 7th one of the Commons sang several times, but the Lessers were silent. On the 14th there was a Garden-Warbler in the elders.

The "leaf-warblers" were rather puzzling, for they showed great variation in colour; it is almost certain that many of them, at any rate of the greyer birds, were Northern Willow-Warblers and Scandinavian Chiffchaffs; few were as yellow as our birds. No doubt some systematists and many collectors will blame us for not shooting, but the study of obscure geographical races is not the sole aim and end of ornithology. These small warblers are restless, active birds, dodging in and out of the bushes; it is very difficult to get a good view in a favourable light. They remain hidden until driven from a bush, flit to the next and vanish; it was not always easy to say if a bird was Willow-Warbler or Chiffchaff. The first Willow-Warbler that we saw was amongst the marram on May 3rd; it was a very yellow bird and sang two or three times; it was certainly *Phylloscopus trochilus trochilus*. This was the only one that did more than utter a call, and most were silent. On the same day, after disturbing several others from the bushes near Overy, we saw one that was so markedly greyer that we had little hesitation in labelling it *P. t. cversmanni*. We saw also one Chiffchaff. On the 4th we saw two Willow-Warblers and on the 5th and 7th several birds of both species at intervals during the day.

On May 8th and 9th we did not come across either bird, but on the 10th one Willow-Wren, and on the 14th the larger elder was the refuge of a grey Chiffchaff. On the 7th there were at least six small birds dodging amongst the suædas on Butcher's

Beach ; one was certainly *P. t. trochilus* and one a Chiffchaff, a third a Lesser Whitethroat and a fourth the Pied Flycatcher already mentioned, but a fifth and sixth puzzled us. One was the greyest warbler that we have ever seen, showing in a good light no suggestion of yellow or green ; its legs were light yellowish-red and it had a distinct pale superciliary stripe. In size, form, action and behaviour it was a typical *Phylloscopus*.

On May 14th and 15th a Wood-Warbler, the only one we saw, was on the island. It was consorting with the Spotted Flycatcher on both days, and with the Garden-Warbler on the 14th.

Probably these warblers and other passerine birds drop out of parties which move in the night or early morning ; they remain to rest and feed for a few hours, and occasionally for a day or more.

We saw neither Sedge- nor Reed-Warbler, but the former was singing beside a small " broad " on the mainland, just across the " wall " that runs from Brancaster to Overy.

The *Hirundinidæ* and *Micropodidæ* (Swifts) gave the best illustration of diurnal migration. Swallows, House-Martins and Sand-Martins, and Swifts passed steadily from east to west almost daily. The first Swallow appeared on April 17th ; House-Martins and Swifts on the 24th, Sand-Martins on the 26th. On the last date, steady passage movements began, and continued, almost without interruption, until June 3rd. The greater numbers passed on days when the wind was blowing from the S.W. There was nothing that could be called a " rush," the birds were never in large numbers at any given moment, but there was no movement in the opposite direction and little deviation from straight flight. Most of the birds appeared to travel along the line of the hills, though not directly over them until they approached the Head, when the majority crossed the col between the two highest sandhills. They followed the coastline over the " hooks," and crossed Brancaster Harbour towards the Golf Links, as if coasting to the Wash. They did not take a N.W. course towards the Lincolnshire coast, the most direct route.

Others crossed the island nearer to Norton Creek, and on some days birds travelled over the shore and sea, flying close to the water. On May 1st and 2nd the passage of Swallows was

continuous, and they were accompanied by a few Sand-Martins. On the 3rd all three Swallows and the first Swifts noted were passing all day, but on the 4th, when the southerly winds were variable and there was some rain, passage practically stopped. The 6th was calmer and warmer, the wind southerly but light. Passage was resumed, all four species travelling over continuously, and on the 7th Swifts were in the majority, but there were many Swallows. The 8th was rough and cold, with shifting westerly winds; no Swallows were noticed and but a single Swift. Swallows and House-Martins came through in small numbers on the 10th, but no Swifts were seen.

The wind was S.W. or S. on the 11th, and migration was steady and continuous all day. Casual counting as we walked the bushes, when we must have missed very many birds if our attention was taken up with other species, gave a result in about three hours of 135 Swallows, 38 House-Martins, 25 Sand-Martins and 19 Swifts. Similar passage continued from early morning until dusk on the 12th, when the wind was light from the N.E. or N. Many of the Swallows twittered as they flew, but the Swifts were silent, flying steadily but at no great pace; endurance rather than speed was suggested by their flight. On the 13th, when the wind was again southerly, Swifts predominated; we took more careful note of the numbers at intervals during the day. Swallows were numerous in the morning, but in the afternoon and evening the two Martins came in large numbers. From 1.20 to 2.20 p.m., 152 Swifts, 115 Swallows and 35 House-Martins passed. In half an hour in the morning we counted 148 Swifts, and in 25 minutes—12.5 to 12.30—164 Swifts passed over the col and near dunes, whilst others were crossing the marshes and following the line of the creeks. The birds came swinging along singly or in couples, or in groups of up to 14 or 15 birds.

Similar passage, practically at the same rate, was kept up all day on the 14th, and birds were still coming through on the 15th. The strength rather than the direction of the wind appeared to regulate the numbers; on days when the wind was light passage was most noticeable.

On July 15th little parties of Sand-Martins passed during the day; these also were flying west.

No Cuckoos were seen attempting to victimize the Pipits and Larks, and though on the 14th H. Loose reported a few passing west over Brancaster Staithe, and though from time to time we could hear birds calling on the mainland, a Cuckoo which Mr. T. Hadfield saw for a moment as it flew over a dune was the only one noted.

The movements of Gulls off the Norfolk coast are always puzzling, complicated by daily passage between feeding grounds and resting places. There was, however, on most days suggestion of passage west of immature Lesser Blackbacks and Herring Gulls. Both mature and immature Great Blackbacks frequented the shore or passed at sea, and a few Common Gulls were seen. Black-headed Gulls were occasional only. We found the ancient remains of a Glaucous Gull on the tide-line.

One pair of Black-headed Gulls nested amongst the Terns, and possibly another pair nested in the marrams.

The *Corvidæ* were represented by a pair of Carrion Crows which visited the island during the first half of May. A few marauding Rooks came from the mainland almost daily throughout May and June, and did much destruction to those Ringed Plovers which nested on the isolated shingle patches.

A single Hooded Crow was flying west on April 20th and another on May 1st.

A Montagu's Harrier regularly frequented the island from April 2nd until July 7th. It was not so far as one could judge nesting here. It never carried away food. Its sex was difficult to determine in the first part of April, but later it shewed the grey of the male bird. Probably it was an immature male.

A pair of Kestrels visited the island regularly up to the middle of May. These birds probably came from the mainland.

At the beginning of April Ringed Plovers abounded; many of these may have been passing birds, but numbers bred on the shingle ridges all over the island.

Oyster-catchers appeared on April 2nd. One pair may have been here earlier. On the 7th, 8 birds were feeding in Norton Creek. A few days later their numbers had increased to 12. These 6 pairs all nested, and their nests were found.

Various Waders (*Charadriidæ*) fed in the creeks and bays at low water. On April 1st a bunch of at least 2,000 Knot were feeding on the saltings below the hut. They went through

various beautiful manœuvres at sunset like Starlings. On the 6th, after circling round and round, the whole bunch mounted into the air, and when at a considerable height flew away west. A little party of 50 came in on April 11th, and on the 16th and 21st two larger parties appeared and passed on the next day. All these Knot were still in winter plumage.

On May 1st there were two or three Knots which were in transition plumage, but on the 8th we saw four very red birds, and six in full summer dress had come in on the 11th. Dunlins were about daily in considerable numbers; a party of 50 or more returned day after day to one feeding ground. The majority had black bellies. On May 12th, when these 50 were feeding in their usual haunt, a pack of 84 were sleeping, every head to wind, on the outermost hook; undoubtedly these were resting travellers. They stayed until May 26th. A single Curlew-Sandpiper was with the Dunlins on May 1st, and one, perhaps the same bird, was observed a few days later.

Sanderlings were not numerous. On May 1st and 7th a few were on the creek, and on the 8th, 12th and 14th small parties in partial summer dress on the shore. Redshanks were numerous and noisy, mostly nesting birds, though some which frequented the creeks may have been on passage. A full clutch of eggs was discovered on the dunes on May 13th.

Redshank nest in fair numbers in the marrams, and in tiny *suæda* bushes on the salt marshes. They are very clever in avoiding the wash of the spring tides, choosing the slightly raised shingle beaches where there is cover. Nests with fresh eggs were found in various places up to June 4th. The bulk of the resident birds seemed to have gone by the middle of June. A bunch of 30 feeding with the Curlew on July 17 may have been fresh arrivals. As already stated, there was a big influx of birds round about that date.

Curlew were in the creeks daily, and an increase on April 14 as well as the fact that some birds gave the flight call, indicated passage. A further influx of passing birds on May 10th and 11th took place. Later, on July 1st, two flocks passed west flying high up in the air, uttering the travelling cry as they flew.

Throughout the summer, from 50 to 60 Curlew remained on the saltings, making night a joy with their yodelling. They objected to the aeroplane night firing practice. Every time

that a searchlight swept over their haunts they uttered wild cries and flew up in a mass ; sometimes single birds flew past us whimpering in the twilight.

These were probably non-breeding birds, though on several occasions two Curlew behaved as if they had young on the saltings. A more diligent search on the rough ground on and beyond the Tundra might reveal surprises during the breeding season. But this is beyond the reach of a single watcher. On July 17th, from 250 to 300 Curlew were feeding in Plover Creek at low tide.

Common Sandpipers were heard at dusk on the nights of May 20th and 22nd, but they were never seen.

Whimbrel first appeared on April 26th. " May birds " is the local name for this species. Throughout May and up to June 9th, passing Whimbrel could be seen and heard daily. None appeared again until July 1st ; on the 7th and 9th there were a few with the large flock of Curlew in Plover Creek.

Turnstones were about the beaches from May 5th to the 16th, many in full dress ; they followed the drift-line, throwing over the dead *Pelvetia* which had been washed off the mud. On May 23rd a bunch of 30 came in and fed below the hut ; all were in splendid plumage. These birds stayed three days. On the 27th a single Turnstone was seen, the last for the season.

Greenshank passed on June 3rd. No more were seen till July 17 and 18.

Grey Plover, many in full dress and others in change, haunted the creeks and bays ; 17 was the largest party we saw. After May 17th none came till June 19th, when a single bird was feeding in the creek. On July 12th one was on the mud flats in the evening.

One Golden Plover was resting on the marshes beyond the Tundra on June 17th. This bird was in splendid breeding dress. It was very tame and allowed us to approach it within a few yards.

Lapwings, at one time numerous as breeding birds—hence the names " Plover marshes " and " Plover Creek "—only visited the island to feed. One pair may have nested in the old area, as their behaviour one day suggested the presence of young. The first passing flock of young birds appeared on June 17th. On June 24 and 25, there was continuous movement of

Lapwings flying west from 7 a.m. On July 12th and 13th, flocks of young Lapwings varying from 5 or 6 to 20 and 30, passed all day, flying low over the marshes with slow purposeful flight, passing the Ternery and heading due west over the sea.

One Bar-tailed Godwit was feeding in Norton Creek on April 7th. A Godwit of sorts came in with the Curlew on July 15th.

One Great-crested Grebe in full breeding dress was on the sea swimming towards the east, on May 21st.

A Diver, not identified, also flying east, passed along the shore on April 22nd.

Lesser Terns first appeared on April 25th, when two passed the Head. On the 26th numbers came in between dawn and 6 a.m. They alighted near the harbour bar, and rested there till 10 a.m., when they all rose into the air, and after circling round a few times, flew steadily westwards.

Sandwich Terns were passing on April 30th and May 1st, but in small numbers only, and Common and Lesser Terns were fishing off the shore. On May 3rd the numbers increased, and after that the numbers of birds of all three species that came to visit the hooks improved steadily though slowly. On the 10th, courtship was vigorous, and on the 11th Sandwich Terns were in groups on the dunes and near the water's edge. Eventually the numbers of visitors to the nesting area had risen from 40 to 50 birds to 500 or 600. On the 12th there were many freshly-made scrapes on the small new dunes, and many more on the 15th, when several of them were fringed with drift-wood or other fragments collected by Terns.

There was a further influx of Sandwich Terns on Sunday, June 5th, when the numbers rose from 15 pairs to 40 pairs.

Three Roseate Terns appeared on June 22nd. One pair nested and brought off two young.

Amongst the *Anatidæ* the Sheld-ducks were, so far as we could tell, all resident. In the immediate vicinity of the hut there were 19 pairs. They had begun to lay by the beginning of May, as we found dropped eggs on the 11th and 13th. The first brood was hatched on June 13th. During the whole of April and until the young were hatched, large parties of Sheld-ducks met in the early morning on the saltings and played

together. These games were indulged in every evening when the ducks came off to feed.

Other Duck were scarce. One pair of Common Teal passed on April 6th, and a pair were feeding in Overy Creek on the 16th.

We found one Mallard Duck's nest with 10 eggs in one of the few swampy hollows in the dunes near Overy. The few drakes which we saw on the slacks probably came there to feed.

On May 15th a Gadwall rose from the marsh, and we found the remains of another on the shore.

Until the 9th or 10th of May, large numbers of Common Scoters were feeding daily over the mussel scalps off shore, and with them were a few Velvet Scoters. A little party of 7 Velvets, 3 pairs and one odd female, fed daily nearer the shore, quite apart from the large packs. On the 13th we saw 4 Common and one Velvet Scoter off shore, but the large flocks had gone. On June 17th, 19 Common Scoters were flying over the sea, eastwards; no more were noted till July 7th, when a bunch of 7 flew up the coast westwards.

On April 21st a Short-eared Owl was put up from the marram on the Head; later in the day it flew from the Head and crossed the saltings. It searched the ground for food, but soon flew over the hill towards the Ternery.

In the early morning of May 7th we disturbed a passing Short-eared Owl which was resting in the marram, but failed to find it later in the day. On the 14th we roused two, one near Overy, where it was sheltering in the suæda, and the other on the western dunes. This second bird, immediately it was flushed, was mobbed by Terns, and we were able to rouse it again by following to the spot where the Terns were repeatedly stooping.

On May 21st and again on the 25th, a Short-eared Owl was caught red-handed feeding on Lesser Terns. On each occasion the Owl flew only a little way, leaving the Tern. This Owl was not seen after the 26th. On July 8th one flew from the sweetbriars on the Tundra, and again on July 12th one was put up from the Head. There is no reason to think that the Short-eared Owl nests on the island. Such may have been the case, as there is suitable cover at the Overy end, but as a rule

even a casual stroll will reveal the presence of a breeding Short-eared Owl. The male is furious if his area is approached.

Cormorants and Shags were noted over the water or resting on the shore during the first half of May, but there was no marked passage. Gannets flying steadily west were seen on May 1st, 3rd, 4th and 15th. On the 13th, 4 Gannets were going east, evidently fishing, but their leisurely flight was different from the direct, steady action of the westward-bound birds.

The first Starlings appeared on June 30th. Hitherto none had been seen on the island during the spring and early summer. The flocks gradually increased from day to day.

A French Partridge was heard calling on the roof of the hut at dawn on April 15th. One nested under the largest elder bush. One or two pairs of Grey Partridges nested on House Hills.*

Stock-Doves were seen coming out of rabbit burrows on April 7th, and again on the 17th, but it is doubtful if they nested. None were seen after the beginning of May. On the 11th there was a slight passage migration of this species—4. 1. and 10 birds crossing the island, flying west. With the last lot was a Ringed Dove, and we saw other Ringed Doves on the 14th and 15th, all travelling west.

Washed up and usually oil-clogged corpses of Divers, Guillemots, Puffins and other birds were not infrequent along the tide-mark, and on the 9th a Guillemot was sitting above the water-line. Its breast was stained with oil, but its wings were evidently clean, for it flew well out to sea when approached.

A Black Stork passed over the Hut on June 9th, and was watched by many as it soared in the sky. After a time it flew out to sea. Two days later two observers thought they saw it again at the eastern end of the island.

It will be seen from the above report that at no time during the months under observation are birds sedentary; passage movements of most species take place at all times.

*(NOTE.—The watcher's dwelling is always spoken of locally as "the hut." The broken-down brick shanty in the hills is always "the house.")

IV

VERONICA SPICATA IN ENGLAND

BY W. G. CLARKE, F.G.S.

OF the twenty-one British stations recorded for *Veronica spicata* Linn., nineteen are in Breckland (eleven in West Suffolk, four in Norfolk, and four in Cambridgeshire), the other two being in Hampshire. Early botanists considered *Veronica hybrida* as a variety of *V. spicata*, and consequently details of height and habitat refer to both, but *V. hybrida* is now regarded as entitled to specific rank. The 10th edition of the "London Catalogue" only records *V. spicata* for three vice-counties—Hampshire, Cambridgeshire and West Suffolk—and *V. hybrida* for nine vice-counties, chiefly on limestone rocks from Westmoreland and Wales to Bristol. It is a larger and more robust plant than *V. spicata*.

The first record of *V. spicata* for England was by Ray in 1660 in his "Catalogus Plantarum circa Cantabrigiam nascentium," p. 174, where his entry reads:—"Veronica spicata recta minor J.B. In several closes on Newmarket Heath."

It is said to have occurred in the Isle of Wight, where Dr. Bromfield recorded it for "St. George's Down, near Newport," and on the mainland in Hampshire, at "Bishopstoke, July, 1839, Herb. Garnier"—Mr. Townsend, Fl. Hants, Ed. 2, 1904, p. 279. There does not appear to be a more recent record.

For Cambridgeshire (co.29), Ray in 1660 recorded it "In several closes on Newmarket Heath; as in a close near the Beacon, on the left hand of the way from Cambridge to Newmarket, in great plenty." In the Power herbarium at Reigate is a specimen gathered on Newmarket Heath on August 18, 1836, by Mr. Partridge. Henslow, in Babington's "Flora of Cambridgeshire," p. 171 (1860) records Beacon Course, Newmarket Heath, and it has also been noted about Horseheath Hall, and among the furze about Hare Park, Newmarket Heath. Mr. F. J. Hanbury gathered specimens at Newmarket on August 1st, 1900, and Mrs. Tate at Litlington in August, 1877. Writing of Newmarket Heath in "A Short

Flora of Cambridgeshire" (1911), Mr. A. H. Evans, M.A., says:—"Owing to the grass among which it grows being constantly cut, the plant may not flower every year, but about a hundred spikes were seen a few years ago."

West Suffolk (v.c. 26) appears to have been the stronghold of *V. spicata*. Sir J. Cullum recorded it in 1777 on a dyke in a heath the west side of Icklingham church. Hind (Fl. Suff., p. 261) quotes the following note by him:—"Monday, Sept. 3, 1781. In company with Dr. Goodenough, Mr. Lamerts, and my brother, on the bank opposite to Icklingham, is the *Veronica hybrida* as well as *spicata*. The chief difference is that the leaves of the former are paler and less rigid." Of course this was not the *V. hybrida* Linn. of the West of England. In the "Botanist's Guide" (1805), Vol. II., p. 537, Sir T. G. Cullum recorded it for Cavenham, Culford and Risby Heaths. It was found on Cavenham Heath, 1793 (herb. Hailstone at York), and by W. West, jun., in 1895, near the Black Ditches, where the plants grow in small clusters of three to five. Other Suffolk records are Bury St. Edmund's (Mr. Crowe); between Barnham and Euston (herb., Salmon); Tuddenham (herb., Skepper); Herringswell Green Lane (Rev. F. Tearle); Culford Heath, 1879 (Gray); Thetford Heath (herb., Mrs. French); Brandon (Britten); and Icklingham (J. Lightfoot in herb. Banks at British Museum). On July 20th, 1912, Mr. W. H. Burrell, F.L.S., and I found a new Suffolk locality between Euston and Rushford, where there were some hundreds of plants in an area of 80 by 15 yards.

V. spicata was recorded for West Norfolk (v.c. 28) by Wardale in Watson's "Topographical Botany" (Ed. 2, 1883, p. 287), but this was an error, the specimen so named in the British Museum Herbarium being *V. officinalis*. (Baker to Geldart.) The first record for Norfolk was therefore made by Mr. Burrell and myself on July 23rd, 1910, when we found several hundred plants growing at Garboldisham. The specimens we gathered had flowering spikes from $3\frac{3}{4}$ inches in height with blossoms for a length of $1\frac{3}{4}$ inches, to $9\frac{1}{2}$ inches in height with blossoms for a length of $2\frac{1}{2}$ inches. Babington gives the height of *V. spicata* as about 6 inches. Judging by his "Letters" he does not appear to have found the plant, though he walked over some of its habitats in West Suffolk,

and found *V. triphyllus* and *V. verna*. On July 22nd, 1911, we revisited the Garboldisham station and estimated that in an area of about 100 by 50 yards there were at least one thousand specimens of *V. spicata*. In just over a square yard, where the growth was most dense, we counted 180 plants. That one season is, however, much more favourable than another is proved by this station, for although there had been no disturbance, and we were of opinion that the site was then unknown to any other botanists, we were able to find only a dozen plants in bloom on July 18th, 1913. During the war the site of this colony was used almost continuously by troops, with the result that *V. spicata* appeared to have been quite exterminated, until September 2nd, 1923, when I found a solitary plant, with three flowering spikes. In August, 1924, there were, however, several hundred plants in this colony, and the species was equally abundant at other Norfolk stations.

