

TRANSACTIONS
OF THE
Norfolk and Norwich
NATURALISTS' SOCIETY

PRESENTED TO MEMBERS FOR

1928-29

VOL. XII.—PART V

EDITED BY THE HONORARY SECRETARY

NORWICH

PRINTED BY A. E. SOMAN & Co., LTD.

DECEMBER, 1929

PRICE 10/-

Norfolk and Norwich Naturalists' Society

Patron

H.M. THE KING

Vice-Patron

H.R.H. THE PRINCE OF WALES, K.G.



OFFICERS FOR 1929—30

President

G. H. GURNEY, F.Z.S., F.E.S., M.B.O.U.

Vice-Presidents

HER GRACE THE DUCHESS OF BEDFORD, F.Z.S., F.L.S., Hon.M.B.O.U.

THE RIGHT HON. THE EARL OF LEICESTER, G.C.V.O., C.M.G.

THE RIGHT HON. VISCOUNT GREY OF FALLODON. P.C., K.G.

MICHAEL BEVERLEY, M.D.

SIR SIDNEY F. HARMER, K.B.E., F.R.S.

F. W. OLIVER, D.Sc., F.R.S.

Hon. Treasurer and Excursion Secretary

H. W. BACK

Hill House

Hethersett, Norwich

Hon. Secretary

SYDNEY H. LONG, M.D., F.Z.S.

31, Surrey Street, Norwich

Hon. Secretary, Junior Branch

MISS JUDITH FERRIER

Hemsby Hall, Norfolk

Hon. Librarian

F. C. HINDE

Hon. Auditor

W. A. NICHOLSON

Committee

MISS A. GELDART

SURG: CAPT: LIVESAY, R.N.

B. B. RIVIERE

W. H. M. ANDREWS

C. G. DOUGHTY

MISS J. FERRIER

H. H. HALLS

H. J. HOWARD

REV. R. W. NEVILL

Wild Birds' Protection Committee

R. J. COLMAN (*Chairman*)

S. H. LONG (*Hon. Secretary*)

Q. E. GURNEY

R. GURNEY

CAPT. L. LLOYD

B. B. RIVIERE

LORD WILLIAM PERCY

TRANSACTIONS
OF THE
NORFOLK & NORWICH
NATURALISTS' SOCIETY

The Committee beg to direct the attention of authors of communications to the Society to the following Regulations which have been drawn up in order to accelerate the publication of the Transactions, and to utilise as widely and as fairly as possible the funds which the Society devotes to the publication of scientific researches :—

1.—PRECEDENCE will be given to papers dealing with local Natural History.

2.—MSS. OF PAPERS.—As soon as any paper is ready for publication, whether it has been read before the Society or not, it must be sent to the Hon. Editor for the consideration of the Committee.

3.—ILLUSTRATIONS.—Illustrations, if accepted, should be drawn in a form immediately suitable for reproduction by photographic process.

4.—PROOFS.—In general, a first proof and a revise of each paper will be sent to the author. If further proofs are required, owing to corrections or alterations for which the printer is not responsible, the expense of such proofs and corrections shall be charged against the author. All proofs must be returned without delay addressed to the Hon. Editor.

5.—ABSTRACTS.—Authors are requested to hand to the Hon. Secretary abstracts of their Papers at the same time that they deposit their MSS.

6.—SEPARATE ISSUE OR REPRINTS.—An author requiring reprints of his paper must inform the Editor of the number of copies he will require. He will be charged for them by the printer, who will forward the copies to him when ready, shortly after the publication of the Transactions.

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.
6. The facilitating of a friendly intercourse between local Naturalists by means of Meetings for the reading and discussion of papers and for the exhibition of specimens, supplemented by Field-meetings and Excursions, with a view of extending the study of Natural Science on a sound and systematic basis.
7. Any Member who, in the opinion of the Committee, contravenes the objects of the Society is liable to have his name erased from the List of Members.

TRANSACTIONS
OF THE
Norfolk and Norwich
NATURALISTS' SOCIETY .

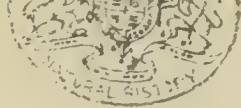
PRESENTED TO MEMBERS FOR

1928—29

VOL. XII.—PART V

EDITED BY THE HONORARY SECRETARY

NORWICH
PRINTED BY A. E. SOMAN & Co., LTD.
DECEMBER, 1929



PAST PRESIDENTS



REV. JOSEPH CROMPTON, M.A.	...	...	...	...	...	...	1869—70
" " "	...	...	...	...	...	...	1870—71
HENRY STEVENSON, F.L.S.	...	...	...	...	...	...	1871—72
MICHAEL BEVERLEY, M.D.	...	...	...	...	...	...	1872—73
FREDERIC KITTON, Hon. F.R.M.S.	...	...	...	...	...	...	1873—74
H. D. GELDART	...	...	...	...	...	...	1874—75
JOHN B. BRIDGMAN	...	...	...	...	...	...	1875—76
T. G. BAYFIELD	...	...	...	...	...	...	1876—77
F. W. HARMER, F.G.S.	...	...	...	...	...	...	1877—78
" " "	...	...	...	...	...	...	1878—79
THOMAS SOUTHWELL, F.Z.S.	...	...	...	...	...	...	1879—80
OCTAVIUS CORDER	...	...	...	...	...	...	1880—81
J. H. GURNEY, Jun., F.Z.S.	...	...	...	...	...	...	1881—82
H. D. GELDART	...	...	...	...	...	...	1882—83
H. M. UPCHER, F.Z.S.	...	...	...	...	...	...	1883—84
FRANCIS SUTTON, F.C.S.	...	...	...	...	...	...	1884—85
MAJOR H. W. FEILDEN, C.B., F.G.S., C.M.Z.S.	...	...	...	...	...	...	1885—86
SIR PETER EADE, M.D., F.R.C.P.	...	...	...	...	...	...	1886—87
SIR EDWARD NEWTON, K.C.M.G., F.L.S., C.M.Z.S.	...	...	...	...	...	...	1887—88
J. H. GURNEY, F.L.S., F.Z.S.	...	...	...	...	...	...	1888—89
SHEPHERD T TAYLOR, M.B.	...	...	...	...	...	...	1889—90
HENRY SEEBOHM, F.L.S., F.Z.S.	...	...	...	...	...	...	1890—91
F. D. WHEELER, M.A., LL.D.	...	...	...	...	...	...	1891—92
HORACE B. WOODWARD, F.G.S.	...	...	...	...	...	...	1892—93
THOMAS SOUTHWELL, F.Z.S.	...	...	...	...	...	...	1893—94
C. B. PLOWRIGHT, M.D.	...	...	...	...	...	...	1894—95
H. D. GELDART	...	...	...	...	...	...	1895—96
SIR F. C. M. BOILEAU, Bart., F.Z.S., F.S.A.	...	...	...	...	...	...	1896—97
A. W. PRESTON, F.R.Met.Soc.	...	...	...	...	...	...	1897—98
J. H. GURNEY, F.L.S., F.Z.S.	...	...	...	...	...	...	1898—99
JOHN T. HOTBLACK	...	...	...	...	...	...	1899—1900
SIDNEY F. HARMER, Sc.D., F.R.S.	...	...	...	...	...	...	1900—01
W. H. BIDWELL	...	...	...	...	...	...	1901—02
HENRY WOODWARD, LL.D., F.R.S., V.P.Z.S., F.G.S.	...	...	...	...	...	...	1902—03
FREDERICK LONG, L.R.C.P.	...	...	...	...	...	...	1903—04
WALTER GARSTANG, M.A.	...	...	...	...	...	...	1904—05
EUSTACE GURNEY, M.A., F.Z.S.	...	...	...	...	...	...	1905—06
C. A. HAMOND	...	...	...	...	...	...	1906—07
SYDNEY H. LONG, M.D., M.B.O.U.	...	...	...	...	...	...	1907—08
REV. M. C. H. BIRD, M.A., M.B.O.U.	...	...	...	...	...	...	1908—09
D. G. THOMSON, M.D.	...	...	...	...	...	...	1909—10
W. M. CROWFOOT, F.R.C.S.	...	...	...	...	...	...	1910—11
W. LINCOLNE SUTTON, F.I.C.	...	...	...	...	...	...	1911—12
ROBERT GURNEY, M.A., F.Z.S.	...	...	...	...	...	...	1912—13
MISS ALICE M. GELDART	...	...	...	...	...	...	1913—14
J. H. F. WALTER, F.Z.S.	...	...	...	...	...	...	1914—15
H. J. THOULESS	...	...	...	...	...	...	1915—16
CLAUDE B. TICEHURST, M.A., M.B.O.U.	...	...	...	...	...	...	1916—17
W. G. CLARKE, F.G.S.	...	...	...	...	...	...	1917—18
EDWARD BIDWELL	...	...	...	...	...	...	1918—19
J. H. GURNEY, F.L.S., F.Z.S.	...	...	...	...	...	...	1919—20
B. B. RIVIERE, F.R.C.S., M.B.O.U.	...	...	...	...	...	...	1920—21
MISS E. L. TURNER, F.L.S., F.Z.S.	...	...	...	...	...	...	1921—22
RUSSELL J. COLMAN	...	...	...	...	...	...	1922—23
SIR HUGH R. BEEVOR, Bart.	...	...	...	...	...	...	1923—24
DONALD HUTCHINSON, M.D.	...	...	...	...	...	...	1924—25
E. H. HANKIN, M.A., Sc.D.	...	...	...	...	...	...	1925—26
" " "	...	...	...	...	...	...	1926—27
H. J. HOWARD, F.L.S.	...	...	...	...	...	...	1927—28
H. F. WITHERBY, F.Z.S., M.B.O.U.	...	...	...	...	...	...	1928—29

Norfolk and Norwich Naturalists' Society



OFFICERS FOR 1928—29

President

H. F. WITHERBY, M.B.E., F.Z.S., M.B.O.U.

Vice-Presidents

HER GRACE THE DUCHESS OF BEDFORD, F.L.S., F.Z.S., Hon. M.B.O.U.

THE RIGHT HON. THE EARL OF LEICESTER, G.C.V.O., C.M.G.

THE RIGHT HON. VISCOUNT GREY OF FALLODON, P.C., K.G.

MICHAEL BEVERLEY, M.D.

SIR SIDNEY HARMER, K.B.E., Sc.D., F.R.S.

PROF. F. W. OLIVER, D.Sc., F.R.S.

Hon. Treasurer

H. W. BACK

Hethersett

Norwich

Hon. Secretary

SYDNEY H. LONG, M.D., F.Z.S.

31, Surrey Street, Norwich

Hon. Secretary, Junior Branch

MISS B. WATERFIELD

Attlebridge, Norwich

Hon. Librarian

F. C. HINDE

Hon. Editor

ROBERT GURNEY

Hon. Auditor

W. A. NICHOLSON

Committee

MISS A. GELDART

SURG: CAPT: LIVESAY, R.N.

B. B. RIVIEVE

H. W. BACK

R. J. COLMAN

CAPT. L. LLOYD

D. PAYLER

H. J. THOULESS

MISS WATERFIELD

Wild Birds' Protection Committee

R. J. COLMAN (*Chairman*)

B. B. RIVIERE

ROBERT GURNEY

LORD WILLIAM PERCY

Q. E. GURNEY

CAPT. L. LLOYD

S. H. LONG (*Hon. Secretary*)

LIST OF MEMBERS, 1928-29

Members who have compounded for their Subscriptions are marked with an asterisk.

Elected

A

- 1927 Alford C. E., "Hurst," Walberswick, Suffolk
- 1892 *Ames Victor, Thornham, King's Lynn
- 1925 Anderson Mrs., 34, Duke Street, Norwich
- 1925 Anderson Dr. T., 34, Duke Street, Norwich
- 1895 Andrews W. H. M., Colney, Norwich
- 1912 Astley Major D. G., Wroxham, Norwich

B

- 1922 Back C. W., 139, Newmarket Road, Norwich
- 1919 Back H. W., *Hon. Treasurer*, Hill House, Hethersett
- 1923 Bacon Clifford, 4, Riverside Road, Norwich
- 1923 Bagnell Mrs., Oulton Lodge, Aylsham
- 1921 Baker E. C. Stuart, O.B.E., F.Z.S., 6, Harold Road, Upper Norwood, S.E. 19.
- 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
- 1927 Barnard Mrs., The Clyffe, St. Leonard's Road, Norwich
- 1927 *Barrington F. F., University Coll: Hosp: Medical School London, W.C.1.
- 1921 Barrow Miss E. J., The Red House, Drayton, Norwich
- 1924 Barton Mrs., 7, Queen's Road, Beccles
- 1927 Bates Miss W. M., B.Sc., "Tudor," Warren Road, Lowestoft
- 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 Beever Sir H., Bart., Hargham Hall, Norfolk
- 1911 Beloe E. M., F.S.A., 27, New Conduit Street, King's Lynn
- 1921 *Berney F. L., R.A.O.U., Barcarolle, Longreach, Queensland
- 1925 Best Miss M. G., F.Z.S., M.B.O.U., 28, Paulton's Square, Chelsea, S.W.3
- 1869 O.M. Beverley M., M.D., *V.P.*, Overstrand, Norfolk
- 1877 Bidwell E., 12, Woodberry Grove, Finsbury Park, London, N. 4.
- 1921 Bignold C. R., Loddon House, Loddon, Norfolk
- 1895 Birkbeck H., High House, Westacre, Norfolk
- 1901 Birkbeck H. A., King's Lynn
- 1921 Birkbeck Oliver, Little Massingham House, King's Lynn
- 1926 Birkin H. R. S., Shadwell Court, Thetford, Norfolk
- 1925 Blofeld T. C., Hoveton House, Norwich
- 1885 Boardman E. T., How Hill, Ludham, Norfolk
- 1927 Boardman C., How Hill, Ludham, Norfolk
- 1896 Boileau Sir M. C., Bart., Ketteringham Park, Wymondham, Norfolk
- 1902 Booth H. B., Ryhill, Ben Rhydding, Yorks.
- 1924 Boyd A. W., Frandley House, Near Northwich, Cheshire
- 1915 Bradfer-Laurence H. L., F.S.A., King's Lynn

Elected.