On July 16th, 1913, Mr. Burrell and I found a second colony of *V. spicata* at Weeting, where about one hundred plants were growing with *Dianthus deltoides*. In August of the same year Mr. F. Robinson and Mr. Frank Newton found another station in Garboldisham and East Harling, the plants being scattered over an area of about an acre. A further Norfolk station was added on August 2nd, 1922, when Mr. H. Dixon Hewitt found a colony at West Harling. The two Garboldisham, the East Harling and the West Harling stations are within an area of a little over two square miles, but the Weeting station is $13\frac{1}{2}$ miles distant from the nearest of the group.

Sir J. E. Smith ("English Flora," Vol. II., p. 17) gave the habitat of *V. spicata* as "high dry chalky pastures, especially on Newmarket Heath, and about Bury St. Edmund's." Withering says "dry pastures"; Babington "chalky heaths"; and Hooker "chalky pastures." It does not appear, however, to be an especially calcicole species, or its distribution would be much more extensive in the chalk districts of England. On Newmarket Heath, *V. spicata* was found among grass and furze; on Cavenham Heath among bracken and furze; at Garboldisham (two stations), Weeting, East Harling and West Harling, in grassy patches among bracken

or on the outskirts of the association ; and at Euston among bracken, heather and sand-sedge, the two latter species being of poor growth and outliers from the main association to the westward. Its distribution in Breckland indicates that its presence is not due to quite the same conditions as those of the other purely "breck" plants ("Trans.," Vol. X., p. 141) as it is not found in association with any of them. Nor is it found in company with distinctly calcicole plants. The height above O.D. of the Norfolk and Suffolk stations ranges from 60 to just over 100 feet, with an average of about 76. The climate of the district is drier and more sunny than that of any other portion of England. As Mr. A. Wallis, says (Marr & Shipley's "Natural History of Cambridgeshire"), "The dry Germanic plants might confidently be expected to show modifications which enable them to exist in the east, whilst elsewhere in England they are choked out by a more water-loving vegetation." Climate therefore plays an important part in the restricted distribution of this species. The soil conditions which seem most favourable are primitive heathland where there is a thin layer of the peculiar "breck" sand over chalk, the sand being of sufficient depth to allow the calcifuge *Calluna* to grow, but not of sufficient depth above the chalk to allow it to flourish.

Mr. Arthur Bennett, to whom I am indebted for most of the older records, adds :—" I cultivated *V. spicata* from Culford Heath, Suffolk, for several years. It kept to the dwarf state, as found wild, never assuming the luxuriant condition of the West of England *V. hybrida*."

V

WILDFOWL IN NORFOLK IN THE WINTER 1923-4

BY B. B. RIVIERE, F.R.C.S., M.B.O.U.

THE winter of 1923-24 will long be remembered by Norfolk gunners for the remarkable influx of wildfowl which took place on our coasts during the month of January. The last two weeks of the old year were marked by frosts, blizzards, and

snowstorms ; and similar conditions prevailed during the first fortnight of January, a particularly severe blizzard from the S.E. occurring on the night of the 8th, and it was during these two weeks that the majority of duck appear to have come in. These do not seem to have appeared upon the inland broads and rivers of Norfolk in such large numbers as was the case in the early months of 1922; but it must be many years since such quantities have been met with upon the marshes, estuaries, and broads in the immediate vicinity of the coast.

On January 12th I had a visit from Mr. A. F. Sherlock, who, with Allen, the punt-gunner, had just spent a fortnight on Breydon. They both told me that in all their experience, dating back for some twenty seasons, they had never seen anything approaching the number of duck which were then on Breydon. They described the number of Wigeon as almost incredible, although owing to the quantity of ice and the persistent high winds they were able to do but little shooting.

At Hickling, Salthouse, Cley, and Blakeney it appears to have been the same, and I learn from more than one reliable source that during the second week in January a Blakeney punt-gunner killed no less than ninety-six Wigeon at one shot. I was at Cley on January 13th, when the number of duck on the marshes was remarkable, and included hundreds of Pochard, with Wigeon, Mallard, Teal, Tufted Ducks, Pintail, and a couple of drake Shovellers.

Mr. A. H. Patterson wrote to me of Scoters, Scaup, Tufted Ducks, and Pochard sitting in the bight off Corton in their hundreds on the afternoon of January 12th ; and in the *Eastern Daily Press* of January 14th, the same observer described the unusually large number of duck which were to be seen in Yarmouth market on the same day.

Besides Mallard, Teal, Wigeon, and Tufted Ducks, Pochards put in an appearance in very large numbers, and there was a fair sprinkling of hard-weather ducks, as Scaup and Golden-eye, some very fine adult drakes of the latter species being killed early in the month. Pintails, also, which I have come to regard as a somewhat uncommon species in Norfolk, occurred in unusual numbers. Twelve were shot during the season on the Cley marshes, where, on January 13th, I saw a bunch of eight ; Mr. Gunn received five or six, one was taken on Fritton

Decoy, whilst several were seen, and two shot, by Mr. Sherlock on Breydon on January 12th.

Goosanders appear to have visited us in large numbers: Miss Turner reported a flock of about sixty on Hickling Broad during the second week in February, whilst I have records of seven more being killed in other parts of Norfolk.

Smews also were much in evidence: six to my knowledge having unfortunately been shot, including two adult drakes. Two Red-breasted Mergansers were shot at Ranworth on January 22nd and two more on February 5th.

Black-throated Divers were also met with in some numbers both on the coast and on inland waters, one Norfolk taxidermist having received four since Christmas. It is, perhaps, also worth recording that on January 15th a fine common Scoter drake was shot on the river at Wroxham, a rather unusual situation for this sea-going species.

* Fresh arrivals of Wild Swans seem to have taken place early in January. On the 2nd thirty-eight whoopers flew over Wroxham Hall, well within gun shot, travelling from east to west (Major S. Trafford); whilst on the 4th a herd of forty-six Bewick Swans, flying in the same direction, were seen at Cley (Ramm).

Early in the month Wild Swans of both species arrived at Hickling to the number of about sixty, and, orders having been given that they were not to be shot at, they continued to frequent the broad throughout January, February, and the early part of March, leaving, as I learn from Miss Turner, on March 17th. Miss Turner also tells me that during the latter part of this time the herd, still about sixty strong, consisted entirely of Bewicks.

In conclusion, it may, I think, give some idea of the numbers of ducks which have visited our coast if I quote some of the bags which were made at a few of the best-known duck shoots in Norfolk during the past season:—

Cley Marsh.—Total bag for season, 768 Ducks, consisting of eleven species in the following numbers: Teal 356, Mallard 188, Wigeon 62, Sheld-drake 47, Pochard 43, Shoveller 41, Pintail 12, Tufted Duck 9, Gadwall 4, Golden-eye 4, Scaup 2 (A. W. Cozens-Hardy).

Salthouse Broad.—Total number of ducks killed on Mr. Cain's shoot up to January 15th, 1924, approximately 500 (G. Cain).

Ranworth.—On January 22nd, 1924, three guns during the morning flight killed 117 ducks, ninety-one being Mallard; and on February 5th two guns only, during the morning flight, killed 140 ducks consisting of the following species:—Mallard 103, Teal 8, Wigeon 17, Tufted Duck 4, Shoveller 2, Pochard 1, Goosander 2, Red-breasted Merganser 2 (J. Cator).

Fritton.—At Fritton Decoy the total take of ducks between December 23rd, 1923, and January 18th, 1924, was 1934, these being practically all Mallard (Major the Hon. F. Crossley).

VI

WOODCOCK IN NORFOLK IN THE WINTER 1923-24

BY B. B. RIVIERE, F.R.C.S., M.B.O.U.

AN exceptional number of woodcocks having been killed in Norfolk during the winter of 1923-24, I think that an account of this remarkable immigration, with particulars of some of the best bags made during the season, may be of interest. And I should like here to thank those gentlemen who have allowed me access to their game-books or have sent me records of bags made at their shoots, and also Dr. S. H. Long, who has collected a good deal of additional information for me.

Up to the end of November not more than the usual number of woodcock appear to have arrived in Norfolk, but early in December some big bags began to be made upon shoots situated near the coast, and large numbers continued to be shot throughout this month and up to the end of the season.

Doubtless the prolonged frosts and wintry weather prevailing in Western Europe during December and January were the cause of such large numbers of woodcock visiting Norfolk; but one curious feature of this immigration was the fact that they were only met with in any numbers in the immediate

vicinity of the coast. No big bags, as far as I can ascertain, were made at any inland shoots, and even at Swanton Novers, the most celebrated woodcock covert in Norfolk, although thirty were killed in one day and the total season's bag was 134, it was the worst woodcock year within the recollection of Mr. E. J. Sharpe, the Head Keeper. Either, therefore, the main flight of woodcocks which arrived early in December remained in the vicinity of the coast throughout the season, or there was a succession of fresh flights during the month and throughout January, and I think the latter the more probable explanation.

The following is a list of some of the best bags made in Norfolk during the season, of which I have been able to obtain particulars :—

Snettisham.—Total bag for the season, 164, some of the best days being December 1st, 16 ; December 2nd, 22 ; January 21st, 52 ; January 31st, 24—all in Ken Hill Wood. Both as regards the greatest number killed in one day (52) and the total season's bag, this is a record for the shoot for the past fifty years, which, I understand, is as long as a game-book has been kept on this estate (E. A. Lycet Green).

Holkham.—Total for the season, 208, with the following as the seven best days :—

December	11th	...	...	16	Woodcock
December	12th	...	...	18	„
December	13th	...	...	19	„
December	14th	...	...	13	„
December	27th	...	...	32	„
January	1st	...	...	21	„
January	31st	...	...	21	„ (A. E. W. Tower)

Stiffkey.—December 27th, 31 Woodcock (Col. J. E. Groom).

Cley.—January 9th, 26 Woodcock, the previous record for one day being 13 (A. W. Cozens-Hardy)

Sheringham.—

January	1st	...	...	16	Woodcock
January	2nd	...	...	18	„
January	4th	...	...	19	„

(H. E. Upcher)

Sidestrand.—

December 22nd	...	...	11	Woodcock
December 26th	...	...	9	"
December 28th	...	...	11	"
				(G. E. Davey)

Northrepps.—

January 4th	28	Woodcock
January 10th	10	"

Trimingham.—

January 7th	41	"
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and I learn from Col. M. Backhouse that two more were picked up the next day.

Gimingham.—

December 24th	...	...	30	Woodcock
December 29th	...	...	15	"
				(G. Davey)

Antingham and Trunch.—

December 27th	...	...	21	Woodcock
				(G. Davey)

Honing.—

December 24th	...	...	10	Woodcock
December 28th	...	...	21	"
December 29th	...	...	19	"
January 17th	...	...	16	"
				(J. Habgood)

Mautby.—

December 17th	...	...	12	Woodcock
December 19th	...	...	27	"
				(W. Warner Cook)

Somerleyton.—Total bag up to January 18th, 215. This is a record for the shoot, the largest number killed in one season previously being 196 (Major Hon. F. Crossley).

The most noticeable Woodcock years in Norfolk in the past would appear to have been those of 1852, 1858, 1865, 1866, 1867, 1869, and 1908. An account by the late J. H. Gurney of some of the bags made in the two last of these years will be found in the "Zoologist," 1909, page 137, and of those of the previous years by Henry Stevenson in Vol. II. of "The Birds of Norfolk."

As regards numbers killed in one day, the well-known wood at Swanton Novers appears easily to hold the record, ninety-three having been killed there in one day in December, 1852, and eighty-three in one day in November, 1858. Other good one-day bags made in the past are forty-nine on November 16th, 1869, at Hempstead; forty-two on December 19th, 1905, at Haveringland; and forty-two on December 1st, 1908, at Swanton Novers, where eighty-five were killed in the big wood in three days' shooting between December 1st and 4th of that year.

VII

WILD BIRD PROTECTION IN NORFOLK IN 1924

REPORT OF THE COMMITTEE

IN presenting its third annual report to the subscribers to the Norfolk Wild Birds' Protection Fund the Committee desires first to record its thanks to all those within, and beyond the bounds of, the county who are supporting it in its important work of protecting our island avi-fauna.

It has truthfully been said that if protection be given to any species of bird during the reproductive season, then there need be little fear of that species becoming extinct, whatever its enemies may be during the remaining months of the year. As an example of this may be mentioned the Bearded Tit, which was only rescued from extinction on the Norfolk Broads—and thus in England—by the intervention of the Wild Bird Protection Acts. More than once has it been feared that from natural causes—notably during the prolonged and very cold winter of 1916-17—this species would get wiped out, but the numbers have always gradually increased again and at the present time give no cause for anxiety.

With its very varied land surfaces and its extended east-line of dunes and salt marsh, the county of Norfolk still offers suitable breeding areas for some of the rarest of our nesting

birds, and it is one of the objects of the Norfolk and Norwich Naturalists' Society to maintain these under natural conditions. The results in the case of Blakeney Point and Scolt Head Island are most encouraging ; but there are other, almost as important, areas in the county which must be secured, and, as soon as funds allow of purchase, one or more of these will be added to the list of Norfolk Reserves. It is hoped, therefore, that during the coming year there will be added a considerable number of subscribers to the fund.

Appended to this report is a list of subscribers for the year 1924, together with a statement of receipts and expenditure down to the end of 1923.

BREYDON

George Jary, the watcher, was on duty, living in the Society's house-boat on Breydon Water, from the middle of March to the end of August. His presence undoubtedly acts as a deterrent to the indiscriminate shooting that formerly took place on this tidal estuary during the closed season. His notes are a record of the movements of the large number of birds, principally waders, that make use of this extensive feeding-ground during migration.

Five Spoonbills turned up on June 18th and were joined by another the next day ; these six birds remained until July 1st, and other Spoonbills were seen almost daily up to August 23rd. By the middle of July some of the locally-bred Terns would seem to begin to work their way round to Breydon, suggesting that a southward movement begins as soon as the young are capable of flight. The first young Black-headed Gulls were seen on the flats on July 1st ; the nearest breeding colony is at Alderfen Broad. A pair of Sheld-ducks successfully reared a brood of eight at the Burgh Castle end of Breydon this year.

HORSEY

The small colony of Little Terns still struggles to maintain its foothold on Horsey Beach as a breeding site. As late as June 16th only about three pairs were seen, and these certainly had no eggs ; but on July 1st fourteen nests were found, and the colony was estimated to consist of about twenty pairs. In one nest containing two eggs one of the latter was scarcely

half the normal size. There is a good deal of traffic on this beach, and the committee makes an effort to protect the birds by requisitioning the part-time services of a keeper on an adjacent beat.

SALTHOUSE AND CLEY

The first terns seen this year on Salthouse Broad by Mr. Cain's keeper, B. Holman, were two Sandwich Terns on April 16th, and these were followed a week later by a few Common and Little Terns. The birds nested, as last year, on the islands in the Broad. These islands are dry mud-banks, partly bare of vegetation and partly clothed with long grass. In striking contrast with Blakeney Point, where the Sandwich Terns merely deposit their eggs on the bare sand, the birds of this island colony made quite respectable nests in the grass, almost as good as those of the Common Terns. On the islands are also nesting Common Terns, and, at one end of the large island, a colony of Black-headed Gulls. Judging by the increase in the tern colony this year, the gulls do not seem to be resented by the terns.

We visited the Broad on June 4th and counted 257 nests of the Sandwich Tern, of which 142 contained one egg and 115 two eggs, and at that date fresh eggs were being laid daily. There were many nests of the Common Tern, one of which was placed in the centre of a gorse-covered shooting hide. At the final census, taken in July, there were 403 nests of the Sandwich Tern; 209 with one egg, 194 with two. Last year there were 303 nests, containing 391 eggs, and, in addition, 180 nests containing 206 eggs on the Cley marshes. In 1924 no Sandwich Terns nested on the Cley marshes.

There were 420 nests of the Common Tern on the islands this year, and 270 Gulls' nests. Of Little Terns, 40 nests were found on the shingle ridge; there were probably double this number.

Fourteen nests of the Ringed Plover were found, and ten of Redshanks, in addition to one nest of the Oyster-catcher. On May 29th the writer found a Shoveller's nest in the grass-covered low dunes on the north side of the broad, the eggs having either been taken or hatched off. On the Cley marshes twelve Shovellers' nests were found this year.

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Photo

R. Gaze

Sandwich Terns at their nests on Blakeney Point, June 14th, 1924



Photo

R. Gaze

Nest containing three eggs of Sandwich Tern on
Blakeney Point, June 15th, 1924

In view of the considerable number of nests of the Sandwich Tern that were deserted on Blakeney Point, the Salthouse keeper was asked to count the number of unhatched eggs that remained at the end of July. He found fourteen, and, with those that he had previously noted, he estimated that about thirty nests had been deserted. He saw only fifteen dead chicks.

A new cut for the drainage of these marshes into the Cley channel has been made this year and was completed at the end of June. That it has been functioning is evidenced by the fact that at the time of writing this report (mid-August) the marshes are once again drained and cattle and sheep are being grazed upon them. How long this new channel will remain open is a point on which opinions differ, but in any case it will probably be some years before the mass of fowl and waders that have used these inundated marshes for the past two-and-a-half years will again find them suitable as feeding grounds.

BLAKENEY POINT

The very large number of Terns that nest on this reserve formed themselves again into two main colonies this year: the one on the Far Point, the other about half-a-mile further eastward. On the intervening shingle ridge many Little Terns nest, whereas Ringed Plovers' nests are found generally distributed all over the area.

On April 17th the first Little Terns arrived, and on the 19th three Sandwich Terns were seen. During the next few days Common and Little Terns turned up in numbers. On the 22nd, Pinchen, the watcher, reports the first Ringed Plover's nest with eggs. On May 5th he found an Oyster-catcher's nest with eggs, which were eventually five in number. This was undoubtedly the nest of the two birds that laid together last year. In all, six pairs of Oyster-catchers hatched off on the Point this season.

By May 13th Pinchen notes that many Sheld-ducks were nesting in the Hood and in the hills by the "Yankee." During this month nests of the Common Tern were found generally distributed, and Sandwich Terns were laying daily on the Far Point. On June 5th the writer visited the area and counted

143 nests of Sandwich Terns on the Far Point, and of these
50 contained one egg,
92 contained two eggs,
1 contained three eggs.

The "threes" were obviously all laid by the same bird, and a photograph of the nest, taken by Mr. Gaze, is here reproduced. On an area of about four yards square there were fifty-nine eggs, and when these were visited again on July 20th there remained twenty-four eggs unhatched and deserted. I estimate that the total number of Sandwich Terns' nests on the Point, this year, was about 300 and that some 40 per cent. of these did not hatch off.

The first young Common Terns were hatched on June 10th, and on the 19th young Sandwich Terns were seen; by the end of June many were hatched off. On July 12th he notes that several second (or third) clutches of Ringed Plover were hatching.

Speaking generally, the birds nesting on Salthouse Broad and Blakeney Point turned up in their usual numbers this year and had a good hatching. The food supply for the terns would seem to have been abundant, as was reflected in the larger number—approximately 50 per cent. of the nests counted—of Sandwich Terns that laid two eggs as a clutch. In the Salthouse Colony quite half of the chicks of the Common Terns died, but there was not noticed any undue mortality amongst the young Sandwich Terns in the colony.

SCOLT HEAD

The hut erected on this island last year has been furnished out of the "Scolt Head Fund," raised by Mr. R. J. Colman, and has been occupied during the past nesting season by Miss E. L. Turner, who offered her services as watcher. It may now be described as a well-found, water-tight hut, with sleeping accommodation for four people, and commanding from the plateau on Scolt Head, on which it stands, one of the most glorious views to be obtained in Norfolk.

Although egg-collecting on the island has for long been looked upon as one of the local "industries," it is the more satisfactory to be able to report that during the past season no attempt has been made to molest the breeding birds or their

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Photo

R. Gaze

Nest of Redshank in *Suaeda fruticosa* on Blakeney Point,
June 15th, 1924



Photo

E. L. Fuoner

Nest of Roseate Tern on Scott Head Island, July 16th, 1924

eggs. Several interested ornithologists have stayed at the hut during the summer, and in another part of this issue of the Transactions will be found a valuable joint paper by Mr. T. A. Coward and the Watcher on the Spring Migration, as observed on the island.

We have received from Miss Turner her Notes on the breeding birds of the island between April 1st (when she first went on duty) and July 30th, and these are here reproduced:—

“The following report is the result of such observations as the Watcher, assisted from time to time by various friends, has been able to make. The area under observation is far too large for one watcher to work satisfactorily. Observations, therefore, have been confined principally to that half of the island which lies west of House Hill.

RINGED PLOVER.—On April 1st numbers of Ringed Plovers were feeding on the saltings; some were in flocks—probably passing birds. None of them shewed any desire to pair off; the wind was N.E. and the weather bitterly cold. However, on the 5th and 6th, with a change of wind and some warmth, vigorous courting took place. On the 6th there were five or six scrapes on one shingle ridge, and on the 7th we found 120 on that small bank.

I saw one male make three scrapes in five minutes, and during the next ten days all the available patches of shingle (and they are many) were alive with the challenging and courting cries of the male Ringed Plover. When making a scrape, the male utters a distinctive triple call-note, which I soon learned to distinguish as the scraping note. When uttering this he kicks out the sand and shingle behind him, picks up tiny pebbles and rolls them down his breast into the scrape. Afterwards, when trying to locate the real nest amongst the hundreds of false ones, it was easy to tell these male scrapes by the little heap of fine stones lying on one side of the depression.

The first egg was found on April 18th. The eggs were laid on alternate days, and sometimes with an interval of two days between them. Some birds laid in the afternoon, others early in the morning. If the first egg in a clutch was laid in the earlier hours, the rest of the clutch would be laid at about the same hour on alternate days, and *vice-versa*. One nest which contained a single egg on April 19th had three in it on the 24th,

in spite of the fact that the spring tide had lapped over the nest seven times. Unfortunately two hooligan Rooks robbed this, and all the other nests on that beach ten days later, so that it was impossible to tell if these eggs would have hatched or not. The great destroyers of all the Ringed Plovers' nests on the south side of the island were Rooks, a pair of passing Carrion Crows and the Spring tides. Some of the birds nested three times. They never seemed able to cope with these high tides, though apparently able to gauge the ordinary level of high water.

Nests were found in various situations. Most were in the open, on the various beaches. Many were under *suæda* bushes. There were numbers also amongst marram grass in the dunes. One nest on the saltings, which must have had some tides over it, was paved with bits of caked mud. This clutch of eggs hatched. Those Ringed Plovers which nested in the Ternery were not subject to robbery. Up to June 9th we counted 67 nests and 136 eggs in that area alone. Almost every day till the end of the month and well into July, two or three nests were found every time we were out hunting; but as many of these were second and third attempts, they were not counted. In spite of the numbers of nests which ultimately hatched off, the mortality amongst the young must be very great. Very few reached maturity. A nest with one young bird and two eggs just chipping was found on August 3rd.

OYSTER-CATCHER.—It is sometimes difficult to tell from the behaviour of an Oyster-catcher exactly what it is doing. This elusive and secretive bird seems to spend half its time loitering about, while the eggs take care of themselves. After Easter Monday three Oyster-catchers were generally together on the shore, three others on the saltings. As eventually six nests were found, three near the dunes and three near the saltings, in all probability these irresponsible birds were the males. But when the females had been sitting some time, the males kept guard and gave warning if anyone came in sight. In two cases the females walked away before we were within a quarter of a mile of them. Only one pair ever showed anxiety or protested if the nest was approached. In the evenings five or six might be seen and heard playing and shouting together on the marshes. Whether or not these were the male birds it

is difficult to say. Probably they were, as the females visible from the Head were brooding while these noisy games took place.

One nest gave me some trouble to find, and every time I gave up the search and turned homewards the two birds followed me some distance with jeering cries. Four of these six nests contained clutches of four eggs, one three, and the sixth I only found when all the eggs but one had hatched. One nest was washed out on June 17th; this pair nested again, further inshore. There was only one egg in this nest, and this was forsaken on July 29th. Another forsaken nest was found containing three eggs, making eight nests in all.

These Oyster-catchers' nests varied very much. One was a mere scrape in the shingle; three were lined with broken cockle-shells, and one with bits of pale blue mussel-shells. Curiously enough, a Ringed Plover's nest three feet away was also lined with similar shells. One other Oyster-catcher's nest was lined with a mixture of blue and white shells.

This species seems to be tolerant of other species and very seldom drives away the Ringed Plovers or Terns which nest close to it. In fact, the truculent Ringed Plovers were far more pugnacious, and frequently tried to drive away the imperturbable Oyster-catchers from their own legitimate area, if there was any overlapping of territorial rights.

A fine upstanding family of three young Oyster-catchers near the Ternery was just able to fly on July 26th. These birds were hatched on June 19th. I lost sight of all the other families soon after they were hatched, as the parents took them to the saltings, where they hid in the creeks and amongst the vegetation.

Incubation took from twenty-five to twenty-nine days, but in three nests the last egg was not hatched.

REDSHANKS.—Redshanks breed in fair numbers all over the island. Their choice of a nesting site varies considerably. Some nests were in quite open situations—in young tender *suæda* bushes, where there was no attempt at concealment. Others were closely hidden in marram grass. One of the most beautifully-made nests I have ever seen was in a tuft of marram on a small dune in the Ternery. It looked like a finely-woven basket. A number of young were running about on the saltings

up to July 26th. The greater bulk of the resident birds had moved on by the end of the month.

SHELD-DUCK.—Quite a number of broods of young Sheld-duck were hatched and could be seen in the creeks. As these birds are very elusive it is difficult to say how many of the nineteen pairs in the area under observation hatched their young successfully. One nest near the hut came to grief just as the eggs were chipping. I found five on the sands, and a lot of down scattered round the nesting hole. Two other nests in the House hills, in what we called "The Valley of the Sheld-duck," also looked as if they had been molested.

I saw the first brood on June 13th, and young were on the wing on August 1st. But unless you catch sight of the little families when they are first taken to the water, it is very difficult to find them afterwards.

COMMON TERN.—Common Terns came in slowly during the last week of April and the first week of May. The first egg was found on May 16th. Up to June 19th, 303 nests were marked, but this number represents only about half the nests found. There were 150 more on the West Point alone, besides those scattered over the whole area. Every shingle beach on the island was resorted to by one or more pairs of Common Terns. The second nest found with eggs was on an isolated beach, and the scrape was made originally by a Ringed Plover.

About twenty nests were washed out by the high tide on June 19th, and the same birds lost their second nests from the same cause on July 17th. Most of the clutches consisted of three eggs, but those birds which laid a second time laid only two eggs. There was one clutch of four eggs, apparently laid by one bird.

There was the usual mortality amongst the young. Many were trampled on in the nest. But the critical time is when they begin to feather. Death at that age seems to be due to some digestive trouble.

The old birds are brutal to young other than their own nestlings. A strayed youngster that has to run the gauntlet of several brooding terns is nearly always pecked to death before it reaches safety. The last clutch of eggs hatched off on August 7th.

LITTLE TERN.—There is a fairly large colony of Little Terns along the shore. The nests are arranged in groups of from five to seven, in proximity. A good many nest on the flat shingle amongst the Common Terns. Another little colony of eight or ten nest at Smugglers' Gap; and a new colony at the Overy end close to the Creek, amongst some new dunes. There were about a dozen pairs in that locality. A number of nests were washed out on June 19th. The Little Terns had all left the West Point by the third week in July, and were to be found along the shore fishing mostly at the Overy end. The several groups seemed to have united, old and young. There was not a great number of young birds. The mortality amongst them was greater in proportion than it was amongst the Common Terns.

SANDWICH TERN.—Sandwich Terns were passing on April 30th, but very few birds stayed at first. Four eggs were laid on May 20th, and nine by the 27th. None of these first eggs were ever brooded.

On June 7th there was an influx of Sandwich Terns, and laying began in earnest on the 9th. Fresh eggs were found daily up to June 26th. Eventually there were forty nests and fifty-three eggs, not counting the first nine eggs which I removed.

The first young bird was hatched on June 26th, and the last on July 24th. Only six nests contained clutches of two eggs.

The Sandwich Tern is more tolerant of the young than the Common Tern appears to be. I frequently found a newly-hatched Sandwich Tern sheltering against an older youngster in a neighbouring nest. They are far more helpless in the earlier stages of their growth than are the nestling Common Terns, and remain in or near the nest for several days. One half-grown youngster was to be found daily sheltering under a thick plank, where it had made a scrape, from July 10th till the 18th.

When stronger, little groups of eight or ten might be seen running about together along the shore, like a brood of ducklings. On one occasion a party of eight took to the water when I approached, and were convoyed from the air by sixteen parents and thus escorted to another beach where they could not be followed.

ROSEATE TERN.—On June 22nd three Roseate Terns were seen by Mr. and Mrs. Riviere and myself. One pair nested and brought off two young. One hatched on June 16th and the other on the 21st.

These two nestlings were akin to young Sandwich Terns in general coloration and markings. They seemed feeble and looked bedraggled for three days, owing to the partially ensheathed down. But after the third day they were fluffy, and though not active, could peck viciously when handled.

The colour of the legs and skin was a dark slate-grey. The legs are almost as stout as those of young Sandwich Terns. When about a week old the under-parts are very blue-grey, and the bird closely resembles the bluish pebbles on the beach. The nestling when once seen could not be confused with the nestling of any other species of Tern.

This pair of Roseate brooded very steadfastly. They never once evinced the nervous restlessness that characterises the Common Tern. Often when the whole colony of Terns rose in panic about nothing at all, the Roseate remained calmly brooding. When I approached the nest after the first young one was hatched, both the old birds attacked me furiously.

On one occasion I saw a third Roseate sitting by the nest, but it was promptly driven off by the brooding bird's mate. Several systematic searchings of the whole area failed to reveal a second nest.

There was a little colony of Wheatears at the East end of the island, and a number of young later on. I saw newly-fledged young, hardly out of down, sitting on the ruined "house" in the House Hills, on July 31st.

Larks, Linnets, and Meadow Pipits bred in countless numbers everywhere. In mid-July young Pipits and Linnets were all over the ragwort by the hut. These birds, both old and young, were very tame and played round the hut all day. By the end of the month they had vanished. A walk over the whole island hardly revealed a dozen small birds of any species."

WOLFERTON

This nesting-ground is a flat shingle area on the edge of the Wash, at the back of which are reclaimed marshes with the higher grounds of Sandringham further inland. Up to a few

years ago Common and Little Terns nested along the low dunes and shingle ridges as far as Heacham—a distance of about two miles ; but owing to the erection of numerous huts and bungalows the birds are now restricted to the area limited by the King's boundary fence. There is a hut, the property of the Society, on the area, and the birds are protected for the Committee during the nesting season by two of the Sandringham keepers.

During 1924 fifty nests of the Common and about forty of the Little Tern were found by Watcher F. Bridges ; he also found forty nests of the Ringed Plover. There are more Lapwings nesting on this area than on any similar-sized piece of ground in the county.

The district is a stronghold of the Sheld-duck, and there must be from fifty to a hundred pairs nesting in the hills above Dersingham and in the Sandringham woods. Bridges found two nests this year, containing twelve and fourteen eggs ; the one in long heather in Whin Hill Wood, the other in bracken near his cottage. He has often seen the old birds leading their young broods down through the wood to the marshes.

GENERAL

Although the Society has no direct control over that large area of Norfolk known as Broadland, it manages to keep in touch with landowners and others, and the following may be accepted as a record of what has happened during the past season.

Of Montagu's Harriers there were nine nests—the largest number within our memory. One of these nests was never discovered, but it was undoubtedly present at Ranworth. A new locality for the nesting of this species is Calthorpe, where, on his marshes, the writer was taken by Mr. Robert Gurney to see a nest containing four eggs, one chipped, on June 29th. Two of these eggs were addled, but the other two hatched and the young birds got away all right.

Reports received about the Bittern are quite satisfactory, and the number of nests this year has not diminished.

Five pairs of Short-eared Owls nested this year in Broadland.

Three Garganeys' nests were found, and a fourth pair of birds was about the district throughout the nesting season.

The Grasshopper Warbler is fairly generally distributed in the Broads District and is undoubtedly holding its own.

The Black-headed Gull is a bird that is on the increase in the county. In addition to the Scoulton colony there are three flourishing colonies on Northwold Fen, which are probably offshoots from Scoulton. The Wells colony—on the saltings—is increasing, and the keeper (Cringle) estimated its strength this year at 200 pairs. The nests on the Salthouse and Cley marshes have already been referred to. On Scolt Head a pair nested and hatched off this season in the middle of the ternery: this is a new nesting site for gulls. There were no gulls at Breccles this year.

In the Broads District the presence of floating hovers would seem to be the factor determining gulls for their appropriation of a broad for nesting purposes, as here the birds very rarely nest on the mainland. Since 1921 gulls have nested in strongest force on Alderfen Broad, and in that year the owner, Mr. Herbert Goodchild, counted seventy nests. When the chicks were about ten days old they were all killed in one night by (probably) an otter. The same fate befell the young from about 200 nests in 1922. In 1923 there were only thirty-five nests, and the young were not molested. This year the writer visited the broad with Mr. Goodchild, when we estimated that there were from 200-250 nests—all either on islands or on floating hovers. The birds had a good hatching and all got away. There were no nests on Hoveton Broad this year—an alternative site.

The Stone-curlew is a bird that nests over a wide area in S.W. Norfolk and, as isolated pairs, in many other places in the county. To what extent the Government's afforestation scheme for Breckland will modify their numbers remains to be seen, but at the present time these birds may be described as numerous in that area. In a letter, dated August 24th, 1924, Mr. Rudge Harding, who was at that time staying in the district, says, "On the 19th I went to Cranwich Heath, where I put up a big flock of Stone-curlew. I counted up to fifty, but others kept rising, and I'm not going beyond the mark in saying that there were at least sixty."

Why the Redstart has forsaken so many of its old nesting haunts in the southern half of England is a question which is puzzling many ornithologists and, so far, Norfolk cannot supply the answer. At the same time, it is very satisfactory to be able to report that Mr. Tracy had four nests in his sanctuary at North Wootton this year and that he found two other breeding pairs in the neighbourhood. These are the only nests we have heard of in the county.

Signed (on behalf of the Norfolk W.B.P. Committee),

SYDNEY H. LONG, Hon. Sec.

LIST OF SUBSCRIPTIONS AND DONATIONS TO THE NORFOLK WILD BIRDS' PROTECTION FUND

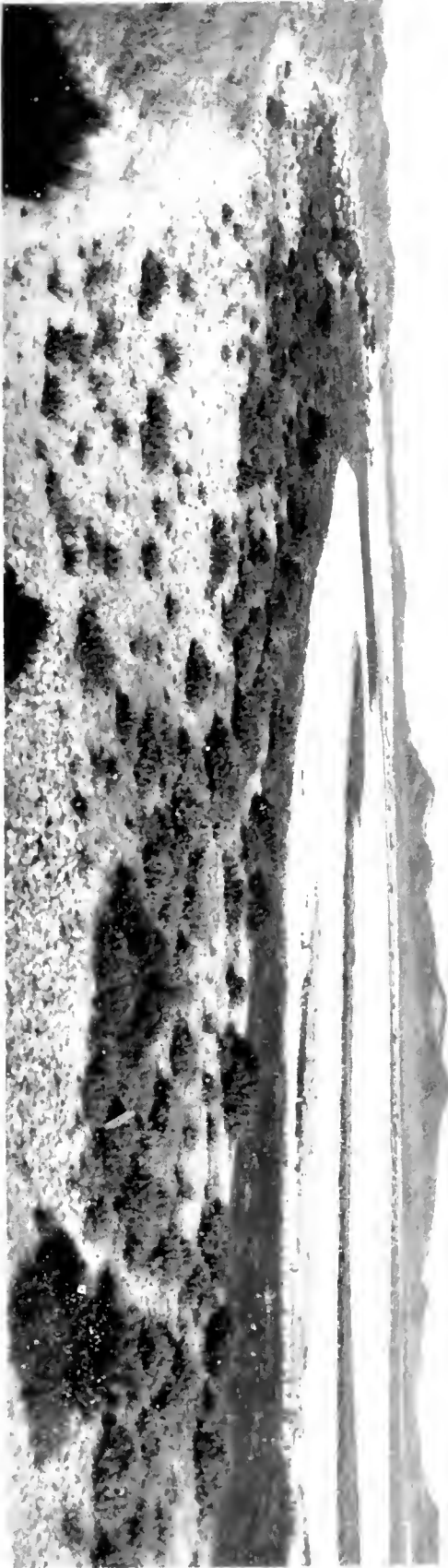
TO THE END OF AUGUST, 1924

	£	s.	d.		£	s.	d.
H.M. THE KING ...	3	3	0	Brought forward ...	36	9	0
H.R.H. THE PRINCE OF WALES, K.G. ...	2	2	0	Burrowes R. B. ...	0	5	0
Ainsworth F. O. ...	0	5	0	Burton S. H., F.R.C.S. ...	2	2	0
Allars Miss E. M. ...	1	1	0	Buxton E. G. ...	2	2	0
Allars E. G. ...	1	1	0	Buxton G. F. ...	3	3	0
Allars R. W. E. ...	1	1	0	Byers J. ...	0	10	0
Andrews W. H. M. ...	0	10	0	Candler C. ...	0	10	6
Baker E. Stuart ...	5	0	0	Carruthers D. ...	2	2	0
Barclay F. H. ...	0	10	0	Cassie R. L. ...	0	10	6
Barclay H. G. ...	2	2	0	Chamberlin Sir G. M. ...	1	1	0
Barry W. J. ...	1	1	0	Chapman His Honour Judge E. H. ...	2	2	0
Barton S. J., M.D. ...	1	1	0	Christie J. A. ...	1	1	0
Bedford Her Grace the Duchess of ...	2	0	0	Coe Mrs. A. E. ...	0	10	0
Bell R. C. ...	0	10	6	Coller G. A. ...	1	1	0
Bidwell E. ...	0	10	0	Colman Miss ...	1	1	0
Bird Rev. M. C. H. ...	1	1	0	Colman Miss H. C. ...	1	1	0
Blakeney Point Collec- tion Box ...	2	1	6	Colman R. J. ...	1	1	0
Boileau Lady ...	1	1	0	Cooke A., F.R.C.S. ...	0	10	0
Boileau Sir M., Bart. ...	1	1	0	Cozens-Hardy A. ...	1	1	0
Boardman E. T. ...	0	10	0	Cresswell Col. G., C.V.O. ...	2	2	0
Brash T. ...	2	2	0	Deacon G. E. ...	1	1	0
Brittain H. ...	0	10	0	Davey G. ...	0	10	0
Brooks J. R. ...	1	0	0	Dew Mrs. ...	0	10	6
Brown Edward ...	3	3	0	Doughty C. G. ...	1	1	0
Brown Henry ...	1	1	0	Ferrier Miss ...	0	10	0
Buckle Lt.-Col. D. W. ...	1	1	0	Fleming Miss R. ...	0	10	6
				ffolkes Sir W., Bart. ...	1	1	0
				A Friend... ...	0	10	0
				Gadesden, Miss ...	0	10	0
Carried forward ...	36	9	0	Carried forward ...	66	9	0

	£	s.	d.
Brought forward ...	66	9	0
Gibbins W. W. ...	1	1	0
Green Sir E. A. Lycett, Bart. ...	0	10	0
Gurdon E. T. ...	1	1	0
Gurney Sir E. ...	1	1	0
Gurney G. H. ...	1	1	0
Gurney Q. E. ...	1	1	0
Gurney Mrs. Richard ...	0	10	0
Gurney Robert ...	1	1	0
Gurney W. S. ...	1	1	0
Halls H. H. ...	1	0	0
Harcourt Miss J. Vernon	2	2	0
Harding J. Rudge ...	0	12	6
Harker W. ...	1	1	0
Hare Sir Ralph, Bart. ...	1	1	0
Haydon W. ...	0	2	6
Heatherley Dr. F. ...	0	10	6
Horsfall R. E. ...	0	10	0
Jones Sir L., Bart. ...	1	1	0
Ketton-Cremer W. C. ...	0	10	6
Key R. ...	0	10	0
Kinder Rev. E. H. ...	1	1	0
Knight E. ...	1	0	0
Lake G. D. ...	0	10	0
Larking C. (the late) ...	1	1	0
Lee-Elliott Rev. D. L.	1	1	0
Lloyd Capt. L. ...	1	0	0
Long Miss M. ...	0	5	0
Long S. H., M.D. ...	2	2	0
Mack H. P. ...	2	2	0
McKenna Mrs. Reginald	1	1	0
Macpherson A. Holte ...	1	1	0
Martin H. ...	1	1	0
Massingham H. J. ...	1	0	0
Meade-Waldo E. G. B. ...	1	1	0
Meadows Mrs. A. ...	0	10	6
Mennell E. ...	0	10	0
Miller O. ...	0	5	0
Millett C. ...	1	0	0
Moxey J. E. ...	1	0	0
Murton Mrs. ...	1	1	0
Newman Miss F. B. ...	0	10	0
Norwich High School (per Miss Wise) ...	1	5	9
Carried forward ...	105	5	3

	£	s.	d.
Brought forward ...	105	5	3
Offord Miss ...	0	10	0
Oliver F. W., F.R.S. ...	2	2	0
Pain P. ...	1	1	0
Patteson Mrs. F. E. ...	1	1	0
Pelham Rev. Canon S.	2	2	0
Petre Mrs. ...	0	10	0
Plowright D. C. T. Mc.	1	1	0
Pond H. J. ...	0	10	6
Preston Sir E., Bart. ...	1	1	0
Purdy Col. T. W. ...	1	1	0
Pym Mrs. R. ...	0	5	6
Ransome Mrs. ...	1	1	0
Richmond H. W., F.R.S.	1	1	0
Ringrose B. J. ...	1	1	0
Rising A. ...	2	2	0
Riviere B. B., F.R.C.S.	2	2	0
Rogers Rev. H. ...	1	0	0
Seolt Head Collecting Box ...	5	9	2
Sewell P. E. ...	2	2	0
Sheringham Sunday School Children ...	0	4	4
Simpson F. T. (1923 and 1924) ...	4	4	0
Smith Col. H. F. ...	1	1	0
Soman A. E. ...	1	1	0
Spalding G. ...	0	10	0
Stimpson E. ...	0	10	0
Strachan C. E. ...	1	1	0
Taylor M. ...	1	1	6
Thomas Maj. F. W.	1	1	0
Thouless H. J. ...	0	10	0
Ticehurst C. B. ...	1	1	0
Tyndall G. H. ...	0	5	0
Upcher Miss L. ...	2	0	0
Upcher H. E. S. ...	1	0	0
Vincent J. ...	0	1	0
Walter Cyril ...	1	1	0
Walter J. H. F. ...	1	1	0
Washington Rev. Canon	1	1	0
Winch Maj. S. B. ...	2	2	0
Wright T. J. ...	0	10	0
Wyllys H. J. M. ...	0	10	0
Wyllys W. E. ...	0	10	0
Total ...	£154	14	3

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THE SCOLT HEAD MASSIVE FROM THE S. W. (1923).—In foreground is a belt of *Suaeda fruticosa*; beyond is a Sea Lavender Marsh partly covered by the tide.