- 1923 Brereton Mrs., Gresham, Holt
 1928 Briscoe Lieut. F. M. Elliott-Drake, Britannia Barracks, Norwich
 1884 Brittain H., 1, Fairfield Road, Town Close, Norwich
 1924 Britton Eric, 43, Cambridge Street, Norwich
 1924 Broderick Miss, Cathedral Close, Norwich
 1912 Brooks J. R., North Walsham Wood, Norwich
 1925 Brooks Mrs., North Walsham Wood
 1925 Brooks Miss Nancy, North Walsham Wood
 1926 Brown Miss I., Walton Lodge, Surlingham
 1927 Brown Miss V., Walton Lodge, Surlingham
 1921 Brown Mrs. Du Puis, Chedgrave Manor, Loddon
 1921 Bruton M. S., The Post Office, Aylsham
 1925 Bryan H., "Lanthwaite," Eaton, Norwich
 1926 Bullard, E. J., Heigham Grove, Norwich
 1922 Bulwer Lt.-Col. E. A., Heydon Grange, Aylsham
 1925 Bulwer Mrs., Heydon Grange, Norwich
 1926 Bullard Ernest, Swan Cottage, Horning, Norwich
 1923 Burnand L. B., Bushy Place, Aylsham
 1923 Burton Arthur, M.D., Cromer
 1923 Burton Mrs. Arthur, Cromer
 1927 Burton-Fanning F. W., M.D., 90, Newmarket Road, Norwich
 1928 Bushell Maurice D., Bolwick, Marsham, Norwich
 1925 Busittil F. P., Swardston, Norwich
 1900 Bussey A., Wayford, Stalham
 1926 Butler S., Lime Grove, Lime Tree Road, Norwich
 1921 *Buxton Anthony, Knighton, Buckhurst Hill, Essex
 1884 Buxton A. F., Fairhill, Tonbridge
 1923 *Buxton Major Ivor, Little Dunham, King's Lynn
 1906 Buxton R. G., Petygards, Swaffham, Norfolk
 1929 Buxton R. J., Sawbridgeworth, Herts.
 1906 Buxton W. L., Bolwick Hall, Marsham, Norwich

C

- 1909 Calvert E. M., Eaton, Norwich
 1925 Canterbury Viscount, Bergh Apton, Norwich
 1923 Carruthers Douglas, Barmer Hall, King's Lynn
 1907 Caton Rev. R. B., Great Fakenham Rectory, Thetford
 1902 Cator John, Woodbastwick Hall, Norfolk
 1923 Cator H. J., Ranworth Old Hall, Norwich
 1922 Cator Miss Diana, Trewsbury, Cirencester
 1926 Chadwick Dr. M., 3, King Street, King's Lynn
 1911 Chamberlin Rev. C. M., Witton Rectory, Norwich
 1924 Chambers Miss M. H., 72, Ditchling Road, Brighton
 1929 Chapman F. S., St. John's College, Cambridge
 1925 Charlesworth J. B., Gunton Hall, Lowestoft
 1919 *Chasen F. N., The Raffles Museum, Singapore
 1924 Chittock A. T., 12, Chapel Field North, Norwich
 1924 Chittock Mrs. A. T., 12 Chapel Field North, Norwich
 1907 Christie J. A., M.P., Framingham Manor, Norwich
 1923 Citters A. van, Broadlands, Wroxham
 1925 Clarke Mrs. F., "Coniston," Newmarket Road, Norwich
 1927 Clarke Miss L. R., 12, St. Philip's Road, Norwich
 1911 Cleather Rev. W. S., Barningham Rectory, Norfolk
 1923 Clodd Mrs., Strafford House, Aldeburgh, Suffolk
 1925 Cobbold J. D., Holy Wells, Ipswich
 1909 Coke Right Hon. Viscount, Holkham, Norfolk
 1923 Cole Lowry A. C., The Lodge, Sprowston
 1923 Cole Mrs. Lowry, The Lodge, Sprowston
 1923 Collin J. F., 419, Unthank Road, Norwich

Elected.

- 1924 Collings Dr. D. W., The Mount, Southwold
 1921 Colman Capt. G. R. R., Framingham Hall, Norwich
 1903 *Colman Miss E. M., Carrow Abbey, Norwich
 1903 *Colman Miss H. C., Carrow Abbey, Norwich
 1881 Colman Russell J., Crown Point, Norwich
 1925 Cook G. J., 143, Newmarket Road, Norwich
 1925 Copeman T. D., The Warren, Reedham
 1919 Copeman W. O., 76, Highland Road, Norwich
 1923 Coward T. A., M.Sc., Brentwood, Bowdon, Cheshire
 1921 Cozens-Hardy A., Oak Lodge, Sprowston, Norwich
 1926 Cozens-Hardy E. W., Oak Lodge, Sprowston
 1886 Cross J. M., Acle
 1928 Cranage Mrs., The Deanery, Norwich
 1926 Cruickshank W. G., 11, Hammersmith Terrace, London, W.C.6

D

- 1910 Dalby Rev. Alan, M.A., The Vicarage, Leamington-Hastings,
 Rugby
 1922 Dallas Chas. C., Eastley Wootton, New Milton, Hants.
 1928 Daniels E. T., 31, Market Place, Norwich
 1923 Daukes Maj. A. H., 22, Egerton Terrace, London, S.W. 2
 1920 Davey Guy, Aldborough, Norwich
 1927 Davies, Miss H., Branksome Road Norwich
 1914 Davies H. C., Old Lakenham, Norwich
 1901 Day Donald D., F.R.C.S., All Saints' Green, Norwich
 1926 Day, J. Wentworth, 61a, Pall Mall, London, S.W.1
 1917 Deacon G. E., Brundall, Norwich
 1928 Dewing B., Point House, Aylsham Road, Norwich
 1891 Digby A., Syderstone, King's Lynn
 1916 Doughty Chester G., 7, Upper Cliff Road, Gorleston-on-Sea

E

- 1911 Easter W. C., 99, City Road, Norwich
 1924 Elliott T. B., 8, Brunswick Road, Norwich
 1929 Ellis Edward, 84, Springfield Road, Gorleston
 1897 Evans H. Muir, M.D., Turret House, South Lowestoft
 1919 Evans-Lombe Major E., Marlingford Hall, Norwich

F

- 1885 Falcon Michael, Sprowston Hall, Norfolk
 1927 Fawkes, Dr. R. B., Rede's House, Cromer
 1922 *Ferrier Miss J. M., M.B.O.U., Hemsby Hall, Norfolk
 1922 Ferrier R. F. E., F.S.A., Hemsby Hall, Norfolk
 1924 Fisher K., The School, Oundle, Northants
 1923 Fisher Sidney, Oaklands, St. Clement's Hill, Norwich
 1924 Fleming James M., "Drumwalt," The Long Road, Cambridge
 1880 *Fletcher W. H. B., Aldwick Manse, Bognor
 1922 Fonnereau Miss Hilda, The Eyrie, Palling, Norfolk
 1924 Fowler Major E., Gunton Old Hall, Lowestoft
 1924 Fowler Miss E., Drinkstone House, Bury St. Edmunds
 1922 Frere Sir Bartle H. T., South Walsham Hall, Norfolk
 1926 Fuller A. W., 18, Kerrison Road, Norwich

G

- 1927 Garnett R. M., Pudding Lane Cottage, Kelling, Norfolk
 1902 Garstang Walter, D.Sc., The University, Leeds
 1924 Gay Miss Ellen, Thurning Hall, Guist, Norfolk
 1927 Gay Miss C. E., Ardleigh House, Hornchurch, Essex

Elected.

- 1925 Gay Miss G. A., Ardleigh House, Hornchurch, Essex
 1926 Gayner J. S., Hall Cottage, New Earswick, York
 1922 Gaze R., 105, Earlham Road, Norwich
 1903 Geldart Miss Alice M., Cotman Road, Norwich
 1928 George Sydney S., Saham Toney, Thetford
 1929 Gifford J., 251, College Road, Norwich
 1926 Gilbert Brig.-Gen. A. R., C.B.E., D.S.O., Sprats Green, Aylsham
 1926 Gilbert Mrs. A. R., Sprats Green, Aylsham
 1908 Gilbert R. T. E., Ashby Hall, Norfolk
 1923 Gill S. T., Rupert Street, Norwich
 1921 Glover T., 224, Unthank Road, Norwich
 1909 Goodchild Herbert, The Chestnuts, Unthank Road, Norwich
 1901 Goose A. W., 10, Sandringham Road, Norwich
 1922 Gossage Mrs., Leet Hill, Kirby Cane, Norfolk
 1922 Gossage Col. W. W., Leet Hill, Kirby Cane, Norfolk
 1927 Grant E. R., Hotel Roosevelt, Washington, D.C., U.S.A.
 1921 Graves Mrs., Oulton Lodge, Aylsham, Norfolk
 1919 Greatorex H. A., Witton, Norwich
 1924 Green Maj. E. A. Lycett, Ashfield, York
 1918 Gresham School The, Holt, Norfolk
 1913 *Grey of Fallodon, The Rt. Hon. Viscount, K.G., *V.P.*, Fallodon,
 Lestbury, Northumberland
 1926 Gunn F. E., 84, St. Giles Street, Norwich
 1918 Gurney Major Cecil F., Berry Hall, Walsingham
 1893 *Gurney Gerard H., F.Z.S., Keswick Hall, Norwich
 1929 Gurney John, Walsingham Abbey, Norfolk
 1901 Gurney Q. E., Bawdeswell Hall, Norfolk
 1894 *Gurney Robert, D.Sc., F.L.S., Bayworth Corner, Boars Hill,
 Oxford
 1918 Gurney Mrs. Robert, Bayworth Corner, Boars Hill, Oxford

H

- 1924 Hadfield Travers, Stoneleigh, Knutsford, Cheshire
 1892 *Haigh G. H. Caton, Grainsby Hall, Great Grimsby
 1905 Halls H. H., 130, Hall Road, Norwich
 1926 Hammond C. R. A., Sprowston Grange, Norwich
 1906 *Hamond Major Philip, D.S.O., Morston, Holt, Norfolk
 1928 Hardinge Lt.-Col. T. S. N., D.S.O., Flaxmoor, Caston, Attleboro'
 1919 Harker Miss Sylvia, Blofield Hall, Norwich
 1908 Harker William, Blofield Hall, Norwich
 1923 Harmer Russell T., The Grange, Rackheath, Norwich
 1881 *Harmer Sir Sidney, K.B.E., F.R.S., *V.P.*, The Old Manor
 House, Melbourn, near Royston, Herts.
 1906 Harris Rev. G. H., Acock's Green Vicarage, Birmingham
 1925 Hartcup Miss, Dial House, Cathedral Close, Norwich
 1929 Harvard C. E., Whalebone House, Buxhall, Nr. Stowmarket
 1923 Hastings Lord, Melton Constable Park, Norfolk
 1925 Hemingway P. H., Bureside, Wroxham
 1928 Hendy E. W., Holt Anstiss, Porlock, Somerset
 1926 Herbert E. G., Braken How, Sheringham
 1925 Hewitt H. Dixon, F.I.C., 25, Croxton Road, Thetford
 1925 Heywood R., Pentney House, Narborough, Norfolk
 1923 Hibberd Rev. H., Burnham Thorpe Rectory, King's Lynn
 1919 Hinde Dr. E. B., 31, Mount Pleasant, Norwich
 1891 Hinde F. C., *Hon. Librarian*, Oaklands House, Cringleford
 Norwich
 1923 Hines E. S., 10, Parker Road, Norwich
 1915 Hitchcock Arthur, Tamworth House, Tennyson Road, King's
 Lynn

Elected.

- 1921 Hoare Miss Marjorie, 17, Camberley Road, Norwich
 1919 Horsfall Charles, Stody Lodge, Melton Constable, Norfolk
 1923 Hoskins Maj. Gen. Sir Reginald, Philip Stott College, Overstone Park, Northampton
 1919 Howard H. J., 6, College Road, Norwich
 1926 Howlett J. K., The Beeches, East Dereham
 1927 Hudson Lt.-Col. P., C.M.G., D.S.O., Martincross, Sheringham
 1929 Hudson Mrs., Martincross, Sheringham
 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
 1929 Hyslop Brig.-Gen., H. G., D.S.O., Littlewood House, Drayton, Norwich
 1929 Hyslop A. B., Burnham Norton, King's Lynn
 1929 Hyslop Mrs., Littlewood House, Drayton, Norwich

J

- 1921 Jarrold T. H. C., Pine Banks, Thorpe St. Andrew
 1891 Jarrold W. T. F., Beeston St. Andrew, Norwich
 1927 Jessopp A. L., Lexham Hall, King's Lynn
 1926 Jolly L. B., Aylmerton Hall, Norfolk
 1923 Jolly T. L., Manor House, Worstead
 1885 Jones Sir Lawrence, Bart., 39, Harrington Gardens, London, S.W., 7.
 1926 Jourdain Rev. F. C. R., Laverstock, 13, Belle View Road, Southbourne, Bournemouth

K

- 1926 Keith E. C., Swanton Morley House, East Dereham
 1927 Kendall O. D., Dept. of Geography, University of Bristol
 1929 Ker Mrs. Rait, 42, Parkside, Cambridge
 1897 Kerrison Colonel E. R. A., C.M.G., D.L., Burgh Hall, Aylsham, Norfolk
 1925 Kerrison Mrs., Burgh Hall, Aylsham, Norfolk
 1912 Ketton-Cremer W. C., Felbrigg Hall, Norfolk
 1926 Kimberly Mrs., M.Sc., "Constantia," Elm Grove Lane, Norwich
 1904 Kinder Rev. E. H., Kirby Bedon Rectory, Norfolk
 1898 Knight Edward, Keswick Old Hall, Norwich

L

- 1925 Labouchere P., The Lodge, Burnham Thorpe, King's Lynn
 1926 Lane D. H., Framingham Pigot, Norwich
 1929 Lawrence F. J., Lauriston, Mossell River, Harmanus, Cape Province, S. Africa
 1926 Leconfield Lady, Petworth House, Petworth, Sussex
 1921 le Strange C., Hunstanton Hall
 1909 Leicester The Right Hon. the Earl of, G.C.V.O., C.M.G., *V.P.* Holkham
 1899 Leney F., Castle Museum, Norwich
 1927 Lister Dr. S. R., Terrington Lodge, King's Lynn
 1921 Lucas Baroness, Horsey Hall, Norfolk

Elected.

- 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
 1925 Lloyd Mrs., Taverham Mill, 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
 1928 Lotbinière Mrs. Joly de, Brandon Hall, Suffolk
 1925 Luddington Miss, Wallington Hall, King's Lynn

M

- 1924 MacKenzie Miss G., The Cottage, Ingworth, Norwich
 1923 *Maepheron A. Holte, 21, Campden Hill Square, Kensington, W.8
 1905 Mann Sir Edward, Bart., Thelveton Hall, Norfolk
 1906 Marriott F. W. P., 11, Queen Street, Norwich
 1892 Marsham Major H. S., Rippon Hall, Marsham, Norfolk
 1912 Mason A., Bank Plain, Norwich
 1911 Master George, M.D., Bury St. Edmunds
 1926 Matthews H. Whitlingham
 1893 Mayfield A., F.L.S., Mendlesham, Stowmarket
 1926 McCall C. Home, Upper Flat, San José, Mount Rd., Hastings
 1922 McKenna Mrs. Reginald, 36, Smith Square, Westminster, S.W. 1.
 1926 McLean Colin, Humbletoft, East Dereham
 1926 Meade Miss P., Croxton, Thetford
 1898 Meade-Waldo Edmund G. B., Stonewall Park, Edenbridge, Kent
 1928 Mileham J., Aylsham, Norwich
 1928 Mileham Mrs., Aylsham, Norwich
 1877 Miller Henry, Bosmere House, Norwich Road, Ipswich
 1923 Minns Mrs. E., Hammond's Wood, Frensham, Surrey
 1923 Moppe Lewis E. van, Cliffside, Overstrand
 1928 Morel Mrs., Burnley Hall, Martham, Norfolk
 1929 Morley C., Monk's Soham House, near Framlingham, Suffolk
 1924 Mortimer Ernest, The Red House, Wrentham, Suffolk
 1922 Mountfield Miss M., 29, The Close, Norwich
 1919 Moxey Llewellyn, Framingham Hall, Norwich
 1920 *Mullens Major W. H., Westfield Place, Battle, Sussex
 1921 *Murton Mrs., Cranbrook Lodge, Kent

N

- 1904 Napier A. J., *Hon Mem.*, Braes, St. Mawes, Cornwall
 1926 Nash J. E., 93, Priory Park Road, Kilburn, N.W. 6
 1922 Nevill Rev. R. W., Old Catton Vicarage, Norwich
 1926 Nevill Mrs. R. W. " " " "
 1925 Neville Sir R. J. N., M.P., Sloley Hall, Norfolk
 1911 Newman L. F., St. Catherine's College, Cambridge
 1889 Nicholson W. A., *Hon. Mem.*, 5. Mill Hill Road, Norwich
 1915 Nightingale S. R., Scratby Hall, Great Yarmouth
 1926 Norfolk and Norwich Library, Norwich
 1919 Norgate Philip, Swanington, Norfolk
 1915 Norwich Public Library
 1927 Notcutt R. F., Woodbridge

Elected.