VIII

SCOLT HEAD AND BLAKENEY POINT

BY F. W. OLIVER

WITH the whole world to choose from, it would be difficult to find two better examples of the encumbered coastline type than those provided by Scolt Head and Blakeney Point, respectively, two reservations held under the National Trust. As they lie within easy reach of one another on the north coast of Norfolk, they can be visited conveniently on successive days, and their features compared before the details have faded from the mind.

Coastlines such as these make a paradise for the naturalist, because their great width from shore to sea and the complexity of their relief provide many and varied habitats for plants and animals, together with feeding and breeding grounds for innumerable birds. This broadness of the lay-out, with its mingling of sandhills, marshes, and beaches, in ordered sequence, makes a landscape fitted to display the light and shade and colour derived from a capricious sky.

The general scheme of construction is the same at both places, Scolt Head and Blakeney Point are compounded of the same ingredients, are subject to the same forces, and clothed with like vegetations. There is the off-shore bar, or spit of shingle with its landward hooks, the skeleton upon and around which the rest is built. The sand dunes over-lie the shingle for the period of their existence, and between the hooks are the salt marshes, green or grey or purple, according to their covering.

Between this complex and the mainland the tide has access, expanding into a glorious sheet of water under the lee of Blakeney Point, and rendering navigation possible at either end of Scolt Head. But the two places are dissimilar in a very important respect. Whilst the main beach and hooks of Scolt Head are largely overlaid with sand dunes, culminating in the high summit constituting Scolt Head proper, Blakeney Point has lost its dunes, except for the Hood and the actual Headland at its western end. Thus, whilst Scolt Head is in the full zenith of middle life, Blakeney Point is relatively aged. Nevertheless,

this ancient body retains the power to throw out from time to time a young head. This is the Far Point, an incomparable spot.

The area under dunes at Scolt Head is at least sixfold that at Blakeney Point, and as these dunes are mostly well established (they are in the stage represented by the Hood at Blakeney Point), they yield the richer flora. On the other hand, with none of its main beach exposed, Scolt Head is destitute of the dynamic phenomena of shingle travel, so characteristic of the Marams and Cley Beach end of Blakeney Point. The sandhills of both areas are infested with rabbits, but this scourge is wider spread at Scolt Head, because here the dunes extend the whole length and no part of the area is beyond the rabbit radius. Rabbits not only feed on the vegetation, but often gnaw and nibble it so as entirely to transform its natural appearance. The bushes of *Suaeda fruticosa*, so copiously developed on both areas, illustrate this effect. Where rabbits can reach them, these bushes assume a coppiced, tussock form, and this is everywhere at Scolt Head. At Blakeney Point, whilst the Hood and Headland are in the same case, the Marams area is practically free from this bane, and *Suaeda* bushes are left to grow as they should. In years to come, no doubt, as Scolt Head loses its sand hills, the trouble will gradually abate.

In this connection several of the hooks at Scolt Head, especially the one commonly used as a landing place opposite Brancaster Staithe, show excellent examples of stages in the destruction of sand dunes. These are crater-like hollows initiated by rabbits or local wind erosion. These craters gradually extend till a gap is formed right across the sandhill. Two ragged ends are thus exposed to the winds, which, in process of time, complete the destruction of the dunes.

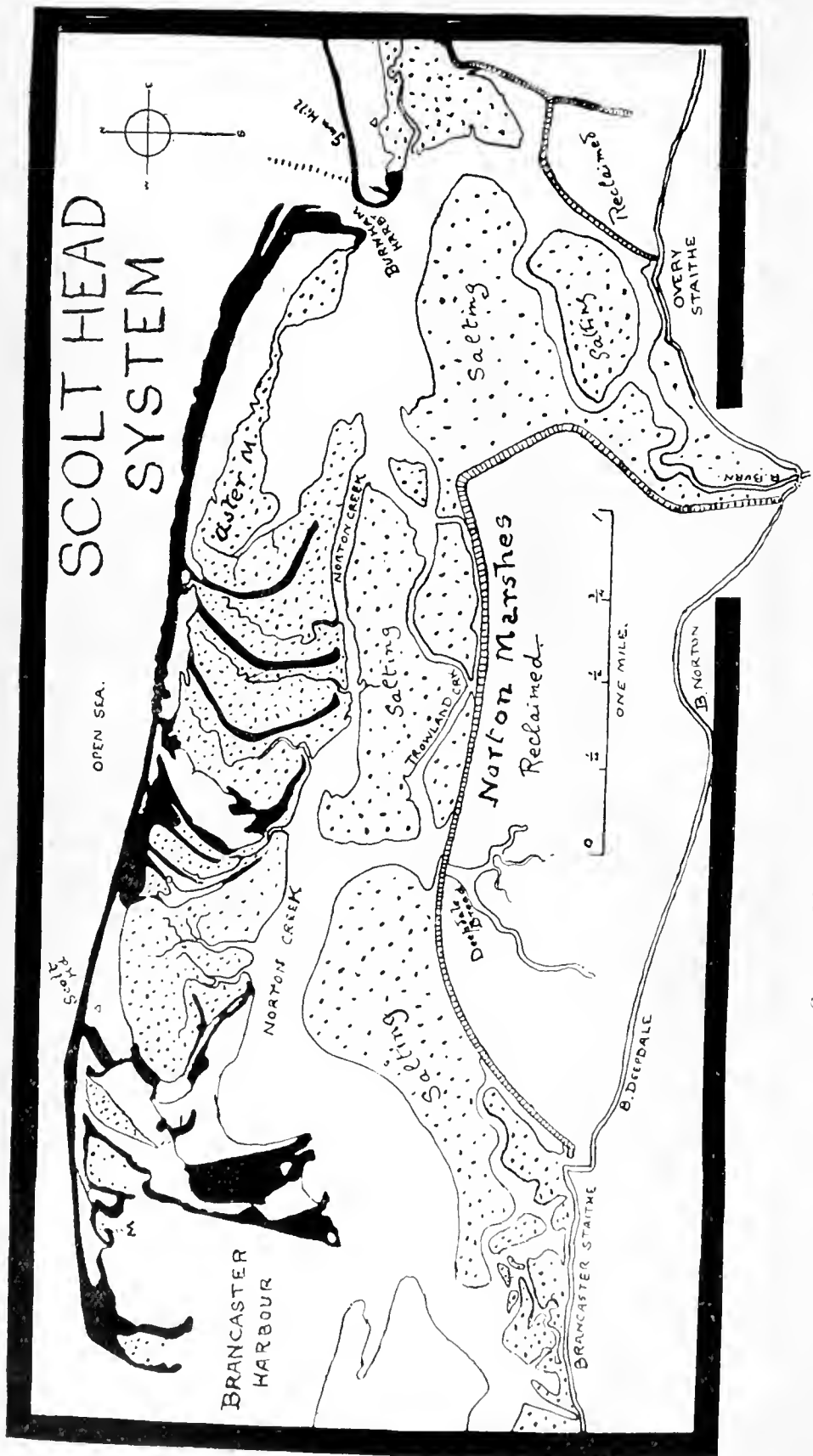
Blakeney Point, owing to its compactness and to the exposure of its skeleton through the loss of its sandhills, serves admirably as a working model for the interpretation of the much more extensive and complex Scolt Head. It is the kindergarten to which our steps must first be directed. The hooks, now placed laterally to the main beach, were at their formation placed terminally. Each as it was formed was deflected by the scour of tide and storm, and the main beach, fed by travelling shingle, resumed its direct growth. Eventually a state of

approximate equilibrium is reached when further permanent extension ceases. To this state Blakeney Point has attained, notwithstanding the fact that a new terminal has recently budded out. This is the present Far Point, a place of entrancing interest, where new dunes are arising and developing, and where large numbers of terns now nest. But such is its exposure that, as on a previous occasion, it should after fifty or eighty years be wasted away. It is the young head on the old shoulders.

One consequence of the presence of a continuous range of sand dunes all along the main beach at Scolt Head is a high degree of stability. When a master-tide overruns a duneless beach, as at Blakeney, much shingle is driven over the crest and advances over the lee fringe, spreading in talus-fans over the marshes, as on the Blakeney Marams. If the rate of advance of the last fourteen years may be taken as indicating what occurs over long periods, the beach in this region advances its own width in about 150 years.

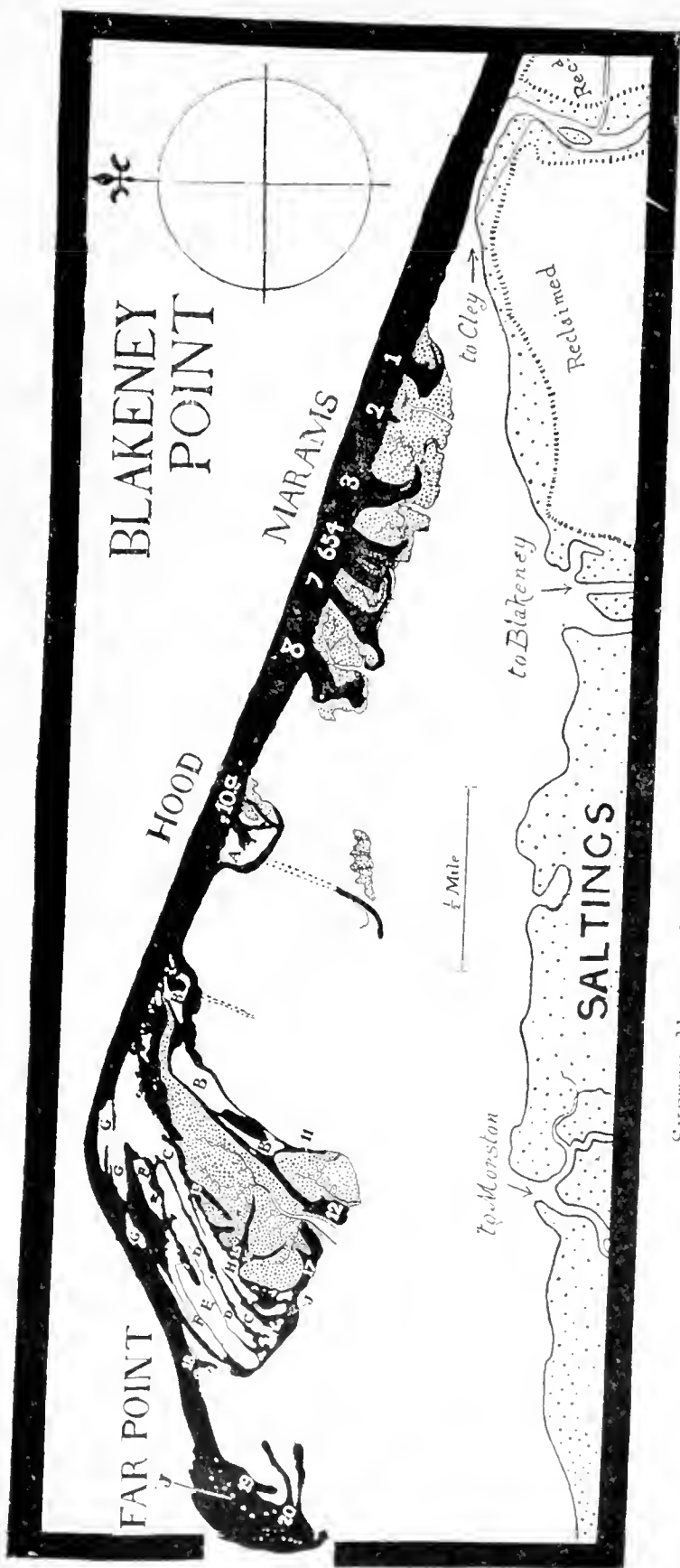
When dunes rest on the beach, however, a certain amount of sand will be cut away; but if the dune is reasonably high, there will be no advance of the sand, nor of the beach beneath it. A line of dunes is thus a great bulwark in preventing transverse beach travel.

This fundamental difference has a further consequence. At Blakeney, as the main beach travels landward, it passes over its hooks as well as over the between-lying marshes. The butt ends of these hooks outcrop on the sea-face and are eroded away. Thus, an old beach that has reached the mobile phase tends to have short laterals, and few, if any, near its point of origin from the land. The hooks on the Blakeney Marams were formerly much longer than they are now, and in 400-500 years should have disappeared altogether, owing to the main beach having travelled right over them. The hooks at Scolt Head, on the contrary, are excessively long (some nearly a mile), and so they should remain till the dune phase is ended. Eventually, no doubt, this beach also will be denuded and travel initiated, but the Blakeney beach has got so good a start that it should be well up the Cley and Blakeney channels long before the Scolt Head beach has got under way. At the present rate of movement the sections of beach along the Marams



SKETCH MAP OF THE SCOLT HEAD SYSTEM

Exposed shingle, black; salt marshes, dotted; sand dunes, channels and unvegetated muds, white. The dunes are almost continuous along the main beach; certain of the laterals (which are black) are denuded of sand. Other laterals still carry extensive dunes. M, near west end of beach, small marsh referred to at p. 573. Scale approximately 1 1/2-inches to mile.



SKETCH MAP OF BLAKENEY POINT ON SAME SCALE

Exposed shingle, black; salt marshes, dotted; sand dunes, channels and bare muds, white. The lateral shingle beaches are numbered in their order of development, whilst the successive systems of dunes are lettered A to J. New cut on Cley Channel represented by straight line to right of pointer indicating Cley.

should be bombarding the ruins of the Blakeney Hotel about the year 4000-4500 A.D. ; Cley Beach is travelling faster, a matter referred to below.

The great length of the hooks at Scolt Head, and the remoteness of the main beach, give Scolt Head a certain spaciousness not found at Blakeney Point. Till lately, this spaciousness, combined with the finely-proportioned modelling of the culminating dune massive, gave to Scolt Head just a touch of the sublime. The arrival of the watcher's hut (itself a work of art and thoroughly adapted to its purpose) on the high terrace below the summit has, by providing a scale, destroyed this illusion. But if the sublimity has departed the spaciousness remains, and the mere factor of distance combined with the awkward going will deter would-be visitors, to whom walking is irksome, from frequenting this spot. It is otherwise at Blakeney Point. The dunes being lower and less finely modelled there was less to lose by the erection of buildings. Its easy accessibility by water from neighbouring resorts ensures a constant flow of visitors. Blakeney Point is seen and enjoyed by many, and from among these a goodly number constantly return as its devoted lovers. The great danger is lest the sand-hills should become worn out before their time. Of all formations none is more sensitive to trampling under foot than the young sand dune. The natural covering becomes worn out at places and the wind removes the surface sand thus exposed. The injury done is of the nature of a running sore and cannot be erased except by constant and laborious operations, requiring the services of a trained staff for whose employment no resources exist. But happily there are compensations, and we don't need continually to look at the ground under our feet! Blakeney Point enjoys in the adjacent coast line seen over the waters of the harbour an incomparable setting. The villages and other features of the landscape, with Blakeney Church dominating the whole, form a picture of rare beauty ; whilst for those who prefer the pure light and colour of sea and sky, unmodified by man, there is the outlook from the dunes into the corridor of light which comes from the quarter of the setting sun.

THE VEGETATION.—As already stated, an outstanding feature of Scolt Head is the extent of its sand dunes. These dunes



THE SALICORNIA MARSH ON THE HEADLAND, BLAKENEY POINT.---On the left are the dunes of the Headland; from the edge of these, low shingle laterals, carrying bushes of *Suaeda fruticosa*, project into the marsh. On the right are the Long Hills, and, beyond, the waters of the harbour.

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are much less fragile than the headland dunes at Blakeney Point, as the plant covering is greatly strengthened by the almost universal presence of *Carex arenaria*—a condition paralleled on Blakeney Point at the Hood. Scolt Head consequently enjoys a triple advantage. There is actually much less traffic; it is spread over a greater area, and the dune covering is better fitted to withstand it. These dunes certainly possess the more robust constitution.

In view of their comparative age and large extent, it is not surprising that the dune flora of Scolt Head should be numerically the superior. There are, for instance, quite a number of bushes—succulent fruited, and probably brought by birds. These include Thorn, Privet, Sweet Briar, Elder, Gooseberry, and Bramble, of which only the last-named is represented at Blakeney Point. Whilst the two localities have many plants in common, Scolt Head has the advantage in possessing Bee Orchis, Rest Harrow, Sea Spurge, Harebell, Sea Holly*, *Lactuca Scariola*, *Viola tricolor*, and *V. canina*. The dunes are also infested by *Cynoglossum*, the burr-fruits of which are a detestable nuisance—especially to dogs. At Blakeney Point the plant is contraband, and visitors who come direct from Scolt Head are respectfully requested to refrain from introducing the fruits on their clothes.

As several of the above plants have been found to have very local or restricted distributions, it seems likely that as Scolt Head becomes more fully explored the number of records will be considerably increased.

Of dune plants recorded for Blakeney Point but not for Scolt Head the most important is *Epipactis palustris*—found in 1912 and not reported since. The Scarlet Pimpernel, a great feature at Blakeney Point where sand and shingle adjoin, is stated not to occur at Scolt Head; but, like other annuals, this plant is subject to marked fluctuation from year to year, and it would be rash to conclude that it is not lurking somewhere.

The dunes on the Headland at Blakeney Point form a series of parallel ridges of different ages—those on the outside being the youngest. This type of aggregation is correlated with an underlying terrace or platform of shingle which continually grows in the seaward direction—a type of formation not

* Strangely rare at Blakeney Point.

illustrated at Scolt Head. The younger dune ridges have grown up very rapidly—fifteen or twenty feet in height in ten or twelve years, so that the landscape at the tip has undergone great alteration. Fifteen years ago there were no sandhills to the S.E. of the big boathouse, whilst the Pilot House, erected long ago where it now stands buried in sandhills, gave a clear view of the sea and harbour within the memory of men still living. In those days the highest point on the Headland stood on one of the older dune ranges overlooking the large *Salicornia* marsh (or "Beachway"). There is still an eminence here, and upon it is planted the highest of the telephone poles. It stands about one hundred yards S.E. of the Laboratory.

THE SHINGLE.—At Scolt Head this is a minor feature, as the main beach and many of the laterals are covered with sandhills. Towards the eastern end of the area several of the laterals have become bared of sand and present the same characters as the Marams hooks at Blakeney Point. Elsewhere, on laterals within sight of the Watcher's hut, sections of the overlying sand have been blown away. The shingle thus exposed quickly becomes recolonised with *Suaeda* bushes and *Statice binervosa*. On the whole, the plant-zonation of the dormant laterals is better shown at Blakeney Point, on account of their greater height, and perhaps because they have been denuded of their sand for a longer period. Certainly they show a much more highly developed turfy crest which must have taken a very long time to establish.

One of the glories of Blakeney Point is its mobile shingle and the dynamic phenomena associated with it. There is nothing corresponding to this at Scolt Head. These phenomena have been fully described and need not be pursued here. The main beach at Blakeney Point carries a rich vegetation; *Silene maritima* occurs everywhere, except on the Far Point, for which new extension it has not yet been recorded. Another great feature on the shingle is the Sea Poppy (*Glaucium luteum*) which stretches in almost pure formation from the Watch House to the Bend, a distance of almost three-quarters of a mile. Early July is its time of maximum flowering here, whilst its seedlings form a belt reaching down on the

*F. W. Oliver and E. J. Salisbury, "Vegetation and Mobile Ground," *Journ. of Ecology*, 1913, page 249.

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THE OLD TERNERY, BLAKENEY POINT (1910)

seaward side to high water mark. This exposed belt, however, does not flower. In the same vicinity is *Mertensia maritima*, the oyster plant, of which one or more plants have been known to occur since 1905.* This occurrence is of great interest; firstly because the spot where it grows is periodically overrun by the sea, and is inhospitable in the extreme; and secondly because *Mertensia* is a northern type, not recorded so far as we know South of Holy Island (Northumberland). It is conjectured that this settlement came from seed derived from a northern station, which came ashore near the point where it still survives. Among the enemies of *Mertensia* is the rabbit. Usually when two or three plants occur twenty or thirty feet apart rabbits will find and nibble one or two, overlooking the third—which seems to indicate that rabbits are deficient in a highly-developed prospecting instinct. This year (1924) our colony was represented by a single specimen, and rabbits having discovered it, Mr. R. J. Pinchen, our Watcher, protected it with a piece of wire netting. This procedure rendered it conspicuous and an easy prey to another enemy, the plant collector. To minimise this danger he attached a label "Not to be touched; very poisonous plant." At the time of writing the *Mertensia* is intact and has seeded freely, so there is every hope that future generations may establish.

Another plant represented by a single patch is the Sea Kale (*Crambe maritima*). This was reported in July, 1924, growing on the main beach opposite the East side of the marsh which lies next, *i.e.*, on the Cley side of, the Watch House marsh. It is only right to state that this patch of *Crambe* has established from seed (derived from the Calshot shingle spit) sown on the selfsame spot in January, 1912. A handful of seed of the Sea Pea (*Lathyrus maritimus*) from the Chesil was put in at the same time close by, but without any result so far. However, the seeds of this plant are known to lie long dormant unless germination be assisted by cracking the shells. These are the only sowings of non-indigenous plants that have been made on the shingle of Blakeney Point since the present writer's connection with it.

*W. H. Burrell, Transactions of the Norfolk and Norwich Naturalists' Society, Volume VIII. (1905), page 201.

THE SALT MARSHES.—With the exception of certain special cases, referred to below, the marshes of both areas show an age sequence from W. to E.—a given marsh being younger than its immediate easterly neighbour and older than the one next to the west. That is to say, hooks and marshes arise in the same sequence, the latter occupying the spaces between the former. As the hooks at Scolt Head are very long, the marshes are also extended in the same sense.

So far as the phanerogamous vegetation is concerned, the marshes on the two areas pass through similar phases. The pioneer covering consists of *Salicornia europea* (agg.), with a marginal zone of *Suaeda maritima*, *Salicornia radicans*, and later, *Obione portulacoides*. In due course *Aster Tripolium* (much of it belonging to the rayless type) becomes dominant, reducing the *Salicornia* to a subordinate position. Then gradually this is replaced by a mixed halophytic community, containing, in addition to the above, the following species :—*Statice Limonium*, *Spergularia media*, *Armeria maritima*, *Glyceria maritima*, *Plantago maritima* and *Triglochin maritima*. At Blakeney Point the older marshes become overrun by *Obione portulacoides* and, this forming a close canopy, the other halophytes survive only here and there (see Pl, viii, lower photo). This accounts, perhaps, for the relatively small display of Sea Lavender (*S. Limonium*) seen on these marshes. The older marshes at Scolt Head are little affected in this way, and the lavender display is very fine, though it far from rivals that on the stretch of saltings which extends from Morston and Stiffkey to Wells. Here, in the first half of August, is a sea of lavender miles in extent, the equal of which it would be hard to discover.

The close association of the brown seaweed *Pelvetia canaliculata* in its free, non-attached, and non-reproductive form ("forma libera") with the *Salicornia* phase of the salt marshes is well shown on the big marsh on the Headland at Blakeney Point. The same condition also obtains in several of the marshes of corresponding age at Scolt Head. The condition is peculiar to the North coast of Norfolk, and although not reported from Wells, it should be looked for. Many of the older marshes also show restricted areas which have not

matured, wherein the *Pelvetia* phase persists. Normally, it disappears with the *Salicornia*.

The rate of change, especially in young salt marshes in the *Salicornia* phase, is relatively rapid. Thus the *Salicornia* marsh at Blakeney Point has in the last fifteen years been continuously invaded by *Aster Tripolium* (and this in spite of the rabbits, which use this plant as their principal summer feed). The small enclosed oval marsh not far from the apex of the Scolt Head system (M on map, page 567a) consisted of a pure *Salicornia* stand in 1915. To-day this has been replaced by *Suaeda maritima* and *Obione*.

Some reference may now be made to marsh development out of its proper sequence. At Blakeney Point to the South of the Hood there existed till 1910 an elongated marsh some few acres in extent of not very dense *Salicornia*. By 1912 a few asters had appeared, whilst to-day the whole area is covered with asters at maximum density. During the same period the surface of the soil has been raised by accretion of silt to an average of one foot. Similar developments at various spots between the Hood and Watch House are now proceeding, and it looks as though what would eventually be a continuous marsh were developing piecemeal long after it was due. This delay of several centuries may be attributed to the exposed nature of this unfilled gap—the hooks on either side of this area not affording the shelter under which salt marsh formation usually takes place.

A much more remarkable case is that of the great Aster Marsh at the Burnham Harbour end of Scolt Head. This is at the oldest end of the system and should by rights show an advanced stage of development with *Statice Limonium* and the other halophytes of the mixed salting. One is driven to the conclusion that for some reason an older marsh has been degraded or rejuvenated and is in the process of running through the succession once more. A possible explanation lies to hand in the existence of an outlet to the sea just to the east of this marsh. This opening (Burnham Harbour) is probably a break-through, which has persisted as an effective tidal inlet. Only one river discharges into the Burnham—Brancaster system of marshes, and this demands, theoretically, only one exit. That exit has been gradually pushed west to Brancaster

with the extension of the beach in this direction. If and when the beach was broken at the Burnham Overy end, the tidal conditions at this end of the system would be suddenly entirely altered. The tide, instead of just reaching to Burnham Overy *via* Brancaster, would now enter at this end first, and the marsh adjacent to the opening would become exposed to the full rise and fall (with corresponding scour), instead of being reached only by the attenuated head of the tide. If this is right, the marsh in question would become liable to erosion (the more so from its having been the oldest and highest), undergoing a set-back to an early phase in the developmental history or "succession." To restate the matter in terms of Blakeney Point, it is as though Cley Beach were broken through and the opening made permanent—an occurrence which would hardly surprise persons familiar with the locality.*

THE LOWS.—The term low is applied to a depression between two adjacent beaches which does not reach down vertically to the zone of salt marsh proper. Lows are common where two beaches run parallel, or in the angle where a beach carries a branch of a higher order. Lows are accessible to the highest springs and develop a soil of loamy character. They have something in common with the marginal zone of a salt marsh, often carrying *Obione* at their deeper levels and *Suaeda fruticosa* around the edge. Very characteristic members of this community are *Statice reticulata* and *Frankenia laevis*; *Glaux maritima* also occurs, as may *Spergularia salina* and *Statice binervosa*. The character plants, *Statice reticulata* and *Frankenia*, tend to flower together in July. Of the Blakeney Point localities, the lows to the east and south of the house-boat "Yankee" on the Long Hills are the best, and here *S. reticulata* has greatly increased during the last ten years. But the Scolt Head localities are incomparably finer, especially those to the west and south-west of Scolt Head itself. Here quite extensive lows occur carrying a pure formation of *S. reticulata*, often in large specimens, a foot or more in diameter, and fringed with immense numbers of lilac inflorescences, prone on the ground. This plant thrives marvellously here, and makes a record display.

* Such a breach might be precipitated either by an inburst by the sea or an outburst by the waters of the River Glaven.



THE NEW TERNERY ON BLAKENEY FAR POINT (LOOKING N.E.), 1924.—The young dunes in foreground and middle distance are built up around nuclei of *Triticum junceum*, with occasional plants of *Psamma arenaria*.

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RECLAMATIONS AND OTHER INTERFERENCES BY MAN.—The operations of man, whether with a view to converting muds and salt marsh into dry land, or of improving the *régime* of a tidal harbour, have a certain interest here. Broadly speaking, the effect of reclaiming ground is by withdrawing parts of the marsh from tidal invasion, to diminish the volume of water circulating therein. Scour and the transport of silt are thus retarded. Moreover, if the tide is excluded from the lee side of a stretch of shingle beach by banking, the beach will no longer be fed by drift from the salt marshes; it becomes impoverished of humus, and plants no longer grow on it luxuriantly. In this way mobility results, with liability to active landward travel of the beach under the action of on-shore gales and very high tides. This is what has happened in regard to the Salthouse and Cley reclamations. The mobile beach has overtaken the sea-wall in both cases, and has brought about its destruction, though in slightly different ways. Thus for the moment at any rate the costly operations of years gone by have resulted in failure. At Salthouse and Cley a very large area became flooded or liable to flooding. In addition to this, the Cley channel, into which the drainage from the above reclamations should discharge, became blocked by the landward advance of the beach and ceased to function. These flooded marshes became the home of wild birds and a paradise for the bird lover. But the resources of man were not exhausted, and to meet this critical position a new Cley channel has recently been cut through the salt marsh a few hundred feet south of the existing channel. This operation, completed in June, 1924, gave immediate relief. The water level in the upper reaches at once fell, and the flooded marshes gradually dried out. But there are three inherent weaknesses in the new *régime*: (1) Whilst the sea-walls remain unrepaired, there is nothing to exclude the entry of the highest spring tides; (2) The new Cley channel has fragile banks in its lower half, as it here cuts through a seam of sand and shingle which the tide will scour out. As the channel widens from this cause the rate of flow must diminish, with the liability that the floor of the channel may silt up and the old position be reproduced; (3) The old Cley channel, now a mere backwater, must speedily fill with the advancing shingle and there is no longer any scour to clear it, even

partially. When it is full the next master tide that tops the beach will discharge the shingle on to the marsh beyond, and no great lapse of time should be required before this advancing shingle reaches the new cut. (*c.f.* right hand of chart, p. 567*o*)

Other reclamations include the head of the Glaven Estuary from Cley to Glandford, and the Blakeney marshes between Cley and Blakeney. It was the cutting off of the former (dating just 100 years ago) that is generally supposed to have been a main factor in precipitating the present trouble, but sooner or later it was bound to come unless a means could have been devised permanently to arrest the advance of Cley Beach. The natural forces at work operate always in the sense of driving the beach landwards, and making it more and more difficult to maintain a passage for navigation and drainage between Cley and the main body of Blakeney Harbour.

Should such a separation eventually take place it would seem not unlikely that the Glaven would find a direct outlet to the sea, on the model of the River Burn at Overy Staithe.

At Scolt Head reclamations have also been made, *viz.*, at the Burnham Overy end of the system and a large central area at Burnham Norton. The sea-walls appear to have been maintained in good order, and the special circumstances of the reclamations that have invited disaster at Cley and Salthouse are absent. As stated above, and for the reasons already given, the direct opening at Burnham Harbour may be regarded as secondary. This conjecture helps to explain the general character of the tract of marshes which stretch from Burnham to Brancaster. Prior to the formation of this breach, all tidal water entered at the Brancaster end, and its flux and reflux were probably adequate to maintain an extensive harbour on the lines of that at Blakeney. But with the appearance of the new orifice the tide would enter at two places instead of one.

At the present time the tidal wave enters Burnham Harbour first and flows up to Overy Staithe and along Norton Creek in a westerly direction. After an interval the tide outside reaches Brancaster Harbour and flows along Norton Creek in an easterly direction. The volume of water travelling this way is greater than that by the other, consequently the second tide overwhelms the first, and the direction of travel in Norton

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BLAKENEY POINT: OBLIQUE AERIAL PICTURES.



The Headland and Morston Marshes seen through a veil of fleecy clouds.



The Watch House Marsh and Bank (Marams), and the Hood Main Beach on right. The dark, irregular figures are areas of salting not yet invaded by Obione.

Creek is reversed. This interesting phenomenon should be well worth detailed study and the results should be published.

The tidal forces, which, on the hypothesis here formulated were in former times sufficient to keep the Burnham-Brancaster Harbour scoured, were now suddenly divided and became relatively impotent. The result has been that vegetation everywhere got a footing and fixed the moving silt so that the general level rose and the area became unnavigable. This silting attained a maximum, as might be expected, in the middle parts opposite Burnham Norton, with the result that the original continuous sheet of water is represented to-day by its two ends (which are adjacent to the orifices) connected by two threads of water, Norton Creek and the less important Trowland Creek, the sole survivors of its middle parts. Obviously, no approximate dates can be assigned to these conjectural events, but it is reasonable to suppose that the enclosure of the Norton marshes took place at a date subsequent to the break-through at the Burnham Harbour end. Land-owners and others in a position to examine ancient estate documents and the like could probably help to elucidate the matter. The National Trust, now that they are acquiring so many properties to hold in perpetuity, may perhaps some-day appoint an official chronicler with the qualifications and leisure for this sort of historical research. Certainly if the type of area now accreting is maintained it will not be many decades before the Trust hold a very remarkable collection of areas representing, in effect, a microcosm of most that is interesting and beautiful in the British Isles. And if to the service of careful and honest administration they could add that of collecting and recording the histories of those areas, they would materially increase the debt of gratitude which future generations will owe them.

To summarise the foregoing remarks. The two areas, being in different phases of development, are complementary and in no way duplicate one another. Scolt Head is pre-eminent for its system of matured sand dunes and for the numerical richness of the dune flora. Owing to the length of the hooks and their tendency to branch, this area is more complicated than Blakeney Point, and the distances are greater. There is consequently a greater variety in detail. At Blakeney Point,

on the other hand, the type of parallel ranges of dunes (wanting at Scolt Head) is well illustrated, whilst the Far Point is, for the moment, unique. The phenomena associated with the travel of mobile shingle are particularly well shown at Blakeney Point—better, perhaps, than on any of the shingle spits in the British Isles.

As a breeding ground for birds, Blakeney Point has the advantage that the terns have tended latterly more and more to concentrate on the Far Point, where, in the breeding season, they form an incomparable spectacle. At Scolt Head, where the birds spread themselves in little groups over a larger area, the impression of numbers is wanting. Now that this area is being carefully watched, changes may come and the colony tend to increase, just as it has over the long period during which Blakeney Point has been protected. Being a recent acquisition, and relatively little known, Scolt Head has the great attraction that it is virgin ground for the student.

IX

METEOROLOGICAL NOTES, 1923

(From observations taken at Norwich)

BY ARTHUR W. PRESTON, F.R.Met.Soc.

JANUARY

THE month was generally fine and mild, with some dull and damp days interspersed. Mean temperature was 2.8 degrees above normal, and there was but little frost. Rain fell on 21 days, but generally the falls were light. Trifling snow fell on the 13th and 20th. The barometer was above 30 inches almost continuously between the 12th and 31st, reaching 30.57 inches on the 25th. The month closed with a great outburst of mildness, bringing the earlier spring flowers into bloom very rapidly.

FEBRUARY

Some exceptionally mild days occurred at the beginning of the month, the thermometer reading 56.4 degrees on the 1st and 57 degrees on the 2nd, and in the intervening night the minimum was as high as 51 degrees. Strong winds and gales from the West prevailed at this time. There were considerable rains on and after the 7th, and the month's total rainfall was more than twice the average. Snow and sleet fell on the 14th, 18th, and 21st, but the snow did not lie long upon the ground. Mean pressure for the month was 29.581 inches, which is the lowest recorded for any month since January, 1915. Frosts were slight and few, and sunshine 23 hours deficient, the sun shining on only one day between the 12th and 22nd.

MARCH

Wet weather continued until the middle of March, with some chilly days, but there was again a great absence of frost, the screened thermometer recording only two nights under 32 degrees. Milder and drier weather set in in the third week, the last week having been exceptionally warm for the season, the temperature reaching 68.8 degrees on the 27th, which was the highest March reading since 1918. Of 123 hours' sunshine, only 31 hours were recorded to the 16th of the month, but there were many bright days in the second fortnight. Distant thunder was heard in Norwich on the 25th, and some sharp storms were experienced in parts of Norfolk on the afternoon of that day.

APRIL

Easterly winds persisted throughout the greater part of April, but there were some warm days in the middle of the month. There was hardly any frost. The month's rainfall was 0.62 inches below the average, and there were many very dry days. Sunshine was 10 hours in excess of the mean, but many of the coldest days were the brightest, the sunshine being accompanied by very cold winds. Thunder occurred on the 14th and 26th, and on the former day damage was done by lightning at Catton Park.

MAY

The month opened with a week of exceptionally hot weather for so early in the season, the shade temperature rising to 81.5 degrees on the 4th, and to 79.5 degrees on the 5th. A sudden drop followed, and during the remainder of the month there was hardly a warm day. The mean temperature of the first week was 60.3 degrees, and that of the last three weeks 47.8 degrees. There were ground frosts on seven nights, that on the 24th doing much damage. On the 27th, 29th, and 31st the thermometer rose only to 51 degrees by day. Sunshine was 58 hours deficient. The cold, sunless weather caused a great check on the development of vegetation, and a hitherto early season became a late one by the close of the month. Rainfall was 0.65 inches deficient.

JUNE

There were hardly any warm days until the third week, and even then they were but few. The mean temperature of the month was 4.1 below the average, and the month was only one-tenth of a degree warmer than the cold June of 1916, which held the record for the lowest mean temperature in any June for 100 years. The nights were generally cold, and there were ground frosts in exposed places on several nights. Rainfall was 1.10 inches deficient, and there were many days of cold parching winds. Sunshine was 61 hours deficient, and the season was generally very late.

JULY

The cold weather of May and June gave place, with the advent of July, to a heat wave of unusual intensity. On the 5th the thermometer rose to over 80 degrees in the shade for the first time since May 4th, and during the 16 days, 5th to 20th, exceeded 80 degrees on 10 days, and rose above 90 degrees on two days (92.9 degrees on the 11th). This was the highest reading recorded here since the 9th August, 1911, when 93.5 degrees was reached. The mean temperature for the week ending July 13th (73.9 degrees) was the highest recorded since these observations were commenced in 1883. The mean temperature of the entire month was 66 degrees or 4.4 degrees

above normal, constituting the hottest month since August, 1911, but exceeding the July of 1921 by 0.2 degrees only. The latter part of the month was cooler and less settled, a tropical downpour on the night of the 31st yielding 1.37 inches, bringing up the month's total rainfall to 3.30 inches. Thunderstorms occurred on the 8th, 10th, 14th, and 15th, but in no case did the storms equal in intensity the appalling visitation which kept London awake all night on the 9th, and which appears to have been the most severe thunderstorm within living memory, no less than 6900 flashes of lightning having been recorded in six hours.

AUGUST

Fine, hot and dry weather prevailed during the first fortnight, and although the heat fell short of that of July, a maximum of 85 degrees was attained on the 9th. A severe thunderstorm on the night of 14th-15th, accompanied by nearly an inch of rain, broke up the fine weather, and during the remainder of the month frequent depressions from the Atlantic caused much showery weather with intervals of fineness, but there was no renewal of the heat to any extent. During the first half of the month rain fell on 2 days only, to the trifling extent of .07 inches, but 2.25 inches fell in the second half of the month. Thunder also occurred here on the 18th, 22nd, and 24th. A severe gale occurred on the 30th, doing much damage. The depression causing it crossed England from the Bristol Channel to Norfolk at an average speed of 36 miles an hour, the wind attaining a velocity of over 60 miles an hour in some places. There were 242 hours of bright sunshine (58 hours above the month's average), of which 140 hours were recorded in the first fortnight.

SEPTEMBER

The first few days were cool with some showers, followed by warmer weather and many bright days. From the 14th to the 25th Atlantic depressions caused very unsettled weather with much thunder and rain at times. Bright mornings were followed by heavy clouds and thunderstorms, the latter being especially severe on the 20th and 23rd. The warmest day of the month was the 30th (maximum 72 degrees), and was

preceded by a very warm night (minimum 56.8 degrees). Sunshine was 37 hours in excess of the average. Gusty winds prevailed on several days, chiefly from the S.W. and N.W.