O

- 1927 O'Donnell O., Great Fransham, East Dereham
 1921 Offord Miss Georgina, "The Larks," Water Lane, Costessey
 1914 Oliver F. W., D.Sc., F.R.S., *Hon. Mem.*, *I.P.*, Blakeney Point,
 Morston, Blakeney
 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 Rectory, Norfolk
 1919 *Palmer Mrs. P. Hurry, "Red Roofs," North Drive, Great
 Yarmouth
 1926 Pank A. H., Bedford Street, Norwich
 1912 Parker H., 10, Aspland Road, Norwich
 1925 Parker Miss Molly Hyde, Smeetham Hall, Sudbury, Suffolk
 1921 Parker R. E., Marlingford, Norwich
 1883 *Parkin Thomas, M.A., F.Z.S., High Wickham, Hastings
 1873 Partridge Rev. W. H., M.A., "Breccles," Sandown, I. of W.
 1889 Patterson Arthur H., *Hon. Mem.*, Ibis House, Lichfield
 Road, Gt. Yarmouth
 1920 Patteson Mrs. F. E., Great Hautbois House, Norfolk
 1901 *Paul J. J. Dawson, Eaton Grove, Norwich
 1911 *Payler Donald, The Museum, Birmingham
 1923 Peed John, Aylsham
 1928 Penrose F. G., M.D., "Woodbury," 9, Grove Road, East Cliff,
 Bournemouth
 1926 Percy Lord William, Catfield Hall, Norwich
 1903 Petre Col. B., Westwick Hall, Norfolk
 1925 Petrie Mrs., The Dower House, Heydon, Norwich
 1926 Phillippo G., 7, St. Philip's Road, Norwich
 1925 Pilch R. G., 45, Grosvenor Road, Norwich
 1923 Pope Dr. G. Stevens, Heigham Hall, Norwich
 1880 Preston A. W., F.R.Met.Soc., 371, Unthank Road, Norwich
 1919 Preston Sir E., Bart., Beeston Hall, Norwich
 1900 Preston F., 66, The Close, Norwich
 1913 Purdy T. W., Woodgate, Aylsham
 1925 Purnell Mrs. Ralph, 9, The Crescent, Norwich
 1925 Purnell Ralph, 9, The Crescent, Norwich
 1887 Pycraft W. P., A.L.S., F.Z.S., British Museum (Natural History).
 London, S.W.

R

- 1929 Ramage H. P., Ridgemont, Carrow Hill, Norwich
 1928 Raywood W., 13, Upper King Street, Norwich
 1925 Reeves Hugh, Honingham Hall, Norwich
 1924 Richmond H. W., F.R.S., King's College, Cambridge
 1925 Ringrose B., Farley, Harbridge Green, Ringwood, Hants.
 1924 Rippingall Neale F., Crabbe, Weighton S.O., Norfolk
 1911 Rising A. P., The Manor House, Ormesby, Great Yarmouth
 1908 Riviere B. B., F.R.C.S., F.Z.S., M.B.O.U., Hill House,
 Saxlingham, Norwich
 1869 o.m. Robinson H. S., Mundesley, Norfolk
 1908 Rogers Commander F. S., R.N., Ingham New Hall, Norwich
 1909 Rogers Rev. Henry, Coltishall Hall, Norwich
 1908 *Rothermere Rt. Hon. Lord, Hemsted Park, Cranbrook, Kent
 1897 *Rothschild Rt. Hon. Lord, F.Z.S., Tring, Herts.
 1922 Rounce G. H., The Pines, Park Road, Cromer

Elected

- 1918 Rudd A. J., F.Z.S., Queen Street, Norwich
 1902 *Ruggles-Brice Mrs. R., Keswick Hall, Norwich
 1906 Rumbelow P. E., 27, Rodney Road, Great Yarmouth

S

- 1929 Sainty Miss O., 38, College Road, Norwich
 1925 Sewell P. E., Dudwick House, Buxton, Norwich
 1925 Sexton K. F., 156, Newmarket Road, Norwich
 1929 Shaw A., Bixley, Norwich
 1922 Shepherd Dr. Samuel, Aylsham
 1924 Shepherd Miss A. M., Convalescent Home, Lowestoft
 1921 Silcock Chas., Decoy Cottage, Hoveton, Norwich
 1926 Slater, B. M., "Bassenhill," Corton, Lowestoft
 1919 Smith Col. H. F., Didlington Hall, Norfolk
 1915 Smith Mrs., Ellingham Hall, Bungay
 1891 Smith W. R., Harleston, Norfolk
 1917 Sowels Miss, The Rookery, Thetford
 1922 Spalding G., 9, St Stephen's Street, Norwich
 1911 Spurrell J. T., Manor House, Newton St. Faiths, Norwich
 1923 Spurrell Miss M., Manor House, Newton St. Faith's, Norwich
 1923 Spurrell Miss P., Manor House, Newton St. Faith's, Norwich
 1925 Steers J. A., St. Catharine's College, Cambridge
 1921 Stimpson Edward, Sall Moor Hall, Reepham, Norfolk
 1927 Stourton Hon. J., Cawston Manor, Norwich
 1922 Sumpter Dr. B. G., Brancaster Staithe, King's Lynn
 1896 Sutton W. Lincoln, F.I.C., Eaton, Norwich

T

- 1921 Taylor Dr. Mark R., 338, Winchester Road, Southampton
 1878 Taylor Shephard T., M.B., The Mount, Edgefield, Melton
 Constable
 1921 Thain D., West Somerton, Norfolk
 1886 Thouless H. J., "Southernhay," Wroxham
 1924 Thursby-Pelham Miss D., Fisheries Laboratory, Lowestoft
 1929 Tillett Miss I., 2, Claremont Road, Norwich
 1896 Tillett Wilfrid S., 2, Claremont Road, Norwich
 1920 Todd Lt.-Col. Eardley, Mundham House, Brooke
 1902 Todd R. A., B.Sc., The Retreat, Elburton, Plymouth
 1923 Tomes Lady, Mannington Hall, Norfolk
 1910 Tracy N., 3 King Street, King's Lynn
 1925 Tucker B. W., 9, Marston Ferry Road, Oxford
 1906 Turner Miss E. L., F.L.S., H.M.B.O.U., *Hon. Mem.*, 13, Storey's
 Way Cambridge
 1927 Turner Edgar, "Kuruman," Walberswick

U

- 1923 Upcher Rev. E. C. S., Great Dunham Rectory, Norfolk
 1921 Upcher H. E. S., The Gables, Upper Sheringham

V

- 1917 Vincent James, Hickling, Norfolk

W

- 1921 Wallis Rev. M. C.,
 1923 Walter Mrs. Cyril, Old House, Drayton, Norwich
 1921 Walton Miss, 17, Camberley Road, Norwich

Elected

1923	Waterfield Miss, Attlebridge, Norfolk
1923	Waterfield Miss Penelope, Attlebridge, Norfolk
1928	Watson J. B., c/o Barclays Bank Ltd., Surbiton, Surrey
1926	Wemys Major, " Bryn coed," Wroxham
1927	Wemys Mrs. " "
1923	Wenn Miss, Ingham, Norfolk
1883	*Whitaker Joseph, F.Z.S., Rainworth Lodge, Mansfield
1928	Whitwell Miss, 1, Cambridge Street, Norwich
1922	Willetts W. L., Paddock Wood, Kent
1913	Williams Miss Margaret, 28, The Close, Norwich
1929	Wilson Mrs. Gerald, Saxlingham Nethergate, Norwich
1909	Witherby H. F., M.B.E., F.Z.S., <i>President</i> , 326, High Holborn, W.C
1924	Wolsey Noel G., 15, King Street, Great Yarmouth
1928	Wood M. S., M.D., Woodland House, Windermere
1923	Woolsey G. E. W., Old Catton, Norwich
1907	Wormald Hugh, M.B.O.U., Heathfield, East Dereham
1922	Wortley Francis, " Seathwaite," Sheringham
1929	Wortley Roger, " Seathwaite," Sheringham
1924	Wright B. D. Z., Hoveton St. John, Norwich
1920	Wyllys Hugh, " Shrublands," Southtown, Great Yarmouth

Y

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

TOTAL

Honorary Members	...	...	4
Life	"	...	29
Ordinary	"	...	368
			401

The Treasurer in Account with the Norfolk and Norwich Naturalists' Society, Year Ending April, 1929

I. GENERAL ACCOUNT

1928-29.				XV			
Dr.				Cr.			
	£	s.	d.		£	s.	d.
To Balance on Current Account	80	0	11	By "Transactions," Vol. xii., Part iv.,...	...	...	...
" " Deposit	22	5	3	" W.B.P.F. Re-fund of two subscriptions	...	...	...
" Subscriptions ...	...	...	...	" Postages ...	...	...	...
" Sale of "Transactions" ...	...	...	...	" Printing ...	...	...	...
" " Flora of Norfolk " ...	...	...	...	" Book-binding ...	...	...	...
" Interest on War Stock ...	...	...	...	" Books ...	...	...	...
" " Deposit a/c ...	...	...	...	" Expenses of Meetings ...	...	...	...
" Publication Fund ...	...	...	...	" Fire Insurance ...	...	...	...
" Excursion Tickets ...	...	...	...	" Excursion Secretary... ..	...	...	...
" Book-binding Account over-paid and refunded	...	...	...	" Purchase of £75 4 per cent. Consolidated Stock	...	...	...
	...	...	...	" Balance on Current a/c	...	...	...
	...	...	...	" " Deposit a/c	...	...	...
	£301	8	10		£301	8	10

Examined and found Correct,
W. A. NICHOLSON,
June 14, 1929

1928-29.

III. LIFE MEMBERSHIP FUND

LIST OF INVESTMENTS AND ASSETS

£155 6s. 10d., 5 per cent. War Stock 1929-47, at cost	...	...	f s. d.
64 War Savings Certificates, dated 24.1.19	...	...	150 18 1
31 War Savings Certificates, dated 17.7.23, at cost	...	...	64 0 0
£191 1s. 10d., 4 per cent. Consolidated Stock, at cost	...	...	24 16 0
Balance in Savings Bank	...	...	166 9 7
			24 12 10
			£430 16 6

ADDRESS

Read by the President, H. F. WITHERBY, M.B.E., F.Z.S., M.B.O.U., Honorary Fellow American Ornithologists' Union, to the members of the Norfolk and Norwich Naturalists' Society, at their Sixtieth Annual Meeting, held at the Castle Museum on April 30th, 1929.

LADIES AND GENTLEMEN,

As my term of office as President terminates to-day I take this opportunity of expressing my regret that I have been unable to attend more of the meetings. These have been held monthly during the session, and, so I am informed, have been well attended. Valuable papers have been read, and these will be published in the next number of our Transactions.

Two Excursions were made during the year: one to Scolt Head Island, in July, in which about 60 members joined; the other, in August, to Keswick Hall, as the guests of Mr. Gerard Gurney, whom you have just elected as your new President.

As regards our membership, there has been a drop of four in our numbers, due to a heavy toll of death whereby we have lost the following, amongst whom were some of our oldest members:—

Dr. S. H. Burton
Mr. E. G. Buxton
Mr. G. F. Buxton
Mr. H. Donnison
Dr. Alexander Hill, F.R.S.
Sir Alfred Jodrell, Bart.
Mrs. Russwurm
Mr. Walter Rye
Mr. A. A. Shields
Mr. Edward Wild

It would be invidious for me to particularise among these honoured names, but I am sure I am voicing your feelings in saying that it is with deep regret that we have to record the loss of these members.

As to our financial position, I think this may be considered to be satisfactory. And in this connexion I would like the Society to record its appreciation of the valuable services rendered to us by Dr. Robert Gurney during the years (1915-28 inclusive) that he has undertaken the duties of

Honorary Treasurer of the Society. When he took over these duties in 1915 the invested funds of the Society amounted to £53; according to our last balance sheet they amounted to £361. I think this is good evidence of the care with which he has looked after and husbanded our resources, and we tender to him grateful thanks.

I will now proceed to read my address, which I have entitled,

A GUIDE TO SOME ORNITHOLOGICAL WORK

IN my capacity as editor of "British Birds" as well as in other connexions I have often been struck by the very casual nature of many observations. The would-be observer, however keen, frequently goes out with no definite objects and quite insufficiently prepared to take full advantage of what he chances to see. No doubt this applies chiefly to beginners, but there are many others, who, I feel sure, would be doing much more valuable work by applying themselves to some definite subject and making that the first object of their observations. It is with the idea of directing attention to subjects for observation and giving a wide field of choice that I have drawn up this "Guide." A second point which I have had in mind, which is especially applicable to a Natural History Society, is the question of co-operative observation. This method requires careful organization and direction and could achieve results not obtainable in any other way. It has such great possibilities that means to exploit it should be very carefully considered by every Naturalists' Society.

In compiling this "Guide" I have endeavoured to draw attention to all main points, but I do not of course claim that it is in any way complete. I have had the advantage of discussing the subject with several friends and desire to express my indebtedness especially to the Rev. F. C. R. Jourdain, Mr. E. M. Nicholson, Dr. A. Landsborough Thomson and Dr. B. B. Riviere for criticisms and suggestions. I should greatly appreciate any further advice from those interested in the subject on any of the points dealt with or on any matters omitted. To keep the paper within limits I have refrained as a rule from giving illustrative examples, while most of the questions raised are capable of being discussed in much greater detail.

To make the address easier for reference I have divided it into sections, the first of which concerns:—

DISTRIBUTION

Perhaps the first duty of a local natural history society is to study and record with exactness and in detail the distribution of the fauna and flora within its boundaries. Norfolk has for many years been fortunate in having a notable band of naturalists and has been well to the fore in this phase of study. Notwithstanding, there is still much work to be done under this heading so far as birds are concerned not only in Norfolk but everywhere. In recent years the best ornithological observations have undoubtedly increased in value by their quality, but owing to the greater number of observers and greater facilities for publication more indifferent observations are recorded. It cannot be too strongly impressed upon beginners that any observation to be of real value must be carried out with scrupulous care and exactness and in detail. Beginners seldom realize for instance, the great difficulties of correct identification of birds they have never seen before and they seldom take the trouble to prove their identification by noting down essential characteristics. Correct identification is the first essential in all observation and an uncertain identification is usually of small value. Notes written down on the spot are of the utmost importance. Practice and training are necessary for all kinds of observation, and a very good course to take would be to note the exact distribution and status of all the birds, both species and individuals, in a very small area. Such work has not been sufficiently done. I may point to a paper by H. G. and C. J. Alexander "On a Plan of mapping Migratory Birds in their nesting areas" (*Brit. Birds* II, p. 322) as an example. This plan of mapping could be adopted for the breeding species in a limited area, while careful notes could be taken of visitors at other seasons. Such exact and detailed records of distribution if combined with full notes on environmental conditions taken over a series of years are much required. They would lead us to a better knowledge of many important questions connected with Distribution in its broad sense.

We must not be content merely to discover and record the exact status of a bird. We must learn what relation birds have to each other and to all other animals ; which are dominant and which secondary species in a given area ; to what extent they are associated with a particular type of environment and what effect changes, whether natural or controlled by man, have upon them ; their density of numbers and the nature and extent of their fluctuations in relation to their environment ; the causes of irruptions ; the effects of climate and food supply whether animal or vegetable ; the meaning of the colonization of new areas and the desertion of old, and many other points which such an ecological enquiry suggests. While we know now a great deal about the distribution of species and subspecies in a general way, the study of distribution in relation to environment and all that implies is still in its infancy. Botanists have gone much farther in this direction than ornithologists and we have the advantage in this society of the experience of the admirable work done by Professor Oliver and his assistants on Blakeney Point. It would be possible for ornithological members with the help of fellow members specializing in other branches of natural science to take very small areas in different types of country and study them intensively. I would especially recommend as of great importance at the present time, an ecological study of the districts now being or about to be re-afforested in West Norfolk.

Such studies will undoubtedly throw much light on the whys and wherefores of the distribution and dispersal of birds and may lead us eventually to a better understanding of the processes of evolution and of the inter-relation between distribution and migration.

Another form of enquiry in connexion with distribution which will certainly lead to very valuable results, is to organize a census of one species over a wide area, as was done with considerable success last year through *British Birds* for the Heron, and as has been done in various counties for the Rook and Black-headed Gull. Although there are not very many species which can be dealt with by this method with any real hope of success, it may be possible in the future, with an increase in observers which we may hope for, to undertake more than seems likely now.