OCTOBER

Much stormy weather occurred during this month with fine days intervening. The month's rainfall here was half an inch above the normal amount, but was considerably short of the falls in London and the Southern Counties, where 5 inches fell in several places. With the exception of two or three slight ground frosts in the middle of the month, the nights were generally warm for the season, and the absence of frost kept the gardens gay to the end of the month. Autumn tints were exceptionally beautiful, but the high winds denuded some of the trees rather earlier than usual. Sunshine was 20 hours deficient, and was 100 hours less than in the brilliant October of 1920.

NOVEMBER

After a few bright warm days a sharp frost occurred on the 8th, denuding the gardens, and during the following night there was a great downpour of rain, followed by snow, the total amount gauged having been equal to an inch of rain. Winterly weather followed, and on the night of the 25th and 26th the thermometer fell to 21.2 degrees in the screen and to 16.7 degrees on the grass, these being the lowest November temperatures registered since 1890. Slight snow fell on the 28th and 29th, but the falls were very trifling. The mean temperature of the month (38 degrees) was slightly lower than in the cold November of 1910 and 1919, and we have to go back to the year 1871 for a lower mean temperature. Frosts occurred on fifteen nights in the screen and 23 nights on the grass. There were many bright days during the month, sunshine having been as much as 35 hours above the average.

DECEMBER

This was a wintry month, with a mean temperature 2.5 degrees below normal. Frosts occurred on 17 nights in the screen, and on 27 nights on the grass. Considerable snow fell on and

The winter was mild and wet, the spring somewhat mild and the driest since 1892, the summer about normal in temperature (the heat of July counterbalancing the coldness of June) and slightly deficient in rainfall, the latter having been four inches less than in the previous summer and about 4 inches more than in that of 1921. The autumn was the coldest since 1919 and the wettest since 1918.

THE YEAR

The mean temperature of the year (48.7 degrees) was in close agreement with the average. The first four months and July were all above the average, June and November much below it, December 2.5 degrees below, and the remaining months nearly normal. The hottest day was July 11th (92.9 degrees), but the succeeding day was hardly one degree less warm. The coldest night was November 26th (21.2 degrees screen and 16.7 degrees grass). The rainfall of the year (27.74 inches) exceeded the average quantity by 1.37 inches. February, July, October, November, and December all yielded more rainfall than the average ; over three inches fell in each of those months. June was the driest month, with only 0.83 inches of rain. During the winter there was hardly any snow, and but little frost. The great heat in the first week of May gave place to more than six weeks of cold, cheerless weather, which was, to some extent, compensated for by the extraordinary outburst of tropical heat which followed in July. The first fortnight of August was splendid both for the holiday season and the commencement of harvest, but the later months were wetter than usual, culminating with very cold weather in November and a snowy Christmas season. Sunshine was somewhat deficient, but only by about 13 hours, the greatest excess having been in August, and the greatest falling off in May and June. Mr. J. H. Willis has, for the thirteenth year in succession, kindly furnished his sunshine readings. Taken as a whole, the year was an improvement on 1922, but the cool, sunless summer of that year had the effect of spoiling, to a great degree, the fruit crop (pears in particular) of 1923, owing to the non-ripening of the wood and the consequent paucity of blossom in the spring. Harvest began in Norfolk about August 8th, and in many places was concluded by the middle of September.

MR. PRESTON'S METEOROLOGICAL RECORDS FOR 1923

MONTH 1923	BAROMETER				THERMOMETER				HYGRO- METER	SUN- SHINE	RAINFALL		WIND									
	Highest	Date	Lowest	Date	Mean	Date	Lowest	Date			Mean Relative Humidity 9 a.m.	Hours	Inches	No. of Days	Direction		and Days					
	in.		in.		°	°	°	°	%				N	E	S	W	N.W.	N.E.	Mean gale- force			
JAN.	30.57	25	29.53	10	30.083	53.5	31	28.6	5	40.4	58.0	1.85	21	2	1	0	2	6	11	8	2.6	
FEB.	30.21	13	28.90	27	29.581	57.0	2	29.0	5	41.6	56.2	3.54	18	0	2	5	8	4	3	4	2	3.4
MARCH	30.36	18	29.28	2	30.024	68.8	27	30.6	12	44.2	123.4	1.58	17	0	5	10	2	6	4	4	0	2.6
APRIL	30.20	2	29.31	13	29.749	69.4	12	30.9	23	46.8	169.6	1.09	11	2	2	14	2	3	3	2	2	3.2
MAY	30.20	2	29.26	11	29.865	81.5	4	33.0	24	50.9	148.2	1.28	20	5	5	0	0	3	4	10	4	3.6
JUNE	30.37	11	29.82	15	30.067	74.7	23	37.0	3	54.0	144.5	0.83	13	6	5	0	0	1	3	2	13	3.5
JULY	30.23	22	29.23	31	29.943	92.9	11	48.5	27	66.0	219.0	3.30	12	0	2	7	0	2	4	13	3	2.8
AUG.	30.31	12	29.20	29	29.881	85.0	9	43.0	31	61.1	242.2	2.32	12	3	0	2	0	4	5	12	5	3.7
SEPT.	30.38	29	29.28	18	29.934	72.0	30	40.5	17	55.4	187.2	1.95	15	2	0	0	2	0	10	11	5	3.0
OCT.	30.20	17	28.90	21	29.673	66.0	19	32.2	15	50.1	85.0	3.62	21	2	0	0	1	6	10	10	2	3.6
NOV.	30.31	10	28.94	15	29.724	58.4	3	21.2	26	38.0	98.3	3.27	17	4	2	2	1	3	5	5	8	2.9
DEC.	30.44	14	29.35	5	29.910	48.2	17	24.0	7	36.4	38.3	3.11	22	5	0	2	2	9	3	5	5	2.3
MEANS					29.869					48.7												3.1
EXTREMES & TOTALS	30.57	Jan. 25	28.90	Feb. 27 Oct. 24		92.9	July 11	21.2	Nov. 26		1569.9	27.74	199	31	24	42	19	43	60	89	57	

X

FAUNA AND FLORA OF NORFOLK

ADDITIONS TO PART XI.—BIRDS (EIGHTH LIST).^{*}
1919—1923

BY S. H. LONG, M.D., F.Z.S., M.B.O.U., and
B. B. RIVIERE, F.R.C.S., M.B.O.U.

SINCE the publication of our last List, five years ago, we have now to record two new species for the County. The first is Evermann's Warbler, which has not previously been obtained in England: the second is the Marsh Warbler, which, although a nesting species in some parts of England, has never been actually recorded for Norfolk, and now only as a passing migrant, though there is some evidence that it nested in the county in 1881 and possibly in 1903. The nomenclature adopted is that contained in the B.O.U. List of British Birds (1923).

GOLDEN ORIOLE (*Oriolus o. oriolus*).—On May 1st, 1921, a male was reported from the neighbourhood of West Winch and Runcton, and on May 28th the unmistakable call of a male was heard by Mr. Robert Gurney at Calthorpe. This bird was heard again on the two following days, but was not seen. ("British Birds," Vol. XV., 282.)

SERIN (*Serinus canaria serinus*).—On May 1st, 1922, a female was caught at Great Yarmouth (B.B.R. "British Birds," Vol. XVI., 47). If one accepts the authenticity of two specimens said to have been captured at Great Yarmouth and purchased by the Rev. H. A. McPherson in April, 1877 ("B. of N.," Vol. III., Appendix, p. 379), this makes the eighth record for Norfolk, all the specimens having been taken at Great Yarmouth and in the first half of the year.

^{*}For previous Lists see Vols. IV., 259 and 397; V., 642; VI., 501; VII., 733; VIII., 847; IX., 784; X., 499.

CROSSBILL (*Loxia c. curvirostra*).—This species is losing ground in the county, though there are probably a few pairs still nesting in the Sandringham district. On April 16th, 1922, one of us (S.H.L.) watched a pair feeding young in the nest at North Wootton.

ORTOLAN BUNTING (*Emberiza hortulana*).—Three were seen on Lowestoft Denes by F. C. Cook on October 19th, 1919, and two the following day by another observer "farther north." ("British Birds," Vol. XIII., p. 256.)

LAPLAND BUNTING (*Calcarius l. lapponicus*).—A regular winter visitor. Three were shot at Cley, Oct. 21st, 1922, and at least twenty others identified during the next few days ("British Birds," Vol. XVI., p. 306). In 1923 the first was seen on Sept. 29th, and others were observed at Cley and Blakeney during the next three months.

WOOD-LARK (*Lullula a. arborea*).—A colony of these birds was found on the boundary of S.W. Norfolk in 1923 (B.B.R.). Mr. N. Gilroy found several nests. On June 16th the birds were watched feeding young (B.B.R. "British Birds," Vol. XVII., p. 265).

GREY WAGTAIL (*Motacilla cinerea*).—A pair built a nest, but deserted it, at Ellingham lock in 1922 (Trans. N. & N. Nat. Soc., Vol. XI., p. 216). Nested in the masonry of the old paper water-mill at Taverham in 1923 and reared two broods (Trans. N. & N. Nat. Soc., Vol. XI., p. 432). This is the first record of the species having successfully nested in the county.

RICHARD'S PIPIT (*Anthus richardi*).—One killed at Cley Oct. 21st, 1922 ("British Birds," Vol. XVI., p. 306).

LESSER GREY SHRIKE (*Lanius minor*).—An immature male was shot at Palling on Sept. 19th, 1922 ("British Birds," Vol. XVI., p. 161).

WAXWING (*Bombycilla garrulus*).—Several were reported in Feb. and March, 1921, and a large immigration—the strongest since 1913-14—started in early November and continued throughout December. Only one

recorded since, namely at Great Yarmouth on Dec. 6th, 1923. For the best account of the 1921 invasion see Ritchie, "Scottish Naturalist," Sept.-Oct., 1922.

RED-BREASTED FLYCATCHER (*Siphia p. parva*).—On Oct. 8th, 1919, a male in first winter plumage was shot at Cley, which makes the fourteenth record for Norfolk ("British Birds," Vol. XIII., p. 218).

MARSH-WARBLER (*Acrocephalus palustris*).—On Oct. 10th, 1923, a male was killed on Blakeney Point, the first definite record for Norfolk ("British Birds," Vol. XVII., p. 26).

ICTERINE WARBLER (*Hippolais icterina*).—One was obtained at Cley by E. C. Arnold on Sept. 5th, 1921. This makes the eighth for the county.

WOOD-WARBLER (*Phylloscopus sibilatrix*).—Two nests of this species were found at North Wootton by N. Tracy in 1922 and in 1923 (Trans. N. & N. Soc., Vol. XI., pp. 328 and 431).

EVERMANN'S WARBLER (*Phylloscopus b. borealis*).—The first specimen of this rare warbler ever obtained in England was shot at Cley on Sept. 4th, 1922. It was exhibited by J. H. Gurney at the meeting of the Society on Sept. 26th, 1922.

REDSTART (*Phœnicurus p. phœnicurus*).—Not for many years before 1918, when a pair nested at Thorpe (Trans. N. & N. Nat. Soc., Vol. X., p. 501), had this species been recorded as nesting in the county. In 1923 a pair nested at Keswick, another pair at Weeting, and N. Tracy found three nests at North Wootton.

CONTINENTAL HEDGE-SPARROW (*Prunella m. modularis*).—On Oct. 17th, 1919, the first example, for Norfolk, of this Continental form of the Hedge-Sparrow was obtained by one of us (B.B.R.) on Blakeney Point. Twice has it previously been identified in England, namely, at Spurn, Yorks., on Sept. 7th, 1882, and Oct. 9th, 1911.

- BLACK-BELLIED DIPPER (*Cinclus c. cinclus*).—This, Scandinavian, race of the Dipper occasionally visits Norfolk in the autumn, and an example was shot at Runham on Nov. 12th, 1919.
- ROLLER (*Coracias g. garrulus*).—One obtained at Southery on Sept. 30th, 1922.
- SHORT-EARED OWL (*Asio f. flammeus*).—In 1921 there were two nests in the eastern area of the county, but no breeding pair was discovered in 1922. In 1923 a nest with five young was found at Martham.
- SNOWY OWL (*Nyctea nyctea*).—During the first fortnight of May, 1922, a Snowy Owl was frequently seen on the sand-hills and warrens of Horsey and Winterton. From pellets examined it appeared to be living chiefly on rabbits. It was last seen at Sutton by one of us (S.H.L.) on the evening of May 13th. The previous record is April, 1905, when one was trapped at Cockley Cley.
- SCOPS-OWL (*Otus s. scops*).—One of these birds was seen by the watcher (R. J. Pinchen) on Blakeney Point, Oct. 6th, 1922.
- LITTLE OWL (*Carine noctua mira*).—Now very common throughout Norfolk and nests freely.
- MARSH-HARRIER (*Circus æ. ceruginosus*).—In 1919 a nest was built in the Broads district, but no eggs laid—both birds being apparently males. In 1921 a pair nested in the same locality and reared two young.
- MONTAGU'S HARRIER (*Cirus pygargus*).—In 1921 six pairs reared young; in 1922 six pairs nested; in 1923 five pairs nested.
- RED-FOOTED FALCON (*Falcon v. vespertinus*).—In the beginning of June, 1922, an adult male frequented Hickling Broad and was seen by E. S. Montagu, J. Vincent and others.
- OSPREY (*Pandion h. haliaetus*).—On May 30th, 1923, an Osprey was captured on a fishing boat off Smith's Knoll ("British Birds," Vol. XVII., p. 269).

SNOW-GOOSE (*Chen h. hyperboreus*).—The Snow-Goose reported at Holkham in the autumn of 1922 ("British Birds," Vol. XVI., pp. 235 and 255) was almost certainly an albino Pink-footed Goose.

WILD SWANS.—An exceptional number of Wild Swans, of both species, put in an appearance on the coast and Broads in November, 1923.

GARGANEY (*Querquedula querquedula*).—In 1921 there were six nests in the Broads District, and one nest was found in West Norfolk. In 1922 two nests were found at Hickling, and the same number in 1923.

WIGEON (*Mareca penelope*).—A duck and drake with five or six young were seen by G. C. Davies on June 15th, 1919, on Burnt Fen Broad. Four days later one of us (S.H.L.) saw the female Wigeon, with four young ducklings able to fly only on the surface of the water, on the same broad. They were doubtless hatched on or near the broad.

HERON (*Ardea c. cinerea*).—A new heronry was started on Hoveton Big Broad in 1920, and in 1921 there were seven occupied nests.

BITTERN (*Botaurus s. stellaris*).—In 1919 three nests, each with five eggs, hatched off in the Broads District, and one with six eggs in the same area of the county. In 1921 at least ten pairs of birds hatched off, and in 1923 sixteen or seventeen pairs nested in the county.

SPOONBILL (*Platalea l. leucorodia*).—Has occurred every summer on Breydon, Salthouse Broad or Cley marshes.

GLOSSY IBIS (*Plegadis f. falcinellus*).—On Sept 18th, 1920, an immature Glossy Ibis was killed near Barton, and on Oct. 3rd another was killed on Breydon marshes ("British Birds," Vol. XIV., p. 249).

RUFF (*Philomachus pugnax*).—Passes through, sometimes in large numbers, in spring and autumn. On June 11th, 1922, a nest with four eggs was found by A. W. Boyd on Cley marsh. One of the eggs, which was broken, was, later, identified by P. Bunyard as a typical Reeve's egg.

- CURLEW (*Numenius a. arquata*).—W. Tracy has evidence that at least one pair have nested in West Norfolk every year since 1910, when he first recorded a nest.
- AVOCET (*Recurvirostra avocetta*).—There were two Avocets seen on Breydon in early June, 1920. The bird is a rare visitor to Norfolk now-a-days.
- OYSTER-CATCHER (*Hæmatopus o. ostralegus*).—Would seem to be increasing as a nesting bird in the county. Some thirteen or fourteen pairs nested on the Norfolk coast in 1923.
- SCANDINAVIAN LESSER BLACK-BACKED GULL (*Larus f. fuscus*).—In contradistinction from the British Lesser Black-backed Gull an example of this dark-mantled race was shot at Cley on Sept. 4th, 1922) "British Birds," Vol. XVII., p. 259).
- ICELAND GULL (*Larus glaucoides*).—Glaucous Gulls occur too frequently on our coast to warrant particular record, but among these immigrant winter gulls the Iceland Gull is occasionally found. One was shot at Blakeney, and another at Great Yarmouth in Feb., 1922, and a third was killed at Cley on Dec. 9th, 1922 ("British Birds," Vol. XVII., p. 259).
- ARCTIC TERN (*Sterna h. hirundo*).—At least one pair of Arctic Terns nested on Blakeney Point in 1922; and in 1923 T. A. Coward satisfied himself "that there were quite a number of Arctic Terns nesting with the Commons" (Trans. N. & N. Nat. Soc., Vol. XI., p. 347).
- ROSEATE TERN (*Sterna d. dougallii*).—Roseate Terns have been identified in the Blakeney Point colony each year since 1919, and on June 11th, 1923, Mr. A. K. Gibbon marked down one of a pair to its nest of two eggs ("Field," May 24th, 1924).
- SANDWICH TERN (*Sterna s. sandivencis*).—In 1921 there were two nests on Blakeney Point. In 1922 there were nine nests and ninety on Salthouse Broad. In 1923 it was estimated that 500 pairs were nesting at Salthouse, Cley inundated marshes, Blakeney Point and Scolt Head.

BLACK TERN (*Chlidonias n. niger*).—A regular migrant on passage in spring and autumn.

BLACK-NECKED GREBE (*Podiceps n. nigricollis*).—On April 18th, 1919, two males and a female were seen "on one of the Broads" ("British Birds," Vol. XIII., p. 263). On July 14th, 1920, one of us (B.B.R.) saw a pair on Rockland Broad. In 1921 one turned up on the Broads and remained for a few days ("British Birds," Vol. XV., p. 290). In 1922 a pair were on Rockland Broad between April 20th and 30th (B.B.R.).

QUAIL (*Coturnix c. coturnix*).—One was heard at Docking on June 12th, 1922, and another was shot near Norwich, Sept. 1st of the same year. Three were seen by Mr. Q. E. Gurney at Bawdeswell on Sept. 14th, 1922. In Oct., 1922, Clifford Borrer was shown a clutch of deserted eggs that had been taken from a nest near Cley ("British Birds," Vol. XVI., pp. 239 and 290). Two eggs from an over-mown nest at Ingham were taken to Mr. Robert Gurney in 1922. We saw one of these eggs.

XI

FLORA AND FAUNA OF NORFOLK

ADDITIONS TO PART IV.—FISHES (EIGHTH LIST)

BY ARTHUR H. PATTERSON

(Associate Member of the Marine Biological Association of Great Britain)

(The species marked with a * are new to the County list)

THE following records of new and rare species continue the series begun by the late Dr. John Lowe in Vol. I. (1873) of the *Transactions*, and subsequently continued by the late Mr. T. Southwell until his death. My own lists began in Vol. VIII., Part 5 (1908-9), continuing in Vol. IX., page 815. The present series covers Vols. X. and XI.

It has been my practice for over forty years to keep in close touch with persons connected with the fishing industry—both “masters and men,” so that strange, or little known, fishes have been, almost invariably, reported to me; whilst drawings of species needed, or wished for, have tended to a commendable look-out, as will be evidenced by my note on the Black-mouthed Dogfish. Persons living along the Norfolk sea-board, notably Mr. Weddall, of Happisburgh, have very kindly sent me specimens obtained on the coast: members of our Society will, I hope, kindly take the hint.

The List of Norfolk Fishes, at the present moment, contains 160 species, which is exactly double the number of species recorded by the Pagets for the Yarmouth district in their “*Sketch of the Natural History of Yarmouth*” (1834). To these 160 species may be added twelve of doubtful species, which, owing to the peculiar circumstances of their occurrence, need a further and more careful pursuit in order to substantiate their claims. As it is, Norfolk boasts the largest number of Marine Species of any English county.

BASS (*Labrax lupus*).—Large hauls of Bass were made off the Suffolk Coast by draw nets in September, 1915. An example of 12 lb. 2 oz. took a bait of stale whiting, and gave a sea-angler a 200-yard run before capture.

***BLACK SEA BREAM** (*Cantharus lineatus*).—Has now an undisputed claim as a Norfolk species. A 3-inch example came, fresh and glistening, into my hands from a shrimper in May, 1914; and a fine fish was landed from Cromer Knowle in February of the same year. Is known in many places as the “Old Wife.”

SPANISH BREAM (*Pagellus erythrinus* Cuv.).—Regarding a specimen, so named, recorded by the late J. H. Gurney, Sen., as taken off the Norfolk Coast on November 13th, 1846, some little doubt exists—Dr. Day admits it, with Cuvier’s naming; but Dr. Lowe (*Victoria History; Norfolk Fishes*), upon the late Mr. T. Southwell’s suggestion, admits it as *P. oweni*. As the Black Bream has so near an affinity to this fish, sea bream of any age or appearance sent to me would be carefully examined.