Besides periodical fluctuations there is little doubt that there are some species which are increasing while others are slowly disappearing in certain areas. If we had an accurate census of birds in Norfolk alone every 100 years we should probably be faced with some astonishing results. We get occasional glimpses of the truth from old lists of vermin, game and items for feasts and from other similar sources, but there are changes going on under our eyes which are not striking, and are not sufficiently recorded but are, nevertheless, important. Among examples in which more obvious changes are now going on may be mentioned Starling, Woodlark, Redstart, certain Ducks and Gulls, Fulmar Petrel, Corncrake and Blackgame.

Some References

- Brock, S. E. Ecological Relations of Bird-Distribution.
Brit. Birds VIII., p. 30.
- Alexander, H. G. A Practical Study of Bird Oecology.
id. VIII., p. 184.
- Thorpe, W. H. Some Ecological Aspects of British Ornithology, *id.* XIX., p. 106.
- Longstaff, T. G. Local Changes in Distribution. *Ibis* 1926, p. 637.
- Elton, Charles. Animal Ecology.
- Nicholson, E. M. How Birds Live, Chap. I and Appendix.

PHENOLOGY

The recording of the dates each year of certain recurring natural phenomena, such as the arrival of spring migrants and the flowering of plants, in relationship to each other and to the weather, should be taken up by those who are likely to be able to make the same set of observations year after year in the same place. The value of such records lies in their continuity, and we have in Norfolk a very notable example in the Phenological Record made by the Marsham family at Stratton Strawless and Rippon Hall, which except for two small gaps covers a period of over 190 years (see *Quarterly Journal of R. Meteorological Society*, January 1926).

MIGRATION

The study of Migration must always be of great interest to Norfolk ornithologists since the county's coast provides good observation stations. Many important observations have been made at Cley, Wells and other places during the past years, but I feel that more could be done and much of interest could be learnt if several observers were to work contemporaneously and systematically in a chain of stations.

It is impossible in this paper to do more than touch on some of the points connected with so large a subject as migration, and I will here deal with practical work rather than theoretical.

FIELD OBSERVATIONS.—Under this head important work could be done, as suggested by a chain of observers working at the same time on the same lines. Small, isolated areas should be taken and the birds counted two or three times a day to record movement. Directions of arrivals and departures, if possible, should be noted. Weather recorded. Song, call-notes, gregariousness, segregation of the sexes, and whether the young migrate with the old or separately (an important point and one upon which it is most difficult to make entirely satisfactory observations), and other habits noted. Observation at night is also difficult but should be undertaken when possible, especially at lighthouses and lightships. Specimens should be collected discriminately to ascertain subspecies, condition of body (amount of fat, etc.) and absence or presence of food, sex and especially age and the condition of the organs, state of moult (if any), and other points. Feet should be examined microscopically for adhering seeds, a point of great interest in connexion with the dispersal of plants. It is also, of course, essential to collect migrants if the species cannot be otherwise determined. An uncertain identification is of no real value. We should never have known that such birds as the Yellow-breasted Bunting ever occurred in this country had they not been collected, and we shall never know how often they occur unless we go on collecting. The occurrence of such so-called rarities has many points of interest and importance in the study of migration and distribution. In this connexion, as I informed the Committee before accepting the honour of being nominated as your President, I do not agree with the present wording of our "object" No. 3, which reads "the dis-

couragement of the practice of destroying the rarer species of birds that occasionally visit the County." This should be qualified so that it does not apply to discriminate collecting of birds on migration, such as buntings, pipits, warblers and certain waders which cannot otherwise be identified. On the other hand, it is scarcely necessary for me to point out that no ornithologist should countenance the wanton slaughter of conspicuous species such as the Spoonbill, Avocet, Golden Oriole and many other scarce migrants. Our first "object" is, quite rightly, "The Practical Study of Natural Science," and if that is to remain our first object it must be encouraged and not handicapped.

Besides coastal observations I need hardly mention that much useful work can be done by careful recording of movements inland and would point especially to the valuable data collected (especially in recent years) at Reservoirs, Sewage farms and other such places visited by migrants.

RINGING.—The accumulation of records of ringed birds has demonstrated the importance of this method as an auxiliary to migrational observations. I need not refer to the well known method of ringing nestling birds, but I should like to impress upon members the importance of systematic trapping as a means of ringing. If two or three trapping stations could be successfully worked at suitable points during the migration seasons for some years I am sure that very valuable results would eventually be obtained. To carry this out successfully would not be easy, but it is a task eminently suitable to a Society such as ours and could be carried out in conjunction with other migrational observations, such as I have indicated above, at the same stations. A small start could be made with two stations and say eight observers, two at each station for a fortnight each, and all working on a definite plan.

Systematic trapping and ringing may some day show whether individual migrants take the same routes each year and whether they winter in the same places. Some very valuable data has already been obtained in America on these points, but insufficient trapping has as yet been done here to yield results, and I sincerely hope that the members of this Society will seriously consider the possibilities of some such plan as I have suggested. Another plan for ringing specially

adapted for Norfolk would be to revive an old duck decoy or use an existing one for the purpose of ringing and releasing at least some of the ducks taken. The results already achieved by the ringing of ducks in various countries have been so important that could we find a decoy owner so generous as to allow some ringing to be undertaken, there is no doubt that valuable knowledge would be gained of the dispersal and movements of these interesting birds. If the use of a decoy is impossible perhaps some duck traps could be set up in suitable places.

THE ALTITUDE AND SPEED attained by birds during migration and at other times are important points which require a great deal more study. Very few definite facts are available. Special knowledge, apparatus and facilities are generally required to obtain accurate and incontestable information on these points, but some useful work could be done by comparatively simple means. For instance, data on the speed of migrants passing along the coast might be obtained by any two observers given a measured line, stop watches and a system of signals. It would be necessary, of course, to ascertain the speed and direction of the wind which are all important in determining air speed.

Although not necessarily connected with migration the relation between the weight of a bird, the area of its wing-span and the character of its flight may be mentioned here as a subject well worth the great labour which its investigation would involve.

OBSERVATIONS AT SEA are frequently made but often without sufficient data to give them their full value. The species seen, position of ship, time of sighting, weather and wind, behaviour of the birds, direction of flight, and so on, should be noted, and even if the exact species cannot be determined a number of small *Passeres* seen well out at sea is an observation worth noting with all relevant data.

Before closing my remarks on migrational observations I may mention work which has been recently done in the endeavour to discover the factors which cause birds to migrate at definite seasons. Such experiments as, for instance, those conducted by Professor W. Rowan (see "On Photoperiodism, Reproductive periodicity and the Annual Migrations of Birds

and Certain Fishes, Proc. Bost. Soc. N. Hist. Vol. 38, No. 6, pp. 147—189) have possibilities and should be persisted in and enlarged in various forms by those who have the necessary facilities and training to make such experiments.

I may also mention here experiments on the faculties of orientation and homing, which have some bearing on problems connected with migration. Our member Mr. B. B. Riviere has made valuable experiments on pigeons and a few noteworthy experiments have been made by marking wild birds, releasing them at various distances and recapturing them, and these are well worth pursuing.

Some Useful References

Clarke, W. Eagle, Studies in Bird Migration.

Lucanus, F. Von, Die Ratsel des Vogelzuges.

Thomson, A. Landsborough, Problems of Bird-Migration and references.

Lincoln, F. C., Traps for Bird Ringing, *Brit. Birds*, XXI. pp. 134—150.

Watson, J. B. and Lashley, K. S., Homing and Relative Activities in Birds. Carnegie Inst. Washington, 1915, Vol. VII.

Riviere, B. B., Homing Pigeons and Pigeon Racing, *Brit. Birds*, XVII. pp. 118—138 and The Homing Faculty in Pigeons, Verhand. des VI. Internat. Orn. Kongresses, pp. 535—555.

Lincoln, F. C., Returns from Banded Birds 1923 to 1926, Technical Bull. No. 32. U. S. Dept. Agriculture (numerous examples of migrants returning to same winter quarters, pp. 60—67).

SONG

There is still much to be learnt about the songs and notes of birds and this can only be accomplished by careful and methodical recording. A good "ear" (though not necessarily a musical ear), enabling one to remember and distinguish differences in pitch and phrasing, is essential for this work. A satisfactory method of rendering and recording songs and notes is a great difficulty. Perhaps a description in plain, but very exact, terms helped by a certain amount of translation into syllables, with the addition of a simple system of accents and notation signs, affords the best means of those yet designed.

The relation of song to breeding activities has been perhaps

best studied, but there are many other aspects of song to be enquired into. More records for instance are required of periods of song, both as regards day and night as well as months of the year, in different localities and under varied conditions. The relation of song to food-supply, weather conditions, moult, and the feeding of young, as well as its prevalence and character in the non-breeding season (whether of resident birds or of migrants) are subjects upon which much more information is required. The period and character of the song of immature birds, variations in song of the same species in different areas, and mimicry in song are all important studies to be undertaken only by those who have first obtained an intimate knowledge of normal song and individual variations. Other points which may be mentioned are song by females and the conditions under which this occurs; song during flight or in other positions unusual in the species concerned; special actions connected with song or certain call-notes (such as raising of crest, spreading of tail, and so on); notes uttered by nestlings at various ages; and the effect upon very young birds of their parents' call or alarm notes.

Apart from vocal notes other sounds mechanically produced by birds and their significance and exact method of production may perhaps be mentioned here, such as the drumming of Snipe and Woodpeckers.

Some References

Witchell, Charles A. The Evolution of Bird-Song.

Morris, Stanley. Bird-Song.

Howard, Eliot. The Warblers and some Problems in their Lives.

Alexander, C. J. and H. G. on Song-periods of Birds. *British B.*, I., 367, IV. 274.

Oldham, C. Paragraphs under "Field-characters" in A Practical Handbook of British Birds.

BREEDING HABITS

Although more observation and careful recording has been done in recent years in this section than perhaps in any other, the subject is so large and important that the work yet to be

done may be said to be unlimited. There are so many phases to be considered under breeding habits that it will be more convenient to treat these under subsections.

CHOICE OF MATES.—There are many problems yet to be solved in connection with this subject and this can only be done by very close observation, and careful recording of the facts observed.

Displays, nuptial flights, courting attitudes, mock fights and real fights and other such performances by birds are extremely fascinating to watch and have for long attracted much attention. but it is only in comparatively recent years that they have been studied intensively. There is still much more to be done before the exact significance of these performances can be determined. Many are of a complex nature and they often take place (perhaps in a modified form) at times and in circumstances, which do not seem to be directly concerned with pairing or breeding.

There are also many problems to be solved in connexion with polygamy and polyandry (both perhaps more frequent than at present realized); the changing of mates (see recent work by Burkitt on Robin and Baldwin on Wren by means of identification rings); pairing for life (is this an individual question or common to certain species?); the proportion of unmated birds and their influence on paired birds.

Another question of importance is, To what extent do birds become paired in their winter quarters or on migration before reaching breeding quarters? Further investigation is also needed regarding the influence which weather and changes of climate have upon pairing and breeding.

LAW OF TERRITORY.—Intimately connected with the choice of mates is the choice of territory, and indeed it is often impossible in the present state of our knowledge to say whether certain displays, actions or songs, have a basis which is mainly sexual or mainly territorial. Even if we do not accept Mr. Eliot Howard's "Law of territory" in its entirety, its conception has opened up a most important and fascinating field for observation. In this connexion not only the actions of birds of the same or allied species must be noted, but the exact distance apart of nests, and the range of each pair in search of food in relation to local conditions are among the points on which many more observations are required.

NESTING SITES AND NESTS.—The share of the sexes in the choice of the nesting site, building of the nest, incubation and tending of the young is still uncertain or unknown in many species. It is also important to observe in those cases where only one of a pair actually builds the nest, or incubates or tends the young, the actions of the other bird whether it assists in any way or not. Variations of site are valuable to record especially in connexion with local conditions, and adaptations to altered conditions. The structure of the nest and the materials used still require more observation, while the exact method of building is seldom observed throughout in detail. Communal nesting as well as combined nests, and the inter-relationship of the birds so breeding call for more observation, as do the curious cases of multiple nests. The construction and use of "cocks' nests" is a subject that will repay further investigation, and the same may be said for nests made for the use of young and for roosting.

The return of the same birds to the same nesting site has been proved in a good many cases by ringing, but there are few facts concerning changes of nesting site by individuals. Incontrovertible facts of the kind concerning the doings of individuals are of great value. More difficult, but equally important, are observations on the occupation of certain apparently favourable sites by birds which can be proved to be different individuals of the same species.

EGGS.—Large series of observations from different localities are required on the variation in the number of eggs in the full clutch of various species before the influence of latitude, locality, climate, food-supply and so on can be determined. More information is also required as to the dates at which birds lay under varying local and climatic conditions. Other points connected with eggs which may be mentioned as requiring further study are their size and weight in relation to specific as well as to geographical variation; their weight at various stages of incubation; the inheritance of colour pattern, which might be determined in some cases (e.g. Guillemot) by systematic ringing.

INCUBATION AND YOUNG.—Much information has been collected in recent years regarding incubation and fledging periods, but much more is needed, and perhaps more than

ordinary care should be taken in such observations. Mr. Jourdain gives me the following points as essential to note in observations of incubation periods:—First of all the intervals between laying must be ascertained. Then the time at which steady incubation begins must be noted. Also whether the bird broods at night, before seriously incubating. Of course, one definite observation is really insufficient; the mean of a good many from different localities is very desirable. It is a very good plan to mark the eggs as laid; in fact this is most necessary when incubation begins before the set is complete to avoid uncertainty due to some eggs being added. Care, however, must be taken to see that handling of the eggs does not cause temporary desertion and affect the normal incubation period. Further difficulties arise when the eggs begin to chip. This should be noted but emergence is the date required for incubation period.

Methods of feeding, carrying of the food, regurgitation, distance from which the food is brought, frequency and times of feeding besides the actual food given, sanitation and brooding are among points to observe in connexion with the care of the young. Besides the behaviour of the old birds to their young, the behaviour of the young to each other should also be observed. The growth of nestlings and their weights under varying conditions would make a valuable study, while the various stages of their plumages and colouring and growth of their soft parts are points upon which much more exact information is required.

The number of young successfully reared by individuals and species in different seasons and places, and the causes and proportion of mortality are exceedingly interesting questions, about which we know practically nothing, owing to the difficulty of making reliable observations, but close watching of particular broods, combined with ringing, might teach us more on these points. The number of broods hatched or reared by different species in different districts also requires further observation, especially in relation to local conditions such as climate, abundance or scarcity of food and so on. In this connexion care must be taken to differentiate between bona-fide cases of second or third broods and birds breeding again after the destruction or desertion of their eggs or young.

Different methods of protecting the young and the nest adopted by different species and the varying strength of the maternal instinct in various individuals and species is a subject which requires more systematic observation. Other matters connected with young birds which should be studied are habits and actions special to their age (such as means of concealment or escape, locomotion, song, feeding). The study of young birds just fledged may also give clues to the origin of impulses, which later become important—e.g., jealousy of territory, song, etc. Such actions in quite young birds are simplified and can be studied with a view to throwing light on the complex behaviour of older birds, which is so much more difficult to analyse. Further points in connexion with young birds are their transportation by the parents and the part the latter take in educating and maintaining the young after they leave the nest as well as their behaviour to the young when full grown, and, for instance, cases of earlier broods helping to bring up later ones.

PARASITISM.—The only example of complete breeding parasitism in this country is the Common Cuckoo, and notwithstanding the great attention which has been paid to it in recent years and the great advance which has been made in our knowledge of its habits, there is still much to be observed. The subject is one of great biological interest and importance and a few of the points to which special attention may be directed are as follow :—methods of depositing the egg in the nests of various species ; period of laying season and number of eggs ; normal fosterers in a district and the resemblance or dissimilarity of the Cuckoos' eggs to those of the fosterers ; the acceptance of the egg and hatching and rearing of the young by the fosterer ; or its rejection by desertion, building over or other means ; damage to covered nests by the Cuckoo and its result ; the destruction of eggs or young of intended fosterers ; results of the hatching of two or more Cuckoos' eggs in the same nest ; territory ; number of males to a female. All these points are obviously difficult of observation and knowledge of them can only be obtained gradually and laboriously.