GREENLAND BULLHEAD (*Cottus grænländicus*).—A handsome 10-inch specimen of this, to my mind, true species, quite as gaudily coloured as Couch's plate (British Fishes), was brought me in the Spring of 1919. *Transitional variations* between it and the common Sea-bullhead, in Norfolk waters, are unknown to me.

TUNNY (*Thynnus vulgaris* Cuv.)—On December 12th, 1921, a Tunny was stranded off Wells harbour; its advent made a very great stir, and photographs of it appeared in various newspapers. It measured 7 ft. 6 in. in length, and scaled 354 lb. It was examined by Professor Stanley Gardiner, of Cambridge, and has since been prepared as a skeleton. In all probability there had been a diverted migration movement, as others appear to have been seen; indeed, a slight panic seems to have seized the coast fishermen, who, like Othello, thought their occupation gone! This fish makes the fifth authentic record of this species for the County.

BLACK FISH (*Controlophus pompilus*).—Through the kind offices of Mr. Weddall, of Happisburgh, I had a second rare fish sent me from that neighbourhood, on April 10th, 1923. Length 17 inches. This fish belongs to the *Scomber* family, and is very nearly allied to the Pilot fish, so often seen in company with sharks. I found a few parasites in this fish, which I sent to the British Museum (Nat. Hist.) for identification. They were described as *Cestodes* of the family *Bothriocephalidæ*, possibly a species of *Ligula schistocephalu*. This is the second example for Norfolk, the first having been recorded as cast up alive at Palling in March, 1908.

RAY'S BREAM (*Brama raii*).—A 22-inch Ray's Bream was drawn ashore at Happisburgh, having become entangled in a fishing-line, on December 17th, 1921. Weight 6 lb. It was very kindly sent me by Mr. H. W. Weddall for identification. A 4-lb. fish had been taken off Cromer in October, 1921.

MAIGRE (*Sciæna aquila*).—For the first time I had the pleasure of examining a Maigre, or Sciæna. On December 22nd, 1923, a message reached me that a strange fish was to be seen near the Fish-wharf, and in a blinding snowstorm I found the fish-yard, and was pointed out a large box packed with Congers, my fish among them. On hauling it out, I noticed it had much the appearance of a Salmon, off colour, or, as the men suggested, "an old Bass." All the rich yellow-orange of the body (as so well depicted by Couch, *British Fishes*, Vol. IV., p. 423) had gone, and only a slight showing of magenta tinted the fins. On opening the mouth the orange of its tongue and mouth was still well maintained, and made its identity complete. Its weight was 7 lb. Only two others are recorded for Norfolk, viz.: 1841, one off Yarmouth, weight 68½ lb.; and 1875, another off Yarmouth, weight 75 lb. It remains somewhat strange that this species is so rare in the North Sea, when, in April, 1917, 300 cwt. were taken off the Coast of Portugal. [I cannot vouch for the locality of the Maigre's capture.]

*ONE-SPOTTED GOBY (*Gobius parnelli*).—Found this species, for the first time, on Breydon when trawling with a shrimp-net, with Jary, the Breydon watcher, on June 5th, 1921. Couch's figure (Vol. II., plate ci.) corresponds fairly well with my examples. The Gobies are a very difficult family.

SHANNY (*Blennius pholis*).—In referring to the Shanny, Lowe merely states, on the authority of J. H. Gurney, that it occurs at Crömer "among stones at low tide." I have hunted among these stones at low water, but without success; and had never seen an example of this fish until Mr. Robert Gurney forwarded me a specimen taken by a man catching prawns near the sewer outfall at Wells, on June 17th, 1922.

*COMBER WRASS (*Labrus comber*).—The *Labridæ* constitutes a very difficult family of sea-fishes to satisfactorily "place," more especially when from a sandy bottom,

like that of our Norfolk waters ; and much juggling with nomenclature appears to characterise even the text books. Day admits the Comber as *L. donovani*, but his drawing is difficult. Couch's coloured plate (Vol. III., plate cxxvi.) answers exactly in shape and coloration to a Wrass that came from a shrimp-boat in March, 1916 ; and as the Comber I place it in my list.

CUCKOO WRASS (*Labrus mixtus*).—A 10-inch example of this beautifully-coloured fish—amber, with blue striped gill covers and sides—was taken off Yarmouth, January 16th, 1917. Now in Yarmouth Museum.

TADPOLE-FISH (*Raniceps trifurcus*).—The name of Tadpole-fish is much more expressive of this fish's appearance than that of Lesser Forkbeard. An example some 9-inches in length had a head as large and nearly the shape of a hen's egg : the body tapers off remarkably to the tail. It was captured on a long line off Yarmouth on January 8th, 1915.

[VARIEGATED SOLE (*Solea variegatus*).—Known to the fishermen as the "thick" Sole from its build ; a number of these black blotched fishes were sold in the town, from Brixham. I noted their appearance in the *Eastern Daily Press* in January, 1917 : and shortly after a fish-merchant called at a Yarmouth newspaper office and stated that he had had some in from Cromer Knowle.]

*SOLENETTE (*Solea lutea*).—For some years I had not satisfied myself that this species had a local status. However, on April 14th, 1917, a shrimper brought me an unmistakable Solenette ; and a large one (4-inches in length) on May 2nd. Since then, I have found it to be quite abundant off the coasts of Norfolk and Suffolk. A shrimper recently informed me that they knew it as the "Ground-rope" Sole, the apparatus of the net being bespattered with them. Rats and Starlings often repair to the nets, when hung from the mast-head to dry, in search of Solenettes in the meshes.

[SPOTTED SOLE.—The most extraordinary Sole I have yet met with was on May 16th, 1918. Length 12 inches, and very thick. The basic colour of the upper side was normal, but the fish was adorned with scores of black spots as if applied by a flat pencil-end dipped in ink. As the surrounding fins were transparently white, the probability is that it was merely a freak.]

MÜLLER'S SCOPELUS (*Maurolicus pennantii*).—A 2½-inch example of this beautiful, and smallest of the *Salmonidæ* was found by Mr. C. J. Doughty, on Gorleston beach, on March 24th, 1916.

SALMON (*Salmo salar*).—On December 1st, 1916, a very lank Salmon was taken on a lugworm bait, off Yarmouth beach. It measured 30 inches, to a weight of only 6 lb. and a girth of 10 inches. It answered very much to the plate (ccxvi.) of Couch's Slender Salmon. I sent a portion of this fish to Mr. C. Tate Regan, of the British Museum, who replied: "I take it that the fish had recently spawned, and had not been more than a few weeks at most feeding and trying to get into condition."

SKIPPER (*Sombresox saurus*).—Known as the Skipper from its acrobatic propensities; it is also described as the Saury Pike; and is a smaller edition of the Garfish (*Belone vulgaris*). On the authority of Mr. J. H. Gurney, Sen., Lowe recorded this species for Yarmouth, but no date is given. Lowe also mentions two at Norwich Museum, caught on October 24th, 1844—which may refer to the preceding instance. From Blakeney the species was also recorded, December 7th, 1846. Since that date, and search for many subsequent years, no others were recorded until November 3rd, 1916, when the advance-guard of a numerous host came to the Fishwharf at Yarmouth. I met with the first examples in a back-street fish shop, when their size, and the presence of half a dozen finlets at the extreme end of the body, above and below,

immediately suggested to me the Skipper. They were fully grown—18 inches in length, and were being sold retail at threepence each. I bought a couple, one for examination, the other for my tea, finding it extremely good eating. At the Wharf they passed for immature Garfish; and I think, but for my seeing and identifying the fish, this great migration of *Sauries* would have passed unnoticed. For some days they were landed by hundreds from various boats; I saw a heap of over 1,000 on one occasion. Many landed at the North of the county passed for Garfishes, but they were, doubtless, Skippers.

STURGEON (*Accipenser sturio*).—A 3-foot example of the Sturgeon was netted by a wolder fishing off shore in July, 1920. There would seem to have been a far greater number of Sturgeons in the North Sea for three or four years after the War; possibly due to a lessened fishing in European rivers, and a consequent increase.

*BLACK-MOUTHED DOGFISH (*Pristiurus melanostomus*).—During the War the few fishermen that went out fished in Norfolk waters; and a vast increase in the number of Dog-fishes of locally common species were landed at Yarmouth, and elsewhere. Such a likely chance for securing the present species had not occurred for years. I made an enlarged coloured drawing of *Pristiurus* and hung it up on the Fishwharf. It was not long before my friend, Mr. R. Beazor, sent a note to hurry up and fetch one that he had discovered with Topes and Spur-dogs. It was a lovely creature which I lugged home. Length $29\frac{1}{2}$ inches, and had been captured on February 8th or thereabouts, in 1919. The locality given was Cromer Knowle. The spottings and markings were singular and the mouth looked as if it had been rinsed after a splashing of ink. The species was said to be poisonous, but my eldest son's family had dinner off it and suffered no ill consequences. Couch gives a finely-coloured plate of this new local species.

*BLONDE RAY (*Raia brachyura*).—On January 19th, 1922, I observed among a large pile of Skate on the Fish-wharf a Ray, apparently well known to local fisherfolk, but hitherto unrecognised as a distinct species; nor is it recognised by Day, although the late Mr. Matthias, of Mevagissey (a naturalist after my own heart), had pointed out its specific points and markings. It has a great resemblance at first sight to the Homelyn, or Homer Skate (*R. maculata*).—In a letter from Mr. C. Tate Regan (who, with other British Museum officials, has been exceedingly helpful and courteous) he stated that “Blonde (*Raia brachyura* Lafont = *R. blonda* of Holt and Calderwood) is quite distinct from the Homelyn (*R. maculata*). Blonde has smaller eyes, and more numerous teeth (when specimens of the same size are compared). As a rule Blonde has spots smaller and more numerous. More distinctive is that in the Blonde (except small specimens) there is a border of spinules on the lower side from tip of snout about half-way to the angles of pectorals, absent in Homelyn.” Several subsequent specimens fully bore out my “finding,” and the description given by Mr. Regan. The Common Homer is smooth skinned; the present fish’s skin is very like fine sandpaper.

*UNDULATED RAY (*Raia undulata*).—New to North Sea. For the first time a fresh-taken specimen of *R. undulata*, a very beautiful Ray, came into my hands, on February 19th, 1924, thanks to a fishmonger named Kemp, who had held it over for me. From enquiries made, there appear to have been several taken in the same catch by the otter-trawler “Herring Searcher,” off Folkestone. After examination, and not finding any reference to the species in Day’s and Couch’s “Fishes,” I despatched the fish to the British Museum (Nat. Hist.); the Curator of the Fish department thus acknowledged the gift: “Many thanks for specimen of Ray . . . a most interesting one. It is *Raia undulata* Lacapede; it will form a valuable addition to our Collection

. . . . it is difficult to believe that it occurs regularly on our Southern Coasts and has been hitherto overlooked, and the only alternative is to suppose that it has extended its range to the coast of Sussex in the last few years. You will see, therefore, that a specimen taken as far northwards as the North Sea would be of considerable interest, and would further extend the known distribution of the species." Mr. Regan pointed out that probably Couch had seen an example, but erroneously described it as a variety of *R. microcellata* (The Painted Ray).

THORNBACK RAY (*Raia clavata*).—In July, 1922, I examined a Thornback Ray on the centre of whose back were two large thick fins, one behind the other, that were as large as a woman's hand, and rather thick, with a tendency to remain at half a right angle to the disc. It is a very rare freak.

STARRY RAY (*Raia radiata*).—Observed a Starry Ray, the most formidably spine-armed of all the Rays, on August 30th, 1916. It was the size of a dinner plate. It was probably a locally captured fish.

LAMPREY (*Petromyzon marinus*).—The Lamprey, whilst having at times been found in the Waveney in some numbers, rarely seems to ascend the Bure. A couple of 2 lb. weight each, and measuring 2 ft. 5 in. in length, were taken in Mr. R. Vincent's eel-set at Hickling Broad in May, 1921. They caused considerable local interest.

Among the abnormal fishes seen by me since the last published list have been as following:—A double Plaice (coloured on both sides, with spots duplicated), May, 1918; hybrid Turbot-Brill, 3½ lb., June, 1915; hybrid Plaice-Flounder, 3 lb., November, 1917; hybrid Turbot-Flounder, 2½ lb., January, 1914; and a Melanistic Haddock, of a rich pale orange colour, which faded to a yellowish hue. Length 17 inches. September, 1923.

XII

FAUNA AND FLORA OF NORFOLK

ADDITIONS TO FLORA

BY W. A. NICHOLSON

SINCE the publication of "A Flora of Norfolk," in 1914, many additions have been made to the Norfolk List, some of which have been already mentioned in the Transactions, by Messrs. A. Bennett, W. G. Clarke, J. E. Little, F. Long, W. C. F. Newton, F. Robinson, and others. The following List only includes the more important species and varieties recorded since the above-mentioned date. The nomenclature is mainly that of the 10th Ed. London Catalogue. Few aliens not in that list are mentioned. Those marked * are new to the County. Numbers refer to districts of county. Abbreviations:—B.E.C.R.—Botanical Society and Exchange Club of British Isles. J. of B.—Journal of Botany. W.G.C.—W. G. Clarke. J.E.L.—J. E. Little. F.L.—F. Long. F.R.—F. Robinson. C.E.S.—C. E. Salmon. Wats.B.E.C.R.—Watson Botanical Exchange Club Report. F.C.N.—W. C. F. Newton. A.B.—Arthur Bennett.

THALICTRUM MINUS L. var. montanum. (3) Tottington
(F.R. B.E.C.R., 1914).

ANEMONE NEMOROSA L. var. rubra Pritzel. (3) Watton.
(F.R. B.E.C.R., 1916).

A RANUNCULOIDES* L. (3) Ovington. (F.R. B.E.C.R., 1916).

RANUNCULUS LINGUA L. var. *hirsutus. (4) Shouldham.
(J.E.L. B.E.C.R., 1919.)

R. RADIANUS* Revel. (3) Hockham (G. C. Druce. B.E.C.R.,
1915).

DELPHINIUM AJACIS L. (1) Norwich (W.G.C.), (3) Stow
Bedon (F.R., B.E.C.R., 1916).

PAPAVER RHŒAS L. var. *Pryorii Druce. (4) Dersingham
(J.E.L.)

GLAUCIUM PHŒNICEUM (Crantz). (1) Norwich (W.G.C.)

FUMARIA BORÆI Jord. (1) Ormesby (F.R., B.E.C.R., 1915,
and C.E.S., J. of B., 1919).

F. BASTARDI* Jord. (1) Ranworth (C.E.S. J. of B., 1919).

- F. OFFICINALIS L., *f. scandens*. (1) Ranworth (C.E.S., J. of B., 1919).
- F. VAILLANTII Lois. (3) Threxton (F.R.), (4) Stow Bardolph (J.E.L., B.E.C.R., 1917).
- RADICULA NASTURTIUM-AQUATICUM Rendle and Britten.
 VAR. SIIFOLIA* Rend. and Br. (1) Horning (C.E.S.), Thurne (C.E.S., J. of B., 1919).
 VAR. MICROPHYLLA* Rend. and Br. (1) Rockland St. Mary (F.L.Watts., B.E.C.R., 1912-13).
- R. SYLVESTRIS DRUCE, var. *tenuifolia. (1) Framingham Pigot (F.L., B.E.C.R., 1913).
- CARDAMINE FLEXUOSA With. (4) Stow Bardolph (J.E.L.).
- ALYSSUM INCANUM L. (1) East Ruston (W.G.C.), (4) King's Lynn (F.R., B.E.C.R., 1917).
- SISYMBRIUM PANNONICUM Jacq. (1) Cromer, Yarmouth (F.R.), Norwich (W.G.C.), (2) Wells, Scarning (F.R., B.E.C.R., 1916), Drayton, Costessey (W.G.C.), (3) East Harling (W.G.C.), Thetford (F.R., B.E.C.R., 1915), (4) Narborough (W.G.C.).
- S. IRIO L. (3) Watton (F.R., B.E.C.R., 1915).
- ERYSIMUM ORIENTALE* Mill. (2) Drayton (W.G.C., B.E.C.R., 1922). (3) Watton (F.R., B.E.C.R., 1915).
- DIPLOTAXIS MURALIS DC var. Babingtonii Syme. (1) Yarmouth (F.R., B.E.C.R., 1914). (3) Thetford (F.R.). (4) Beechamwell, 1919, J.E.L.).
- CAPSELLA BURSA-PASTORIS Medic var. *stenocarpalyrata Mott. (3) Watton (F.R., B.E.C.R., 1917).
- RAPHANUS MARITIMUS Sm. (1) Yarmouth (F.C.N., 1914).
- RESEDA ALBA* L. (3) Rockland St. Peter (F.R.). (4) Marham (F.R., B.E.C.R., 1921).
- VIOLA HIRTA L. (3) South Pickenham (F.R., B.E.C.R., 1914).
- V. CANINA L. var. Miss Pallis's violet. (3 and 4) Norf. Breckland, Mrs. Russwurm (B.E.C.R., 1920, var.*pusilla Bab. (1) Yarmouth (F.R., B.E.C.R., 1914), (Norf. E. and W., E. S. Gregory, B.E.C.R., 1917).
- V. STAGNINA Kit. (4) W. Dereham (A. Templeman, B.E.C.R., 1921).
- V. EPIPSILA* Ledeb, *f. glabrescens* A. and G. (4) Stow Bardolph (J.E.L., Wats.B.E.C.R., 1919).

- V. CURTISII FORST* var. *Pesneau* Ll. and Fouc. (2) Sheringham (F.L., Wats. B.E.C.R., 1918). (3) Croxton (F.R., B.E.C.R., 1919. Santon. B. Reynolds, B.E.C.R., 1920).
- POLYGALA DUNENSIS* Dum. (2) Wells, Holkham (C.E.S., J. of B., LIII).
- CUCUBALUS BACCIFER* L. (3) Merton (F.R., B.E.C.R., 1914).
- CERASTIUM ARVENSE L., var. **latifolium* Fenzl. (3) Rockland (F.R., B.E.C.R., 1918).
- STELLARIA NEGLECTA* Weihe. (4) Downham Market (A. Webster, B.E.C.R., 1913).
- POLYCARPON TETRAPHYLLUM* L. (3) Watton (F.R., B.E.C.R., 1922).
- HYPERICUM ELATUM* Ait. (1) North Walsham. (2) Wood Dalling, Costessey, 1803 (Eng. Bot., A.B. in N. & N. Nat. Trans., X., p. 478)
- LAVATERA CRETICA* L. (2) Sheringham (F.L.).
- MALVA PARVIFLORA* L. (3) Little Ellingham (F.R., B.E.C.R., 1916).
- GERANIUM SANGUINEUM L. (2) Attlebridge, 1920 (W.A.N.).
- G. MOLLE L. var. **grandiflorum* Lange. (1) Ranworth (C.E.S., J. of B., 1919).
- G. ROTUNDIFOLIUM L. (1) Caister-on-Sea (B. Reynolds). (2) Stiffkey. A. J. Crosfield, near Dereham, Mrs. Russwurm. (3) E. Harling, A. J. Crosfield
- ERODIUM CICUTARIUM L. Herit var. **chærophyllum* (Cav.) (4) Dersingham, Shouldham (J.E.L.).
- E. MOSCHATUM L'Herit var. **minor* Rouy & Fouc. (1) Salhouse (F.R.).
- E. MARITIMUM L'Herit. (1) Yarmouth (Herb. G. Fitt 1809-1893).
- IMPATIENS PARVIFLORA* DC. (2) Aylsham. (3) Hargham, Shropham (F.R.).
- I. GLANDULIFERA* Royle. (2) W. Runton (R. Creed, B.E.C.R., 1917).
- MEDICAGO LAPPACEA* Desr. (3) Thetford (F.R., B.E.C.R., 1917).
- MELILOTUS INDICA All. (1) Yarmouth (F.R.), Trowse (W.A.N.). (2) Drayton (W.G.C.).

- TRIFOLIUM STRIATUM L. var. *erectum, Leight. (1) Felmingham (F.R., B.E.C.R., 1917).
- ASTRAGALUS GLYCYPHYLOS L. (3) Holme Hale (F.R., B.E.C.R., 1914).
- CORONILLA VARIA* L. (3) near Wymondham, Miss Pomeroy (B.E.C.R., 1920).
- VICIA LUTEA L. (1) Norwich, 1915 (W.G.C.).
- LATHYRUS APHACA L. (1) Norwich (W.G.C.).
- L. SYLVESTRIS L. (2) Morston (Miss Patteson).
- L. MARITIMUS Bigel. (2) Salthouse (A. R. Norwood, B.E.C.R., 1921).
- RUBUS IDÆUS L. var. *obtusifolius (Willd.) (3) Stow Bedon (G. C. Druce and F.R., B.E.C.R., 1918).
- R. INFECUNDUS* Rogers. (3) Stow Bedon (G. C. Druce, B.E.C.R., 1918).
- POTENTILLA NORVEGICA L. (3) Thetford (M. Cobbe, B.E.C.R., 1920).
- AGRIMONIA ODORATA Mill. (2) Alderford (W.A.N.). (3) Tottington (Thompson), Watton (F.R., B.E.C.R., 1917).
- CRATÆGUS MONOGYNA Jacq. var. *splendens Druce. (3) Wymondham (F.R., B.E.C.R., 1915).
- SEDUM REFLEXUM L. var. *albescens (Haw). (2) Costessey, Sparham (W.G.C., J. of B., LV).
- EPILOBIUM ROSEUM Schreb. (3) Carbrooke (Mr. Watson, and F.C.N., 1914), Ashill (F.R., B.E.C.R., 1916).
- E. OBSCURUM Schreb. (4) Snore Hall, 1917 (J.E.L.).
- CIRCÆA ALPINA* L. (1) Hoveton (Rev. M. C. H. Bird).
- BUPLEURUM ROTUNDIFOLIUM L. (1) Yarmouth (F.C.N.), Norwich (W.G.C.).
- B. TENUISSIMUM L. (1) Yarmouth, 1923 (B. Reynolds).
- ASPERULA ARVENSIS L. (1) Norwich (W.G.C.).
- MATRICARIA SUAVEOLENS Buchenau. Spread all over Norfolk.
- SENECIO PALUSTRIS L. (3) Thet valley, 1922 (Sir H. Beevor, Bt.)
- CNICUS ERIOPHORUS Roth. (2) Longham (Rev. P. H. Cooke, 1919), Scarning (Mrs. Russwurm).
- CENTAUREA ASPERA* L. (3) Tottington (F.R., B.E.C.R., 1914).
- C. NEMORALIS* Jord. var. diversifolia C. E. Britton. (2) Wells (A. J. Crosfield, 1923).

- CREPIS VIRENS L. var. *agrestis W. & K. (1) Woodbastwick (C.E.S., J. of B., 1919).
- HIERACIUM SCIAPHILUM Uechtr. (2) W. Runton (F.R., B.E.C.R., 1914).
- H. CORYMBOSUM* Fr. (2) Hevingham (F.L.).
- HYPOCHÆRIS GLABRA L. var. *erostris Coss. and Germ. (4) Dersingham, Wolferton (J.E.L.).
- TARAXACUM ERYTHROSPERMUM Andrz. (1) near Mulbarton (W.A.N.). (2) Holkham (J.E.L.). (3) Scoulton (F.R.).
- SONCHUS PALUSTRIS L. (1) Haddiscoe, 1922-23, P.E.). Rumbelow (see N. & N. Nat. Tr., XI.).
- TRAGOPOGON MINUS Mill. (4) Beechamwell, Wallington, 1917. (J.E.L.). Narford, 1919 (Rev. P. H. Cooke), Cranwich, (W.G.C.).
- LYSIMACHIA PUNCTATA L. (3) Scoulton (F.R.).
- CENTAURIUM VULGARE Rafn. var. *intermedia Wheldon. (2) Wells or Holkham (J. & A. Bennett, 1900).
- MYOSOTIS REPENS* G. & D. Don. (1) Filby, 1879 (A.B.).
- SOLANUM NIGRUM L. var. nov. *sinuatum. (3) Thetford (Miss Cobbe, B.E.C.R., 1920).
- VERBASCUM BLATTARIA L. (2) Felthorpe. (3) Brettenham (W.G.C.).
- LIMOSELLA AQUATICA L. (3) Scoulton (F.R., B.E.C.R., 1916).
- EUPHRASIA ROSTKOVIANA Hayne. (2) Scarning. (4) Gooderstone (F.R., B.E.C.R., 1918).
- UTRICULARIA MAJOR* Schmidel. (3) Stow Bedon (F.R.).
- U. OCHROLEUCA* Hartm. (4) Foulden (F.C.N.).
- MENTHA GRACILIS Sm. var. cardiaca Baker. (3) Holkham (F.R., B.E.C.R., 1921).
- SALVIA PRATENSIS L. (3) Griston (F.R., B.E.C.R., 1915).
- GALEOPSIS ANGUSTIFOLIA Ehrh. (3) Saham Toney (F.R., B.E.C.R., 1915).
- PLANTAGO MAJOR L. var. intermedia (Gilib). (3) near Wymondham (Mrs. Russwurm, B.E.C.R., 1920).
- LITTORELLA UNIFLORA Aschers. (4) East Winch (F.R. and F.C.N., B.E.C.R., 1918).
- HERNIARIA GLABRA L. (1) Horstead (J. F. Buxton, B.E.C.R., 1917).
- AMARANTHUS RETROFLEXUS* L. (3) Thetford (F.R., B.E.C.R., 1917).

- CHENOPODIUM POLYSPERMUM L. var. *cymosum Moq. (2)
Blickling (F.R., B.E.C.R., 1921).
- C. OPULIFOLIUM* Schrad. (3) Watton, Thetford (F.R.,
B.E.C.R., 1916).
- POLYGONUM MITE Schrank. (3) Ashill, Thompson, (F.R.).
- P. MACULATUM* Trim. & Dyer. (4) Fordham (J.E.L.,
B.E.C.R., 1921).
- URTICA DIOICA L. var. *angustifolia Wimm & Grab. (2)
Sheringham (F.L.).
- MALAXIS PALUDOSA Sw. (1) near N. Walsham, in some
abundance (W.G.C., 1915-20).
- ORCHIS PRÆTERMISSA* Druce. "Abundant in the marshy
meadows of Norfolk." G. C. Druce, B.E.C.R., 1917.
(3) Stow Bedon, Watton (G.C.D.). (4) Beechamwell,
Caldecote, Oxborough, Shingham (J.E.L., J. of B., LVII.).
*FUCHSII. (3) Watton, Stow Bedon (G. C. Druce,
B.E.C.R., 1918).
- O. FUCHSII* Druce. (4) Shingham (J.E.L., J. of B., LVII.).
- ORNITHOGALUM NUTANS L. (3) Bodney (F.R., B.E.C.R., 1917).
- FRITILLARIA MELEAGRIS L. (3) Ovington (F.R., B.E.C.R.,
1914).
- JUNCUS TENUIS* Willd. (1) Caister-on-Sea (Miss. M. Cobbe,
B.E.C.R., 1920).
- POTAMOGETON PANORMITANUS* B. Bernardi. (1) Brograve
Level (C. E. Moss). (2) Between Dereham and Holt
(F.R.). (4) Wolverton (G. C. Druce, B.E.C.R., 1919, and
N. & N. Nat. Tr., XI., A.B.).
- P. PECTINATUS L. var. *diffusus Hagström. (1) Yarmouth
(Trimmer, Herb. Pearsall, B.E.C.R., 1919). (2) Wells
district (J.E.L.).
- P. INTERRUPTUS Kit. (3) Scoulton (G. C. Druce, B.E.C.R.,
1918).
- SCIRPUS FILIFORMIS Savi var. *monostachys. (2) Scarning
(F.R., B.E.C.R., 1915).
- S. MARITIMUS L. var. *monostachys Sonder. (2) Holkham
(J.E.L.).
- ERIOPHORUM VAGINATUM L. (4) Roydon (F.R., B.E.C.R.,
1918).
- CAREX DISTICHA Huds. (3) Garboldisham (F.R., B.E.C.R.,
1916). (4) Wallington, Caldecote (J.E.L.).

- C. PARADOXA* Willd. (3) Hockham (F.R., B.E.C.R., 1914).
(4) Shouldham (J.E.L.).
- C. PANICULATA* L. *f. *simplicior* And. (1) Ranworth (C.E.S.,
J. of B., 1919).
- C. CURTA* Good. (1) near Horning (C.E.S., J. of B., 1919).
- C. OVALIS* Good. var. **argyroglochis* (Hornem). (3) Wretham
(A. R. Horwood, B.E.C.R., 1918).
- C. GOODENOWII* Gay, var. **juncella* Asch. (3) Scoulton,
Stow Bedon (G. C. Druce, B.E.C.R., 1919).
- C. PANICEA* L., var. **tumidula* Laestad. (1) Ormesby (C.E.S.,
J. of B., 1919). (4) Shingham (J.E.L.).
- C. FULVA* Host. (3) Saham Toney (G. C. Druce & F.R.,
B.E.C.R., 1918). (4) Marham, Caldecote, Shingham
(J.E.L.).
- C. FLAVA* L. var. *lepidocarpa* Tausch. (1) Flegg Burgh,
Upton (C.E.S., J. of B., 1919). (4) Caldecote (J. F.
Luddington and J.E.L., B.E.C.R., 1919).
- SETARIA VIRIDIS* Beauv. (1) Trowse, 1917 (W.A.N.). (3)
Watton (F.R., B.E.C.R., 1916).
- S. GLAUCA* Beauv. (1) East Ruston (W.G.C., J. of B., LV.).
- DEYEUXIA NEGLECTA** Kunth. (3) Hockham, and var.
**Hookeri*. (3) Stow Bedon (F.R.).
- APERA INTERRUPTA* Beauv. (3) Threxton (F.R., B.E.C.R.,
1916). (4) Cockley Cley (J.E.L., Wats. B.E.C.R.,
1914-15).
- AVENA FATUA* L. var. **pilosissima* Gray. (3) Watton (G. C.
Druce, B.E.C.R., 1921).
- CYNOSURUS ECHINATUS** L. (2) Wells (F.R.), Drayton
(W.G.C.). (3) Thetford (F.R., B.E.C.R., 1917). (4)
Hunstanton (Gambier-Parry, B.E.C.R., 1918).
- KÆLERIA GLAUCA** DC. var. *arenaria* (Dum). (3) Little
Cressingham (F.R., B.E.C.R., 1915).
- MOLINIA CÆRULEA* Moench var. **obtusa* Hackel. (4) Foulden
(F.R., B.E.C.R., 1916).
- BRIZA MAXIMA** L. (2) Drayton (W.G.C.).
- GLYCERIA FLUITANS* R. Br. var. **triticea* Lange. (1) Claxton
(G. C. Druce, B.E.C.R., 1920).
- G. DECLINATA** Bréb. (1) Flegg Burgh (C.E.S. & J. W. White,
J. of B., 1919).

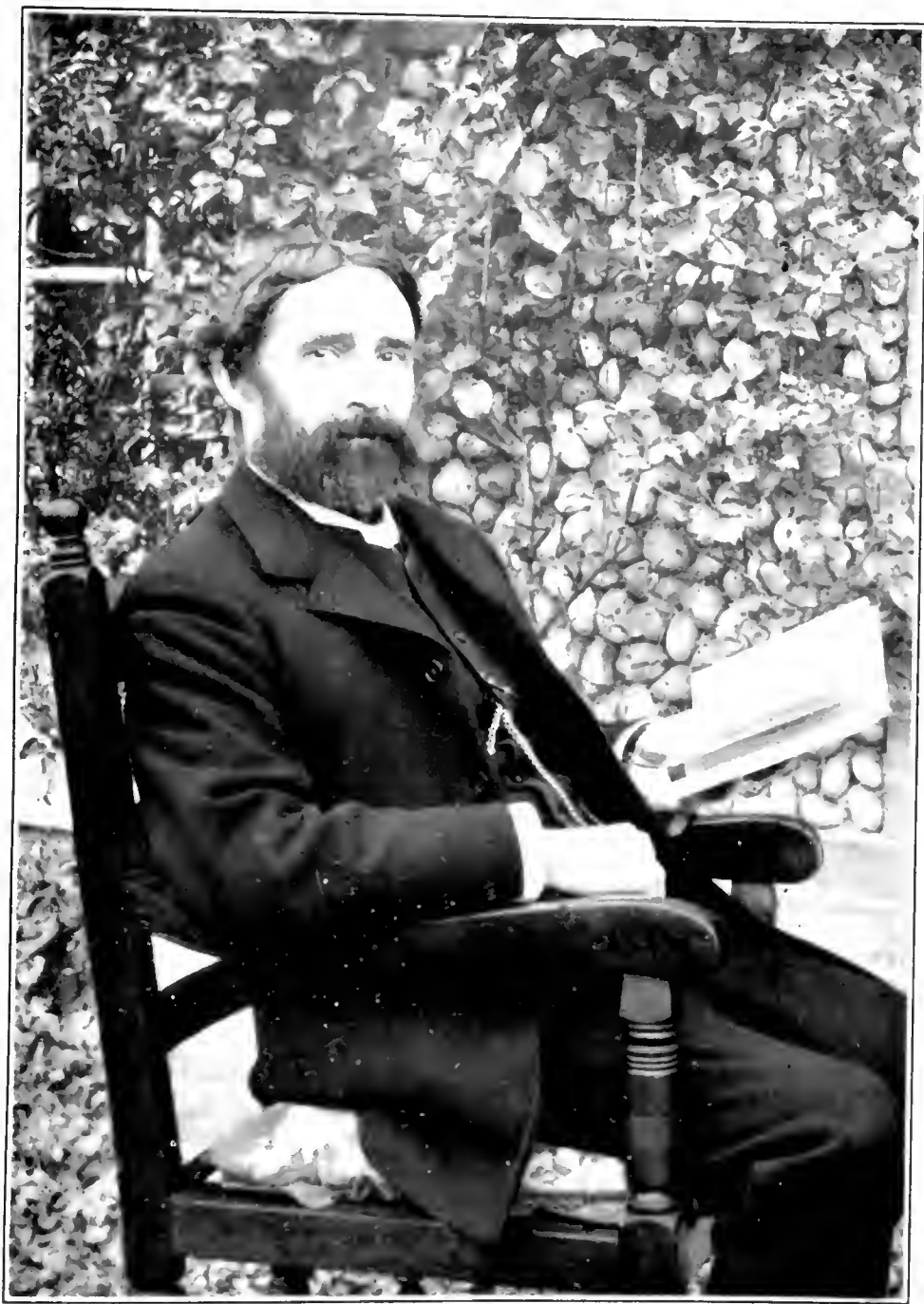
- BROMUS MADRITENSIS L. var. *rigidus Bab. (3) Thetford (F.R., B.E.C.R., 1915).
- B. TECTORUM L. (1) Norwich (W.G.C.), Yarmouth. (3) Thetford (F.R.).
- B. MAXIMUS Desf. (1) Yarmouth. (3) Threxton (F.R., B.E.C.R., 1914-1917).
- B. RACEMOSUS L. (3) Saham (F.C.N.).
- LOLIUM TEMULENTUM L. var. arvense (With). (3) Thetford (F.R., B.E.C.R., 1916).
- CHARA BALTICA* Bruzel, var. nov. rigida. (1) Hickling, 1898 (Rev. G. R. Bullock-Webster, J. of B., LXII.).

XIII

MAURICE CHARLES HILTON BIRD, M.A., M.B.O.U.
1857-1924

We have to record, with deep regret, the death of the Rev. M. C. H. Bird, Rector of Brunstead, which took place at Brunstead Rectory on October 18th, 1924. In May of this year he underwent a serious operation, which, it was hoped, would give him a new lease of life, and, after returning to his home, he was able to enjoy in a limited way the pleasures of his garden and greenhouses, which had always been his chief recreation. But he did not get on as it was hoped, and his strength gradually failed, and he died very peacefully in his sleep on the date above mentioned.

The Rev. Maurice Charles Hilton Bird was born on March 28th, 1857, and was therefore in his 68th year. He was the eldest son of Captain H. H. Bird, of Little Waltham Hall, Essex, who married Eliza Sophia Master. He owned practically the whole of the parish and the estate descended to his son, who, however, spent most of his life in Norfolk, for his father subsequently bought Burnley Hall, West Somerton, and lived there and afterwards at Kelling Hall, which he hired.



MAURICE CHARLES HILTON BIRD, M.A., M.B.O.U.

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The Rev. M. C. H. Bird went to Trinity Hall, Cambridge, took his B.A. degree in 1879, and M.A. in 1884. In 1887 he married Miss Kate Bonner, a daughter of Mr. Henry Calthorpe Bonner, of the Manor House, East Rudham, by whom he had four children, two sons—one of whom was killed in the war—and two daughters, both of whom predeceased him. The elder son, Mr. M. B. Bird, lives at Little Waltham.

Before being ordained, Maurice Bird was a master at Weymouth College, where he had many opportunities for shooting and wild fowling. He was subsequently Curate at Rudham, and accepted the incumbency of Brunstead in 1887. He was greatly beloved by his parishioners, and was an ideal clergyman for a rural parish.

He took an extremely active part in the life of the district. He had been a Guardian for the parish since 1888, and subsequently a District Councillor; a very active member of the Stalham Farmers' Club, for which he had acted as judge of root crops; a chairman of the local War Pensions Committee, which has now ceased to function; and during the war was secretary of the local War Agricultural Committee. In accordance with his invariable practice, he has left detailed records of the work of the committee, which will be invaluable to future historians. For many years he had been a member of the Sea Breach Commission, in which he took a most active interest. He was asked to become a member of the last Royal Commission on Coast Erosion, but regretfully declined. On this subject also he had made very copious notes. He had been a manager of the Stalham and Brunstead School since 1887, and for the past few years has acted as chairman and school correspondent. It may be of interest to note that his great abilities were given to the Norfolk Education Committee as an examiner in the Bird and Tree competition.

He had many of the characteristics of Gilbert White, of Selborne. Everything associated with country life had for him a perpetual interest—the interest of a cultured, sympathetic observer. He was a first-class field naturalist. When a boy he was well schooled in the arts of fishing and shooting by his

father, whom he accompanied on expeditions to Scotland and elsewhere. He had always been a keen sportsman, and years ago did a great deal of shooting, as Mrs. Lubbock, of Catfield Hall, gave him the rights over a large part of Hickling Broad and of Catfield. Since 1892 he had been a member of the British Ornithologists' Union, and since 1882 of the Norfolk and Norwich Naturalists' Society. In the latter he filled the office of president in 1908-9, and devoted his presidential address to "The rural economy, sport, and natural history of East Ruston Common," a paper which is of the utmost value to the student, giving more details than are available for any other Norfolk Common. Possessed of a keen sense of humour and a comprehensive knowledge of the Norfolk dialect, he delighted in associating with outdoor people of all kinds—farmers, labourers, gamekeepers, broadsmen; in fact, all the types to be met with in the rural parishes of the neighbourhood. Throughout his life he had also been a keen gardener, and judged at most of the local shows.

Nothing in the life of the countryside was too small for his observation. Dialect, folk-lore, animals, birds, plants, insects, farms and farm animals, commons, weather phenomena—on all he kept a watchful eye, the eye of a sympathetic observer possessed of a critical intellect. Although he wrote a number of ornithological and meteorological articles, we believe that the wealth of his recorded observations has been scarcely touched. For nearly sixty years he kept a diary—not the kind which is associated with the owner's egotism—but a diary in which he recorded the happenings of everyday life in a small and somewhat remote village. Should these volumes ever become available there is no doubt that they will provide an almost inexhaustible mine of country lore. It is very doubtful whether any equally competent observer has thus transcribed the life of the Norfolk countryside. A man of such a type meets many men, and those he meets are his friends. Few men in East Norfolk enjoyed so wide and well-deserved a popularity. His death leaves the county poorer in many ways.

Among the papers he contributed to the Transactions of the Norfolk and Norwich Naturalists' Society were a most graphic account of the hailstorm of July 14th, 1917, when damage estimated at £30,000 resulted to the fruit and other crops in the Stalham district ; and a most comprehensive account of the effects of the drought of 1921. It is not too much to say that there was no man living in the county who was so eminently qualified as an accurate observer to place on record the many and various effects of this long drought on the agriculture, horticulture, animal, bird, and insect life in Norfolk. The section on birds in W. A. Dutt's " Norfolk Broads," a series of articles on " The Bird-Life of the Norfolk Broads " for the " Field Club " ; and " Bird-life on the Broads in Summer," and " Winter on the Norfolk Broads " for the " Field Naturalists' Quarterly" were also from his pen. He was a man of genial disposition, of wide knowledge and understanding, generous in helping others, and the regret felt by a wide circle of friends at the news of his death will be deep and sincere.

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*Copies of the TRANSACTIONS OF THE NORFOLK AND NORWICH NATURALISTS' SOCIETY can be obtained of the Hon. Librarian, Mr. F. C. Hinde, Quebec Road, Norwich, at the following reduced prices. Those marked by an * are damaged by fire.*

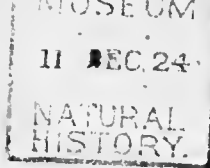
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Ordinary Members proposed and seconded at any meeting of the Society are balloted for at the next meeting. The Annual Subscription is 10s., payable in advance on election, subsequent subscriptions becoming due on the last Tuesday in March annually. This subscription may be compounded for by a single payment of £8.

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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