Besides parasitic feeding habits such as those of the Skuas and less obvious and more complex examples, cases of partial-parasitism may be here mentioned as worthy of attention,

such as the use of old nests of other species, the dispossession of one bird by another of nest or nesting site, and the laying of eggs in other birds' nests.

Some References

Thomson, J. A., *The Biology of Birds*.

Selous, E. and Huxley, J. S., various papers on Displays, Courtship Habits, and sexual life of Birds.

Howard, H. Eliot, *Territory in Bird Life*.

Jourdain, F. C. R., Paragraphs under "Breeding Habits" in *A Practical Handbook of British Birds*.

Kirkman, F. B. and others, *The British Bird Book*.

Baker, E. C. Stuart, *Cuckoos' Eggs and Evolution*, Proc. Zool. Soc., 1923.

Chance, E., *The Cuckoo's Secret*.

Jourdain, F. C. R., *A Study on Parasitism in the Cuckoos*, Proc. Zool Soc., 1925.

DISPERSAL AND HABITS OF YOUNG

Intimately connected with both distribution and migration are the habits of the young after they are fledged. How they form flocks or become dispersed, whether they migrate alone or accompanied by adults, whether they spread into new areas or return to breed in the place of their birth, are all questions of which we have some knowledge, but concerning which we want many more observations. On some of these points valuable facts are gradually being accumulated by the records of ringed birds, and there is no doubt that much more could be learned if those who ring young in the nest would combine this with trapping in the same area. There seems little doubt that different rules govern different species in the dispersal of the young. Ringing has given us an inkling that, for instance in some of the ducks, the young disperse very widely. This habit may be confined to a few species or it may be more or less an individual question, the known facts are too few to enable us to say. In the same way we do know that young birds sometimes migrate differently from old ones, but a great deal more observation is required on this point and we do not know how this may affect their dispersal. In the case of partially migratory species such as Lapwing, Song-Thrush and

many others, we do not know why some individuals migrate and others stay at home, nor whether the act of migration has any effect on the distribution of the young in future breeding seasons. Much less do we know if this habit is hereditary and constant or irregular. Systematic and continued trapping as well as ringing of the nestlings should in time give us valuable facts on these points. Here I must mention that it is important that ringers should record invariably which ringed birds are members of the same brood. In some cases of migrants, such as the Pied Flycatcher, we do not really know what are their movements after leaving the nest and before actual migration. Besides the dispersal of the very young, the distribution of the immature non-breeding birds requires further study and I shall revert to some points regarding this under the next section.

NON-BREEDING HABITS

There is much to be observed outside the breeding season and in non-breeding birds. Flocking habits should be studied in their various aspects, e.g., the formation and disbandment of flocks in birds which breed separately, or their alteration in communal breeding species ; the association of different species, or of different forms of the same species ; their relations to each other ; the segregation of sexes ; feeding habits of the flock ; daily movements and roosting habits ; the flight of the flock and the unexplained unison of movement, and many such questions.

The varying density of species in the same area in summer and winter and its relation to food supply or other environmental factors are points in which little systematic work has yet been done. The effect of climatic changes as well as of other environmental changes, whether in the breeding season or not, on various species in various localities has been referred to under distribution, but may be mentioned again here owing to the importance of such investigations.

There are many other subjects for study in winter (as well as summer) such as flight ; diving ; the senses of smell and taste ; sleeping places ; diseases ; mortality and ages to which birds live ; autumn and winter song and display ; breaking up of flock into pairs ; and the return of migrants.

A very important point which may be dealt with under this section is the age at which birds breed. Concerning this subject we have very little real evidence. It is certain that this often does not depend upon the assumption of the mature plumage (e.g., many hawks breed in an immature plumage), that it varies largely in different species and probably considerably in different individuals, while the influence of climate, food supply and other varying local conditions is unknown. The study of a non-breeding bird on an exact basis is difficult because, even after having discovered for certain that it is not breeding, the age of the bird can often not be ascertained, and there may be many reasons other than immaturity for its not breeding, as for instance sterility or inability to get a mate or suitable territory, or the loss of a mate. There is certainly a great deal to be learned about non-breeding birds and their migrations and movements, as well as their habits at all seasons and their influence on breeding birds, and all these points require special study.

A subject for investigation which may be referred to under this section is the mentality of birds. This requires very careful study, and to present a true picture of the bird's actions and their meaning the observer must be entirely unbiassed and free from any anthropomorphic suggestions in interpreting the behaviour observed.

Food

Most of the systematic work which has been done on the food of birds has been undertaken primarily from the economic point of view. This is a very important side of the question, and, notwithstanding Dr. Collinge's great individual effort, much further exact knowledge, drawn from a wider field, is required on the nature of the food of birds in this country before the real economic status of a species under varying local conditions can be ascertained. Moreover, such work should be continuous since changes in environmental conditions, numbers and food-habits are constantly occurring. I may mention without discussion that the merits of the volumetric and other systems of estimating economic value form a suitable subject for further investigation. In any case it would seem that an economic verdict cannot be based purely on stomach

contents by whatever method they are analyzed, and some working procedure for giving due weight to observational data in the case of rapidly digested food is certainly needed. Rate of digestion ; total consumption ; diet in relation to numbers, to quantity of available food and to competitive species must also be investigated.

The scientific aspects of the food and feeding habits of birds are of very great importance and there is here a big field awaiting exploration. It is of primary importance to ascertain the exact food taken by a species at different seasons and in different areas. Dr. Collinge has given us a basis for this, but I would point out that co-ordinated work with scientists abroad upon species of wide distribution is of great importance and has hardly been touched yet. Arising out of such knowledge a number of interesting investigations suggest themselves. For instance, what is the effect of weather on food supply? How does this affect the periods at which birds breed? What effect does food supply have upon fecundity, and what relation has it to the colonization of new areas or the desertion of occupied areas, and to increases and decreases in species? Conversely, to what extent are increases or decreases a factor in altering food-habits?

Intimately connected with these larger questions are more detailed points such as the range of different species of birds in search of food, not only in the breeding season when a return to the young with food at certain intervals is necessary, but also at other seasons where this controlling factor is absent. Other subjects for study are methods of searching for, and taking and eating, food, as well as carrying and storing it. Differences in feed and feeding habits at different times of year in the same species are also important. The exact methods used by different species in feeding the young have also been insufficiently studied. Other points connected with food requiring more experimental treatment are the ejection of pellets and gizzard linings and the possibility of change of food causing modifications in structure or diseases.

As food is of primary importance to the life of the bird and is necessarily interrelated with most of its activities it is rather strange that the subject has not been more widely and intensively studied in all its bearings.

Some References

- Collinge, Walter E., The Food of some British Wild Birds. 2nd Edition—see also Bibliography given here.
- St. Clair Thompson, G.W., The Protection of Woodlands.
- Jourdain, F. C. R., Paragraphs under Food in A Practical Handbook of British Birds.
- Henderson, J., The Practical Value of Birds. (An American view).

AVICULTURE

Many bird-lovers devote their main energies to keeping birds in captivity. This is generally done merely as a pleasurable hobby, and I wish to appeal to aviculturists to make use of their experience of how to keep birds successfully in captivity by carrying out experiments and observations which would be of value scientifically. There are many possible subjects for enquiry from which the scientifically inclined aviculturist could choose according to his or her inclination and resources. I need only mention a few in order to show that the field for research is large, and I think I am justified in saying that the number of aviculturists who have occupied it is disappointingly small in comparison with the large number who keep birds in captivity merely to please themselves.

I may mention first one simple case of supposed dimorphism which could be proved directly and conclusively by aviculturists. I refer to the Black-throated and Black-eared Wheatears (*Oenanthe hispanica*) both of which have occurred in the British Islands and breed commonly as near to us as in Spain.

The majority of ornithologists have for some time considered these birds to be dimorphisms of the same species but this conclusion rests on circumstantial evidence. It is high time that some aviculturist went to Spain and having obtained broods of these birds proceeded to rear and keep them until they attained their first winter plumage. I need hardly say that it would be a highly necessary part of the experiment to collect and preserve the parent birds of each brood and ring or otherwise carefully mark the young so that they could be permanently identified as belonging to a certain brood of certain parents. The proof of dimorphism, would lie in some of the young being different from the parents or different from others of the brood and this would be apparent in the males

when they moulted from juvenile to first winter plumage. I have drawn attention to this case in some detail in the hope that aviculturists will no longer neglect the obvious duty of providing proof of the correctness or otherwise of the present view.

Most valuable work can be done by observing the breeding and other habits of birds kept in captivity under conditions approaching as nearly as possible those in nature. Courtship and display can be studied under favourable conditions; incubation periods can be readily ascertained as well as the share of the sexes in building, incubation and tending the young. Such observations must of course be checked by watching wild birds, but they are specially valuable in species where the sexes are indistinguishable by plumage. In such cases the sexes could be ascertained for certain by watching a pair in captivity and one of the birds could be marked.

Among other important subjects suitable for investigation by aviculturists I may mention studies connected with mentality, instinct and cognate subjects. The plumages and other characteristics peculiar to nestlings are also very suitable for study in captive birds. The breeding of hybrids, Mendelian variations and other experiments which may throw light on the processes of evolution is an important and skilled branch. The varied effects of light, cold, heat, dryness and humidity as well as diet, provide for investigation an almost unlimited number of subjects of the highest importance. Under this head I may also perhaps refer to Pathological research as a subject of eminent importance to be undertaken by medical aviculturists.

As aviculturists have been mainly responsible for introductions of birds I shall state here my conviction that all introductions of aliens to any area are fraught with the greatest danger to indigenous species. It is perhaps only in comparatively recent years that we have begun to appreciate how delicate is the natural balance and how easily it may be upset by the introduction of aliens, which for some unascertained reasons may flourish exceedingly and at the expense of indigenous species.

Some References

Heinroth, Dr. O. and Frau M., *Die Vogel Mitteleuropas*.

Morgan, C. Lloyd, *Habits and Instinct*.

Beebe, C. William, *Geographic Variations in Birds* with especial reference to Humidity, *Zoologia* Vol. I., No. 1, 1907.

PROTECTION

It would be impossible to deal with this subject in its general aspects here, and I will content myself by saying that of the three main points of view—the scientific, the economic and the æsthetic, the first two are of the greatest importance while all require special study. Unfortunately many of those who busy themselves over this subject have regard for only one or other of these points of view and have no real knowledge of the others.

Protection under a Society of Naturalists should be based on scientific grounds, and although economical, and to a certain extent æsthetic and sentimental, considerations must be studied and considered, these should be entirely subservient to the main scientific aspects if we are to avoid a course of action which may result in a mere glorified poultry farming. The protection of really rare species which breed and have bred in any area is by far the most important work from the scientific point of view. If a species is in danger of becoming so scarce in any given area that interference of any sort is likely to affect its natural status as a breeding species in that area, then it becomes a necessary scientific act to prevent so far as possible any such interference. In some cases this can be done best no doubt by the provision of sanctuaries or reserves which are known to be suitable to such species. Such reserves if owned and managed entirely by a scientific society could perhaps serve a double purpose. Besides the fostering of the rare breeding birds and subject to this object, advantage could be taken of the control of such areas by conducting within them properly organized experiments and observations of such kinds as were possible to the society concerned and were without risk of disturbance to the rare species. Reserves used in this way could be made of great scientific importance not only on account of their rare breeding birds, but also because of the researches carried out in them. Moreover, such work properly controlled by experienced leaders would be of the greatest possible advantage as a training for beginners.

We have in this county an organisation—the Norfolk Naturalists Trust, which I suggest could be developed to meet the requirements outlined above, should the directors of the Trust look favourably on such a scheme.

COLLECTING.—Under the head of Protection it may not be out of place to say a word or two about collecting. In my opinion all collecting of natural objects should be done with a view to advancing our knowledge of those objects. Every specimen so collected should be made full use of, and I may say in passing that unless such specimens are properly collected and preserved with essential data they cannot be made properly useful scientifically. It is impossible to regard as an ornithologist the man who collects birds or eggs merely because they are beautiful or because they are rare in a particular area (e.g. the British Islands), or indeed for any reason which has no scientific basis. Such a collector is anathema to our science and should be treated as such. If this were made clear more widely the very important and highly necessary work of discriminate collecting for scientific purposes would be greatly strengthened especially among the younger generation. Some latitude must be given to beginners who cannot of course be expected to collect in every way correctly. But they should be educated to do so rather than educated not to collect at all. It must be remembered that collecting provides an undoubted stimulus in many cases to subsequent serious study, and it seems to me of great importance to the future of ornithology that this stimulus should be maintained, and that no risk should be run of diverting the interests of a potential ornithologist to other fields by stifling a keen desire to collect.

STRUCTURE AND CLASSIFICATION

Every ornithologist should know something of the anatomy and physiology of birds and it would be an excellent training for a beginner, who had the time and opportunity, to take a course on the subject. An enormous amount of work has been done in recent years in systematic ornithology, but this has been largely confined to the study of the external features of species and subspecies. A still greater work remains for the laboratory and museum worker. Comparative

anatomy, physiology, embryology, palæontology, pterylosis, feather structure, moults and sequences of plumages are among the subjects in which comparatively little work has been done, and it is amongst these that those who desire to specialize in laboratory work should choose. All these subjects are highly technical and are work for specialists and all I can do here is to point out in a general way the direction which should be taken by those who have the desire and ability to embark in work of this character.

DRAWING AND PHOTOGRAPHY

I have left these subjects to the end because they can only be regarded as adjuncts and, however valuable as part of an educational or recording system, cannot otherwise be regarded in a review of ornithological work. Let me advise those with ornithological leanings so to regard and use them. To be more explicit I would say that an ornithologist should not be concerned with the taking of a picture as such, but should use his camera, his cinematograph, or his pencil to record definite facts. Unfortunately, it is more usual, though by no means invariable, for those who use a camera to think firstly of the photograph and only secondly of observation, but to become an ornithologist it is necessary to reverse this order.

CONCLUSION

In conclusion I would say that every exact first hand observation is of value, but this often only becomes apparent when many isolated observations on the same subject have been co-ordinated and worked up to show their significance. For this we want specialists and I would appeal to my audience to take up some definite line and specialize. It should be possible in the future to have acknowledged specialists in all branches of observation, who would collect published and unpublished notes on the particular subject on which they specialize and publish from time to time co-ordinated papers giving the results, showing the progress that had been made, and pointing out the nature of the observations still required.

II

THE FRESH-WATER CRUSTACEA OF NORFOLK

BY ROBERT GURNEY, D.Sc.

CONTENTS

	PAGE
The physical features of the Broads and their effect on the fauna	551
The Plankton	556
Littoral and bottom-living Crustacea	560
The fauna of brackish water and the tidal region ...	562
Additional records for the County outside the Broadland	568
Heaths and spring waters	569
The Meres and Breckland	569
East Ruston Common	571
Westwick Perch Pond	572
Subterranean Crustacea	573
List of Additions	573
Appendix I. Water analyses	575
Appendix II. Examples of Crustacean fauna of special localities	576

IN two papers published in these Transactions I have given some account of the Crustacea of the Broads and rivers of East Norfolk (², ³). During 1903 and 1904 about 900 collections were examined, and the total is now probably about 2,000, the result being that the mass of notes has grown to indigestible proportions. I do not propose to inflict on any reader a detailed account of the results, but, since I shall not now be able to carry the work any further, the time seems to have come to offer as general a survey as possible of the Crustacean fauna in the light of present knowledge. I am well aware that much remains to be done. A large part of my work, indeed most of it, has been rather of the nature of a preliminary survey. Problems remain for solution which the exigency of this survey work prevented me from attacking.

I shall deal first with the area of the Broads, an area which, in its physical features and past history, is of quite exceptional interest.

BRITISH
MUSEUM
25 FEB 30
NATURAL
HISTORY



LEGEND.—Map of East Norfolk showing rivers and valleys. The dotted area is 10 feet or more above Ordnance Datum

THE PHYSICAL FEATURES OF THE BROADS AND THEIR
EFFECT ON THE PLANKTON AND THE CRUSTACEA

The nature of the fresh-water fauna of any area depends largely upon the chemical constituents of the water, and that in turn upon the geological history and present relief of the land. Norfolk as a whole is founded on the chalk, which is at the surface at Norwich, but dips so rapidly to the east that it cannot directly influence the surface waters in the region in question, except in the Yare valley to some small extent. Above the chalk is the Crag, consisting of deposits of sand or gravel often impregnated with iron oxide ; but these deposits are not very extensive and are not as a rule at the surface in the immediate neighbourhood of the broads. They no doubt influence the nature of the deeper waters,* but probably only to a very slight extent those of the surface. Overlying all, however, is the great sheet of glacial drift, comprising gravels and clays of varying quality, and these directly determine the qualities of the waters, and to some extent the components of the fauna and flora. According to the views of Mr. F. W. Harmer, this drift is of two sources, namely the North Sea drift, and the Chalky Boulder Clay. The two sheets are supposed to meet and overlap roughly along a line between Norwich and Winterton, dividing the Broadland into north and south halves. There is, however, no very material difference between the two for our purposes. In both cases the glaciers ploughed their way over country where chalk was exposed, and in both cases the drift forms rich arable land. The drainage waters will then be always relatively hard and, owing to the large areas of highly cultivated land, will tend to be exceptionally rich in dissolved salts and organic matter. The water is, therefore, neutral or alkaline. A rather striking indication of its alkalinity is the almost complete absence of erosion of molluscan shells. Old shells of *Anodonta* may be dredged up almost everywhere, and are generally in perfect condition. In the Friesland Meres, on the other hand, an area which has some resemblance to Broadland, erosion is very rapid and even living shells may have the umbones quite perforated. Old dead shells are always greatly eroded.

* See Appendix I. 1.

On the other hand the lime-content of the water is not very great and rarely, if ever, is lime seen to be deposited on the floor of marsh pools. A deposit of this kind, leading to the formation of a bed of marl, is sometimes seen outside the area, as at Flordon Common and Smallburgh Fen. The latter is within the drainage system of the river Ant, and the excess of carbonates is difficult to account for.

Taking, then, first the factor of surface drainage, the Broads will necessarily be designated as eutrophic waters according to modern terminology, offering optimum conditions for phytoplankton.

There is, however, another factor of the utmost importance to be considered, namely their relation to the sea. It is well known that in geologically very recent times the valleys of the Yare and Bure were occupied by inlets of the sea, and that these conditions persisted down to Roman times and even later. Perhaps the most convincing evidence for the existence of these great post-glacial estuaries is the abundance of shells of *Coekles* and *Scrobicularia* in the mud of the river bed, and presumably also beneath the marsh peat, in the river Ant at St. Benet's and in the Thurne River (4, 11). In 1875 a fine Bronze shield was found close to Sutton Broad buried beneath 7 feet of peat and lying on clean white sand (8). Close by were charred logs showing that this was a land surface on which a fire had been kindled. It has been suggested that the estuary extended even to this point, and the conditions must certainly have been very different from what they are now. The whole of this flat area has been artificially embanked and drained and, while much of it is below the level of even ordinary high tides, the greater part is below 10 feet above O.D. and pays a graded "Sea Breach" rate for defence against invasion by the sea. It is, in fact, defended from relapse to the old conditions, not by elevation of surface, but by embankment, and maintenance, by the Sea Breach Commission, of the coastal sand dunes. Until the Commission was formed breaches in the sand hills through which the sea flowed were frequent, and disastrous inundations are recorded down to recent times.

The Broads district is a great alluvial flat through which the rivers wind sluggishly with a fall of about two inches per mile. The whole region has undoubtedly sunk in level since the

glacial period and may be sinking now. Peat beds are exposed on the beach, and the sea covers at high tide peat and clay whereon birches and alders once grew. The Broads probably all occupy hollows in the boulder clay, and are concentrated in what one may call the middle region of the rivers, the upper region being that part of them where they run from the uplands, with relatively rapid current and in well-marked valleys. In the lower region they flow through wide flats built up of estuarine silt and noted for the high quality of their pasture. In the middle region, where the river has been embanked and the soil of the adjacent marsh is peat, the level of the marsh has fallen greatly since the embankment, owing to the long-continued drainage and consequent shrinkage of the peat. In such cases the marsh lies much below the level of the river. This is well seen along the river Ant.

These being the conditions, it is not surprising that the nature of the waters should be influenced both directly and indirectly by the sea, and it is certainly true that, throughout the region of the Bure valley, at all events, the water has a salinity rather more than normal. It is characteristic of the well waters of this district that they generally contain so high a proportion of salt that in many cases they would be condemned for drinking purposes if the source of the salt were not known. (See Appendix I., 5.)

Lying nearest to the sea are the Broads of Horsey, Hickling, Heigham Sounds and Martham, all these draining west by the Thurne river. Here the water is always of a definitely high, though variable, salinity, amounting sometimes to 78 grains per gallon. It is found that there is a salt-water table extending inland a few feet below the surface (¹³), and it is no doubt from this source that these Broads obtain their salt. Even Sutton and Barton Broads seem to be just within the range of its influence, since their water has a higher salinity than that of the upper Bure Broads.

The fauna is also influenced directly by the tide. Salt water usually flows up the river for about 8 miles, but the salinity is raised to a distance of about 12 miles—say to Acle Bridge (⁵, ⁶). Frequently—more often in summer than in winter—under the influence of northerly winds, the range of the tide is greatly increased and salt water may be driven up the river as far as

Horning. Conversely, but very rarely, the river may contain fresh water even down to Yarmouth. The effect of these high tides is traceable by analysis to a very great distance. For instance on March 12th, 1906, with a W.N.W. wind, the tide rose at Southtown Bridge to 9-ft. 9-in. (the normal height being about 5 feet), with the result that a great body of salt water was driven up the river and affected the salinity of the Bure to above Horning. Just below Horning the river contained 22 per cent. of sea water (see Appendix I., No. 4). Analysis of water made on March 21st showed that salt water had even penetrated beyond Barton Broad, and was just traceable at Sutton. At Barton the salinity was 33.8. The effects of this tide continued to be felt for some time. Thus, over a month later, the salinity at Horning was still up to 10.37 grs. per gallon, which is at least twice the normal amount (Appendix I., 3).

How very changeable the conditions in the river are is further shown by the example of another tide, the effects of which were recorded in 1911 ⁽⁶⁾.* In this case the effects of the tide disappeared within a few days, at least in the river, and conditions were so far reversed that a fresh-water fauna was found right down to Yarmouth five days later.

The water of high salinity draining out of the Thurne river enters the Bure at Thurne mouth and is carried up the river on the flood tide, affecting the fauna to some extent as far as South Walsham and Ludham Bridge.

There is another factor which no doubt very greatly affects the fauna of the Broads as compared for instance with that of north German lakes—namely the equable climate. Freezing of any of the Broads is comparatively rare, and never of long duration. This certainly affects the life-cycle of many Crustacea, and explains the rarity of sexual forms of some Cladocera and the survival through the winter of species which, under a continental climate, would die out in winter. In the Baltic region the lakes are generally frozen for two or three months, and the break-up of the ice causes great erosion of the shores. Temperatures in summer are also higher than with us.

* See Appendix II. 9.

It is probably to the high summer temperature that the pronounced seasonal change of form which is characteristic the *Daphnias* of the Baltic region is due. There is practically no seasonal variation in the Norfolk forms, and *D. cucullata* never has anything approaching the grotesque head crests seen in Friesland and Denmark. The shallowness of our waters has also a good deal to do with this absence of seasonal change.

Something must be said of the depth and bottom deposits of the Broads. They are all relatively small, as the following examples show ⁽¹⁶⁾ :—

						Acres.
Hickling and Whiteslea	...	...	...	...	...	578
Ormesby, Rollesby and Filby	...	...	...	...	...	464
Barton	...	...	...	...	...	229
Wroxham	...	...	...	...	...	92
Sutton	...	...	...	...	...	75

All the Broads are shallow, the depth rarely exceeding 10 feet, so that there can be no thermal stratification. In the Broads of the Bure, namely those of low salinity, and in the Ormesby group, circumstances are highly favourable to a rich growth of phytoplankton, and the water in summer is consequently very opaque and green, but there is seldom, if ever, any striking "water-bloom" except in the Ormesby group where it is sometimes very pronounced.

In these Broads there is deep soft mud or ooze of a grey-green colour, often with much sulphuretted hydrogen, but harbouring a rather rich Crustacean fauna. The mud is exceedingly fine and completely decayed, with few traceable plant remains. In the Broads of the Ant and Thurne the water is commonly very clear owing to the scanty plankton and the bottom varies a good deal. They are always very shallow and often have a rich bottom vegetation of *Chara*, *Utricularia* and *Nitella*. The mud is deep, dark in colour and contains undecayed plant remains. The bottom fauna is scanty. Mud of the Bure type is found in parts of Barton Broad and this mud is calcareous, but neither here, nor anywhere in the Broads, is there any deposit of lime forming a marl or "gytje." In some of the Danish lakes this "gytje" is "so rich in lime that the bottom layer may be directly used as marl to improve the arable soil." ⁽¹⁷⁾.

THE PLANKTON

The phytoplankton of the Broads has not been by any means sufficiently studied. The general features are summarised by G. S. West (¹⁸), and Griffiths (¹) has published a paper on the subject based on a short visit in August, 1924. While the list of species given by Griffiths for the Broads visited is helpful, he evidently had no general acquaintance with the district and did not appreciate the peculiar conditions. I have not seriously studied the phytoplankton myself, and can only deal with it superficially.

The district cannot be treated as a homogeneous whole for the reasons given above, but may be divided into several sub-regions :—

1. Bure Valley (a) Wroxham.
(b) South Walsham.
2. Ant Valley.
3. Thurne Valley.
4. Ormesby Group.
5. Yare Valley.

The Broads of the Thurne, Ant and Yare valleys have peculiar features, and can be dealt with first.

2. In the Ant Valley are Barton and Sutton Broads, the latter so much grown up with reeds, etc., that there is little open water and practically no plankton. At times there may be immense numbers of small Peridinians, giving the water a golden yellow colour, and *Bosmina longirostris* may be present in some numbers. Barton also seems rarely to have any indigenous plankton except a few *Bosmina* and *Diaptomus*, but in the summer it may apparently be invaded by some of the species from the Bure, including *Daphnia cucullata*. Probably the absence of normal plankton is due to some extent to the trace of salt alluded to above.

3. The Broads of the Thurne river, Horsey, Hickling and Martham, have a high salinity and, as West says, the phytoplankton consists only of some species of Peridinians and a few Diatoms of brackish affinities. The plankton is variable, but the most constant member of it is *Eurytemora velox*. There are no Daphnias and rarely any *Bosmina*.

All these Broad's are shallow, and those of the Thurne are characterised by immense beds of *Chara* and of *Potamogeton pectinatum*. Twenty years ago *Neomysis vulgaris* abounded, but it has now completely disappeared. *Gammarus duebeni* and *Cordylophora* are still common and owe their presence to the high salinity.

5. With the Yare valley I have little acquaintance. This river has been excessively polluted, and also is more exposed to tidal influence than the Bure. At the times of my own recent visits there has been no zooplankton whatever, the water appearing absolutely lifeless. Griffiths found in Surlingham Broad a scanty plankton "consisting largely of vegetable detritus and epiphytic organisms from the submerged macrophyta." This scarcity is probably a phenomenon of quite recent origin, due to pollution by the Cantley Beet Sugar Factory and partly to the Thorpe sewage farm, since in 1903 there was a very definite zooplankton including *Bosmina*, *Ceriodaphnia* and *Daphnia longispina*.

1 and 4. Bure Valley and Ormesby group. The summer plankton of these two areas and of the river from Wroxham down to Thurne mouth is exceedingly rich and, to a large extent, uniform. It is characterised by the great abundance of the Diatom *Melosira*, which may at times dominate almost to the exclusion of other forms. On the other hand there are features distinguishing the plankton of Wroxham and Salhouse from that of Ranworth and South Walsham, and of these Bure Broad's jointly from that of the Ormesby group.

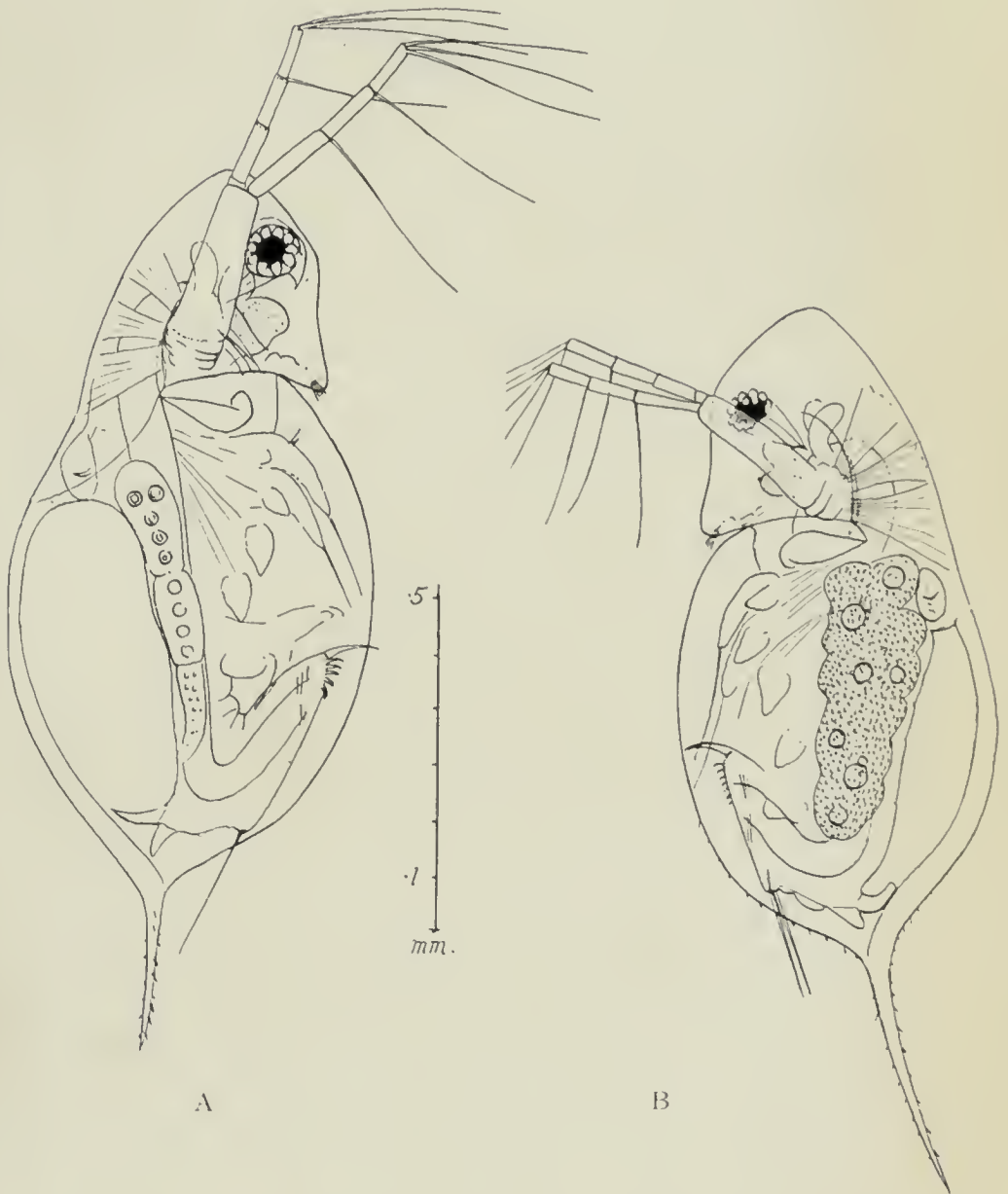
The Bure Broad's are characterised by the total absence of *Ceratium* and the presence of *Daphnia cucullata*, but Wroxham and Salhouse are remarkable for the absence of *Diaptomus gracilis* which is the common species of the plankton of the district as a whole. In these two Broad's *Eurytemora velox* takes its place, but it is not a case of the exclusion of one species by another since both species occur together in other places. There must be some obscure factor influencing the distribution of *D. gracilis*, the nature of which it is impossible even to guess at.

Ormesby has the richest plankton of the whole region. There is so great a development of phytoplankton in summer

that there is a striking "water bloom" which lasts from about the end of April to the end of June. At such times the water seems to be covered with a coat of emerald green paint. This seems to be mainly due to Myxophyceæ—*Anabæna*—but there is an enormous quantity of *Melosira* and a large variety of Protococcales. Naturally the components of the plankton vary with the season, and *Microcystis æruginosa* may contribute to the bloom. *Pediastrum* and *Asterionella* are common, and *Ceratium hirundinella* is present in small numbers and at some seasons. (See Appendix II. 8).

Eurytemora velox appears to be absent, while *Diaptomus gracilis* is abundant throughout the year. *Daphnia* abounds, but it is difficult to determine to which species it should be referred.

In my list of Crustacea published in 1904 I included both *Daphnia lacustris* and *D. cucullata*, relying chiefly upon the presence or absence of the ocellus as a distinguishing character, since at that time this was regarded as an important and easily recognised difference. In the meantime the literature poured out upon the subject of the *D. longispina-cucullata* group has been prodigious. The result is that all the barriers between species and varieties have been broken down, but we have no sure guide to their understanding. In the Norfolk Broads the pelagic form of *Daphnia* is a small form with almost no seasonal variation. The young frequently, and the adults rarely, have peaked heads in summer, but there is never a conspicuous crest. Taking a single plankton sample in summer it is quite impossible to separate two races or species by external form. On the other hand the ocellus may be fully developed, or it may be represented by a minute pigment spot embedded in the brain, or it may be quite invisible. The dorsal processes of the abdomen may be of the form characteristic of typical *D. cucullata* or of *D. longispina*, or intermediate between the two. What name, then, can we give to this *Daphnia*? It is, I believe, the same form as that recorded in 1892 by Scourfield from Essex as *D. galeata*, but it is certainly not the same as the large *galeata* form so common in the Scottish plankton, and it is, I think, misleading to give it that name.



Daphnia cucullata.—A. River Bure at South Walsham, Aug. 1st, 1909; B. Ormesby Broad, May 31st, 1911. Two individuals obviously of the same species, but one (B) with ocellus, and the other (A) without.

BRITISH
MUSEUM
25 FEB 30
NATURAL
HISTORY.

I consider it best, provisionally, to regard the pelagic *Daphnia* of Norfolk as *D. cucullata* of the var. *apicata*.

The common *longispina*-form of the Broads is *longispina-rosea*, but a great variety of forms has been met with at different times, from which an almost unbroken series might be built up between it and the *cucullata*-form here dealt with. I give figures to show the pelagic form with and without ocellus.

COMPARISON WITH OTHER AREAS

It is difficult to compare the Broads as a whole with any other lake area. They have nothing in common with the lakes of Cumberland or Scotland, where the Crustacea are totally different.* Neither do they seem to have any close resemblance to the lakes of Friesland, where *Bosmina longirostris* is accompanied or replaced by *B. coregoni* and *Dinobryon* is abundant in the plankton. It is true that there is a greater similarity with the Naardermeer in Holland, and I have seen similar plankton from near Gröningen; but here one finds *Leptodora*, which does not occur in Norfolk.

Griffiths (¹) considers that the closest parallel (having regard to the Phytoplankton) is with the Danish lakes. There are, however, marked differences in the Zooplankton. The Baltic area is conspicuously the home of *Bosmina coregoni*, *Leptodora* is of general occurrence, and *Diaphanosoma* is a regular member of the plankton.

Taking the plankton of Ormesby as typical of the Broads, it is thus characterised:—

- (1) Dominance of *Melosira* and abundance of *Cyanophyceæ*.
- (2) Absence of *Ceratium*. It is occasionally present in Ormesby, but very rare. Entirely absent from other Broads.
- (3) Absence of *Cyclops oithonoides*, *Leptodora*, *Bosmina coregoni* and usually of *Diaphanosoma*. The latter is common in ditches or weedy waters, but rare in plankton.
- (4) Presence of *Daphnia cucullata*, *Bosmina longirostris*, *Cyclops vicinus*. *Eurytemora velox* present in other Broads.

I do not propose to go deeply into this question; but I think one may say that the plankton of the Norfolk Broads

* See Appendix II. 10.

belongs generically to the Baltic type, but that it has marked specific differences attributable partly to marine influence and partly to the factors of depth, size and climate.

LITTORAL AND BOTTOM-LIVING CRUSTACEA

Turning now to the littoral and bottom-living Crustacea we find the interest of the region equally great.

The shallow weed-grown Broads are extraordinarily rich in Entomostraca, but the richness depends to a large extent on the nature of the vegetation and the salinity of the water. Beds of *Chara* in Hickling for instance harbour relatively few species, but a great abundance of individuals of species such as *Simocephalus vetulus* and *Eurycercus lamellatus*. This is also the case in other Broads and is due to some peculiarity in the *Chara* rather than to the high salinity.* The high salinity of Hickling does, however, account for the presence of *Nitocra lacustris* and *Mesochra rapiens*. *Horsicella brevicornis* is another Copepod which prefers a rather high salinity and is commoner in Hickling and Horsey than elsewhere. It is a remarkable species closely allied to the marine *Cylindropsyllus*, found only in decaying stems of *Typha* and *Scirpus*, and seems to be widely distributed though rarely seen. It is recorded from Greifswald, Dalmatia and West Siberia, and I have found it myself at Ismailia in Egypt.

The richest life is found in Sutton Broad, among the thick mass of *Potamogeton* and *Nymphæa*. Weeds such as *Hippuris*, *Myriophyllum* and *Ceratophyllum*† do not seem to be very favourite habitats. Beds of *Sparganium minimum* sometimes provide a home for incredible numbers of Entomostraca, particularly *Sida*. (See Appendix II. 4). In the Broads of the Bure, and in the Ormesby group, there is only a narrow belt of vegetation and nothing approaching the wealth of weeds seen at Sutton or Barton. Consequently the Entomostraca are much fewer in number and variety. On the other hand they have a relatively rich bottom fauna, including all the three known British species of *Ilyocryptus*. *I. sordidus*

*Investigation of the pH of the Broads may throw light on this and other difficult points.

† These two plants are dominant in the Yare Broads and perhaps explain to some extent the poorness of the fauna.

seems rather indifferent to the nature of the bottom and is often common in quite coarse deposits, but *I. acutifrons* and *I. agilis* are rarely seen except in fine flocculent grey mud.

In general the Crustacean fauna is characterised by its great variety and the absence of all northern forms. In the Cumberland lakes, for instance, the characteristic littoral Cladoceran is *Alonopsis elongata* and this is commonly accompanied by *Drepanothrix dentata*, but neither of these occur in the Broads. There are none of the northern Harpacticids, but we have *Nitocra hibernica* and *Canthocamptus trispinosus* which are not found in the north, and *Cyclops leuckarti* and *C. hyalinus* are common in our summer plankton but are never seen in the plankton of the lakes of Cumberland or Scotland.

Of the river Crustacea the most interesting is *Leander longirostris*, the "White Prawn" or "Jack Shrimp" of Breydon. Previously wrongly named as *L. squilla*, this was recorded for the first time as a British species in 1921 (⁹, ¹⁰). It is now known to occur also in the Tamar in Devonshire. Curiously enough I identified its larva in plankton from the Eddystone Grounds years before it was known to live in any other rivers than the Bure and Yare. This prawn is almost as much at home in fresh as in salt water, and certainly runs up the river as far as Hickling and South Walsham, and may penetrate normally to fresh-water. Its range of tolerance is much greater than that of *Palæmonetes varians* which is very sensitive to water of low salinity. The Jack Shrimp, however, goes to sea to hatch its young, and indeed its eggs will not hatch in fresh water, while the larvæ of *Palæmonetes* thrive in brackish water.

I have not much to add to previous lists of littoral forms. A number of species have been added from the estuarine region, but they are not of general interest. The region between Acle and Stokesby is, roughly, the limit of distribution of the brackish species*. Only one ranges much beyond this, namely *Tachidius littoralis*, which is established in fresh-water in South Walsham Broad.

It is rather remarkable that *Carcinus mænas* (the "Kittiwitch" of Norfolk) and the Brown Shrimp (*Crangon vulgaris*), though they swarm in Breydon and are typical estuarine

*For an example of the fauna of this section of the river see Appendix II. 3.

species, are absolutely confined to salt water. I have never found any evidence of their ranging beyond the reach of salt tides. The Flounder, on the other hand, runs up quite into fresh water and I have caught a specimen in the middle of Wroxham Broad. It is taken commonly, in company with the White Prawn, in the eel-sett at St. Benet's.

THE FAUNA OF BRACKISH WATERS

In discussing the fauna of brackish water one meets at once with the difficulty of defining the term numerically, and any study of the question leads to the conclusion that we are dealing with a problem which is not solely one of the chemical composition of water. Redeke (¹⁴) has divided brackish waters as follows :—

Oligohalin with .1 to 1.0 grm Chlorine per litre.

Mesohalin with 1.0 to 10.

Polyhalin with 10 and more.

It is no doubt possible to make a rough separation of habitats in this way, but I feel that it is premature to divide and label associations on the basis of a single factor. Undoubtedly salinity is the only indicator of which we have reasonably precise knowledge, but it is certainly not the only determining factor, and it is just to this point that limnologists might with advantage direct their attention.

The brackish-water fauna is merely one branch of the fauna of a region ranging from open sea to pure fresh water, and it is impossible to draw hard and fast lines. In the first place the conditions of life for the plankton and the bottom fauna do not appear to be the same. The Copepod plankton of the open sea is not the same as that of littoral waters. These waters are characterised by the predominance of certain species which are less frequent in the open sea—c.g., *Acartia clausi*, *Centropages hamatus*, *Temora longicornis* and *Euterpina acutifrons*; but there is no accompanying notable difference in salinity. The difference is perhaps attributable more to the predominance in coastal waters of certain forms of phytoplankton, themselves dependent upon the influx of nutrient salts from coastal drainage.

Passing from the open coastal waters to the more confined estuarine region we still find the same, or nearly the same,

plankton, but with the addition of such species as *Acartia bifilosa* and *Eurytemora affinis*. The water is still definitely sea water, but may be liable to fluctuations of salinity, and the determining factors may be as much depth, turbidity and currents as salinity. Between the outer estuary and the region of fresh water there is an ill-defined area of fluctuating extent, liable to violent changes in salinity and hardness, strong currents and changes in temperature conditions, in which no new and characteristic plankton forms appear, but the species of the outer estuary disappear and only *E. affinis* survives.

E. affinis is certainly a euryhaline species, but how far the same can be said of the other estuarine plankton forms is uncertain. They may be carried up and down with the tide, remaining always in water of approximately the same composition, and the occasional presence of specimens in water of low salinity may indicate no more than the capture of stragglers surviving for a time in an uncongenial, and ultimately lethal, element. As an example I may refer to Oberg's remarks on *Paracalanus parvus*. This species is common in the Bay of Kiel and in parts of the Baltic, but he found no evidence of its actually breeding there, and concluded that it was being constantly brought in by currents from the North Sea. Conversely he stated that *Eurytemora hirundo* is carried out into the Baltic from brackish water, but unable to establish itself there.

Speaking from an experience limited to the conditions in Norfolk, I should say that the brackish-water (euryhaline) Copepod plankton consists only of *E. affinis*—with its varietal forms.

Such a conclusion would hardly be admitted as applicable to the Baltic, but the conditions there are so different from those on our own coasts that no exact comparison is possible. In a relatively tideless sea, of which the highest salinity is far below that of the North Sea, and the salinity gradient is very gradual, the mixture of marine and fresh-water forms is very much more intimate than it is elsewhere.

Turning to the littoral and bottom fauna, we go from conditions of comparative simplicity and uniformity to conditions of extreme complexity, and it is impossible at present to unravel the factors operating. We cannot speak of a "brackish-

water fauna" as a simple community, as we can with the plankton; for, while it is possible to draw up a long list of species commonly or exclusively found in brackish water, there are several obviously different types of habitat, each of which has its characteristic species. For instance, on many parts of our coast, as at Blakeney and Wells, there are stretches of salt marsh covered with maritime plants, chiefly *Obione*, and dotted about with small shallow pools of peculiar form. These pools have a level bottom of fine sticky mud and no vegetation apart from the overhanging plants of their edges, and they vary in depth from a mere film of water to about a foot. Their fauna has not been fully studied, but it is rich in Ostracods and Copepods, and it is in these pools that *Palæmonetes varians* particularly thrives. Of the Copepods *Tachidius brevicornis*, *Mesochra lilljeborgii* and *Metis ignea* are characteristic, but a long list might be made from an extended study of them. The salinity is probably on an average very near that of sea water, but it fluctuates much according to the amount of rain and also owing to the fact that the marshes are periodically overflowed by the sea. After such a flood the pools may be found to contain marine plankton, and these forms (e.g. *Acartia clausi*) may survive for a considerable time. There are, towards the edge of the marsh, pools which are not, or only very rarely, flooded. These have a salinity which is very high, and contain not only *Palæmonetes* and *Tachidius*, but also immense numbers of *Eurytemora velox*—a species which is equally at home in quite fresh water.

Again, on the Norfolk coast, there are at Salthouse some large ponds lying on the landward side of the shingle bank. These ponds have, for the most part, a stony bottom, and their water is of high salinity, though generally a good deal less than that of the sea (e.g. 1456 parts Cl per 100,000). Here there is a rich vegetation of *Ruppia rostellata*, and the fauna is quite different from that of the marsh pools. Conspicuous species are *P. varians*, *Idotea viridis*, *Gammarus locusta* and *Neomysis vulgaris*. On the stones are numbers of the interesting Anemone *Sagartia lucia* and much *Membranipora monostachys*. In places the Hydroid *Gonothyrca loveni* is found. The Copepods are not numerous and are generally not of the same species as in the marsh pools. The commoner

BRITISH
MUSEUM

25 FEB 30

NATURAL
HISTORY.

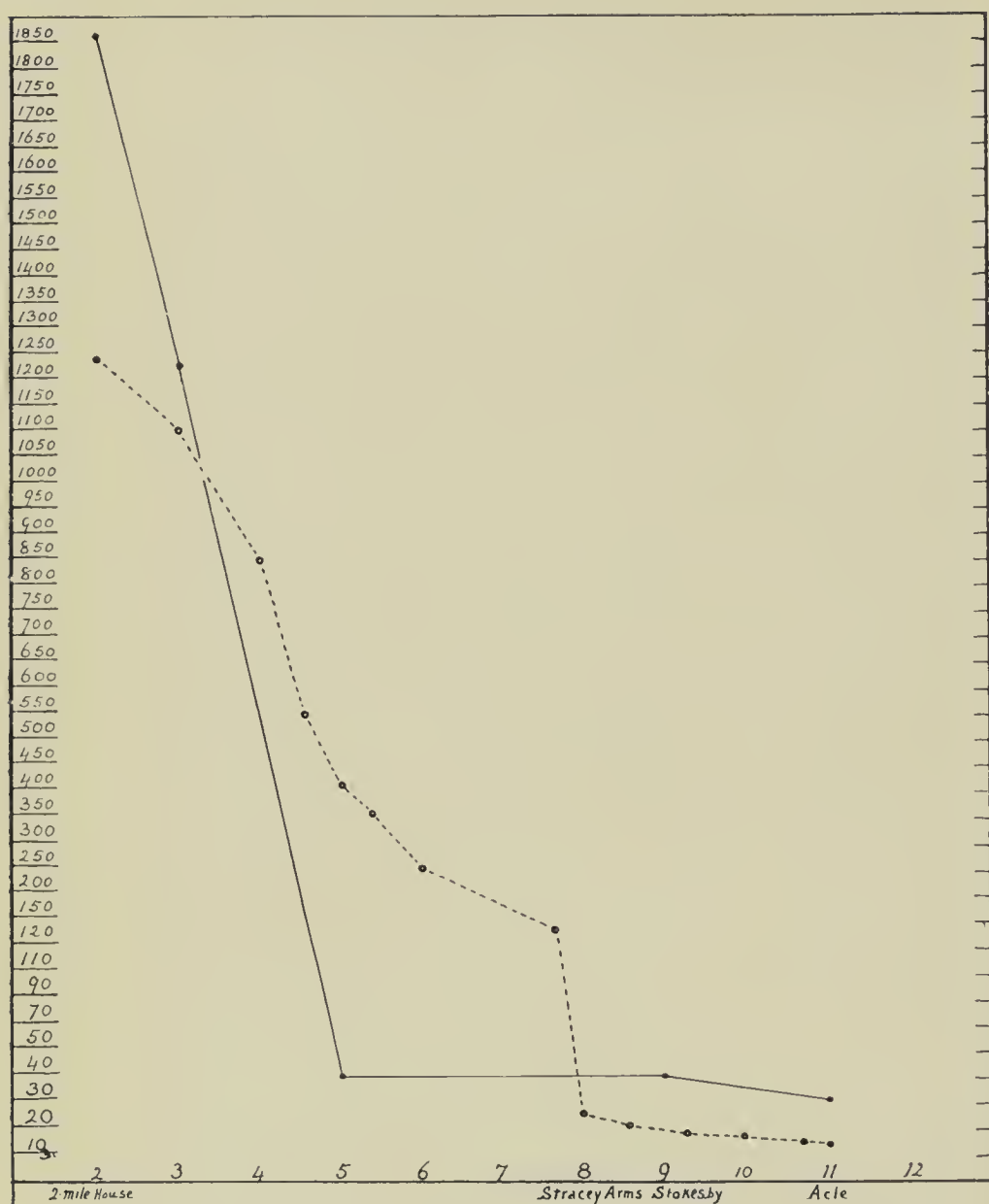


FIG. 1

SALINITY GRADIENTS IN THE RIVER BURE

Salinity expressed as grains of Chlorine per gallon. In order to bring the great range of salinity within the diagram the value of the vertical intervals is made to increase upwards. The horizontal intervals represent miles from Yarmouth.

Solid line - — April 9, 1906. W. L. Sutton. 9 a.m.—10.30 a.m.

Broken line - - - Oct. 2, 1906. A. G. Innes. 9 a.m.—12.50 p.m.

In both cases high water at Southtown Bridge at 9.30 a.m. and the moon was full.

forms are *Halicyclops magniceps* and *Nitocra spinipes*. Curiously enough I have not found any *Eurytemora* in these ponds.

Here, then, we have two kinds of pool of which the only common factor is the high salinity, but the fauna is as different as possible, and it is clear that there are several categories within the "brackish-water fauna."

In the river Bure between Yarmouth and Acle a considerable number of brackish species have been taken at different times. The commonest species of Copepod of the bottom is *Tachidius littoralis*, which in some places is to be taken in enormous numbers. In fact it is the dominant species and there is no other that is really common. It is evidently specially adapted to the exacting life of a river, most other species requiring the relatively tranquil conditions of ditches and pools. Of the higher Crustacea *Heterotanaïs gurneyi* proves to be very common, and *Cyathura carinata* and *Corophium grossipes* are probably so but are not so easy to find, as they burrow in the mud.

Carcinus maenas and *Crangon vulgaris* do not extend far up the river at ordinary times, being confined to practically salt water, but *Leander longirostris*, as has been said, is indifferent to the amount of salt. *Balanus improvisus*, which is abundant in Oulton Broad, has been taken as far up the river as Muckfleet, but it is not well established in the river itself. This is no doubt due to the uncertainty of the conditions for larval life.

Two species of this region, *T. littoralis* and *L. longirostris*, are completely euryhaline, but it is difficult to be sure of the others. It must be remembered that one cannot ascertain precisely the conditions under which they are living. Thus, although the river may at any point appear to be full of fresh water, it is very possible that there are, as it were, pockets of salt water in holes and crannies of the bank left over from a preceding tide, and that the "brackish" species are really living in water of high salinity (see Appendix II., No. 3).

We can, however, again draw the conclusion that salinity is not necessarily the determining factor, and that the conditions in a river definitely exclude a number of species which, in pools, can tolerate a high and fluctuating salinity.

BREYDON WATER

Breydon Water offers conditions intermediate between river and pool, but has not been studied with the attention it deserves. The fluctuations of salinity are here, too, violent, but the water is usually nearly normal sea water. Apart from the main river channel there are great stretches of mud laid bare at low tide and there are also shallows thickly overgrown with *Zostera*. In these *Zostera* beds the fauna is very rich, and consists of typical "brackish-water" species. *Halicyclops magniceps* may be the dominant Copepod, but the immense numbers of the small mollusc *Paludestrina* simply clog the net. As an instance of the curious mixture of species that may be met with sometimes in Breydon, I give a list in the Appendix II. 7 of a collection made at the north end during a time when much fresh water was flowing down. There can be little doubt that on this occasion, though salinity was lowered throughout, salter water was retained over much of the bottom and among the weeds. The brackish species, then, though able perhaps to endure for some time a lowered salinity, are not necessarily adapted to live in it permanently.

I think it of importance to emphasise the necessity for caution in attributing to bottom-living forms the power of adaptation to the salinity of the water in which they are apparently found. Buxton (1924) has shown the great difficulty in ascertaining the temperature conditions under which desert insects live, and we have here a problem almost more difficult.

One point which seems worth noting is that it is not the species of the rock pools and tidal zone such as *Tigriopus fulvus*, *Tisbe furcata* and *Carcinus mænas* which tolerate best the lower density of the upper estuarine region, and it is not *Palæmonetes varians*, though reputed the most characteristic species of brackish water, that ranges into fresh water, but *Leander longirostris*, which none the less finds it necessary to go down to the sea to breed. We are, indeed, dealing with a region where there are cross currents of adaptation of which we have no understanding. I venture to think that it is a region more worthy of the attention of the modern student of aquatic life than the region of pure fresh water, concerning which so much has been written already, that progress of under-

standing seems likely to be impeded by the weight of accumulated fact.

Under the head of "brackish-water" fauna is also sometimes included the fauna of inland waters, the high salinity of which is due to drainage from saline deposits or evaporation of lakes without outlet. Inasmuch, however, as the salinity is generally higher and not less high than that of the sea, they do not fairly come within the same category.

The term "brackish-water" should be applied only to waters which, permanently or temporarily connected with the sea, have a salinity or density less than that of sea water. Brackish water is, in fact, diluted sea-water.

The water of inland salt lakes and pools has generally a composition different from that of sea water in the relative proportions of the salts. The salt pans into which sea water is admitted for the purpose of ultimate evaporation for the recovery of salt may pass through at certain seasons a brackish-water phase, as in the salines of Croisic, and contain for a time a mixed or euryhaline fauna; but, when evaporation sets in they pass into the salt-pan phase, while the fauna changes with changing density till ultimately only *Artemia* is able to survive.

In cases such as this we have the factors of density and acidity changing while the rest remains the same. Labbé⁽¹²⁾ has devoted much attention to these salines and has published much valuable information about them; but his work is throughout directed to establishing a wholly untenable theory of the transformation of species from one to another by the influence of small changes in hydrogen-ion concentration. The new species and "allomorphs" described are so fantastic that it is unfortunately impossible to discover in his papers any really reliable information concerning the reaction of any definite form. It is certain that he was dealing wholly or in large part with species already known, but they are so disguised that they can seldom be recognized with certainty.

The interest of a study of the brackish-water fauna lies in the light it may throw upon the origin of the fauna of fresh water.

The statement is often found in literature that in *Cordylophora lacustris* and *Dreissensia polymorpha* we see two species actually in process of migration from the sea to fresh water. This seems to me a false view. *Dreissensia* is a very definitely fresh-

water species, quite intolerant of salt water, and there is no shadow of evidence that it has changed its habits in historic times. *Cordylophora* is by no means an estuarine or even brackish-water form. It is able to live in perfectly fresh water, but prefers a salinity of about 20 to 50 parts Cl. per 100,000, and is able to tolerate higher densities for a time. It is not markedly euryhaline, and its distribution does not show evidence of recent penetration from the sea. The discovery that it is identical with *C. caspia* Pallas has thrown new light on its origin, which is probably connected with the past extensions of the Baltic and Caspian Seas.

The fauna of estuaries seems to consist of species which are in a sense euryhaline, but within relatively narrow limits, and in very few cases is there evidence of extension of these limits. The best case is that of *Paludestrina jenkinsi* (see Robson ¹⁵) which seems definitely to have passed from brackish to fresh water within quite recent times. It is known to have inhabited Britain since about 1550, but was not actually described until 1889. Up to about 1893 records show it to have been a relatively rare species inhabiting brackish water. From that date it seems suddenly to have multiplied to an enormous extent, and to have pushed its way, far and wide, into fresh water.

It seems probable that the colonisation of fresh water has occurred, not by the gradual acclimatisation of estuarine species, but by the occasional appearance of physiological mutations giving a new range of tolerance of low salinity. Such mutations need not necessarily be accompanied by structural change. *P. jenkinsi* of to-day is apparently identical with the *P. jenkinsi* of mediæval times, but the *P. jenkinsi* of fresh water is certainly physiologically a new species.

ADDITIONAL RECORDS FOR THE COUNTY, OUTSIDE THE BROADS DISTRICT

Exploration beyond the Broads district has brought to light some interesting waters. Generally speaking, ponds and ditches in the area covered by the boulder clay are likely to contain no species not already recorded for the Broads or adjacent waters, but wherever there is a marked difference in physical features a new fauna is to be expected.

HEATHS AND SPRING WATERS

Thus there are heaths where the water supply is "acid" and the vegetation is of the "bog" type. Examples are Newton Common, Buxton Heath, parts of Booton Common and Roydon Fen (near Lynn). The indicator plant is of course *Sphagnum*, with which *Drosera** is generally associated. Both *Sphagnum* and *Drosera* may be found in the Broads district, but only in small areas and then without any characteristic fauna. In other places, however, one finds a definite "sphagnophil" fauna, the Crustacea being *Moraria brevipes*, *Canthocamptus weberi*, *C. echinatus*, *C. zschokkei*, *Alona rustica* and *Chydorus piger*. *M. brevipes* proves to be widely distributed and sometimes abundant. *C. weberi* was first found on Newton Common in 1921. It is, however, by no means a very rare species, since it inhabits moist *Sphagnum* and can be got by squeezing the water from the moss into a fine net. In this way I have also found *Epactophanes muscicola* at Buxton Heath, a species not previously known in Britain.

One of the most interesting discoveries is the occurrence of *Canthocamptus cuspidatus* in a spring at Holt Lowes. Here it is associated with the Planarian *Polycelis cornuta*. Both are northern "cold-water" species sometimes alluded to as glacial relicts. This they certainly are not here. They owe their presence to the relative coldness of the water, but how they can have got there I cannot suggest. We know too little of the means of distribution of these Crustacea to draw far-reaching conclusions from their occurrence in isolated colonies. The Ostracod genus *Limnocythere* is sometimes claimed as a glacial-marine relict; but *L. relictus* was found in a small pond just below the springs on Holt Lowes which was made by embankment during the war.

THE MERES

The Meres of West Norfolk, near Thetford, are of much interest by reason of their rather problematical origin and their situation amid the barren Breckland (¹⁶). They all occupy depressions in the chalk, and the level of the water depends

* *D. rotundifolia*. This is replaced by the long-leaved species where the water is charged with lime, e.g., at Smallburgh.

mainly upon the level of saturation of the latter. Consequently this level fluctuates, and a mere may dry up entirely after a succession of dry seasons. The water is, of course, "hard." A characteristic of some and perhaps of all the meres is the enormous numbers of mollusca that inhabit them. I have not seen any *Anodonta**, but the number of dead shells of *Limnæa stagnalis* round the margin of a shrinking mere is most striking. I have collected Crustacea in several of the meres and the pools in their neighbourhood, but will refer only to Langmere and a pool at Larling. During the years 1917-19 Langmere was very full, and had apparently been so since 1912. At this time there was a rich fauna, and it included great numbers of the remarkable and rare Rotifer *Pedalion mirum*. It is notable that *Ceratium*, *Volvox* and the Polyzoon *Lophopus crystallinus* were all abundant. About fourteen species of Cladocera and Copepods were found, and the characteristic Cladoceran was *Daphnia longispina*—on the whole a fauna of clear, permanent and open water. In 1921 there was a season of exceptional drought and the mere was reduced to three separate ponds. In these ponds the fauna had changed entirely. Instead of *D. longispina* there was *D. magna*, a species characteristic of farm ponds, and only five species of Entomostraca in all were present. *Ceratium*, *Lophopus* and *Pedalion* had gone.

Normal conditions have gradually been restored, but not the original fauna—at least it was not so in 1926 and 1927. This is a fact of some general interest. Many fresh-water animals have resting eggs, or can survive drought in some other form, and from a sample of the dry débris taken from the edge of Langmere in 1920 and placed in an aquarium the following species were hatched—

Lophopus crystallinus

Daphnia longispina

Ceriodaphnia reticulata

Alona rectangula

Canthocamptus staphylinus

Cyclops rubellus

* I refer only to the meres on Wretham Heath. Scoulton Mere, for example, is quite a different kind of water, and has abundance of *Anodonta*.

One would expect then that, as the mere extended, the drift line would be submerged and the old fauna restored. Apparently this has not happened, and one may conclude that the life conditions are now in some way different and unsuitable, even though the original dimensions and depth may have been regained. The introduction of new species, such as *D. magna* may easily be accounted for by transport by birds, since the mere is frequented by numbers of ducks. At the same time we have very little positive evidence of the means by which fresh-water animals are distributed and this is a subject of great importance from the point of view of zoo-geography. The evidence given above of the failure of a lake to repopulate itself in spite of the demonstrable presence of the resting eggs of some of the species makes the ready colonisation of new waters even more difficult to understand.

Mention should be made of a small pool on Larling Heath which was first examined in May, 1927. The pool has a rich vegetation and a very rich fauna, but there is nothing definite to distinguish it from other pools in the vicinity. Yet it was found to contain two species quite new to Britain—*Cyclops gracilis* and *Echinisca tenuicornis* (*Macrothrix rosea* auct.) Only one specimen of the latter was seen and repeated search on subsequent visits failed to produce any more. *Cyclops gracilis* has since been found in one¹ other pool near by. A list of the Entomostraca of the original pool is given in the appendix.

EAST RUSTON COMMON

The richest hunting ground for Entomostraca which I have found has been East Ruston Common. Here, alongside the road, is a wet marsh with a mossy bottom in which *Utricularia* (three species) abounds. Here, in an area of only a few square yards, I have taken twenty-five species of Cladocera and twenty-four of Copepods as well as several specially interesting Ostracods (see Appendix II. 1). Among these were some of extreme rarity :—

Ceriodaphnia setosa new to Britain

Kurzia latissima new to Britain

Cyclops rubellus

Canthocamptus gracilis

Metacypris cordata

Candona euplectella

Canthocamptus gracilis is a species which turns up fairly often, but generally only as single specimens. At East Ruston it was found to be quite common in the bladders on the earth-shoots of *Utricularia intermedia*. This fact gave a clue to its real habitat, and I found it could always be taken deep down in the moss.

Such flooded marshes, with submerged moss, are always very rich in Entomostraca, but I have met with none so rich as this.

WESTWICK PERCH POND

For the sake of completeness I may mention this pond although it has already been fully dealt with in these Transactions (7). It is a large pond, artificially formed in 1819 by the embankment of a small valley in the glacial sand. The bottom slopes down to a depth of about 14 feet and is, for the most part, covered thickly with *Littorella*, a plant which is of very rare occurrence in the Broads district. In fact I have only once seen it myself in a gravelly bay at Sutton. The water is exceedingly clear and phytoplankton very scanty. The pond approaches in several respects to the character of a small highland lake, and is totally unlike any other pond in Norfolk with which I am acquainted. The fauna is not rich, but it contains some species of Cladocera characteristic of "acid" waters, two of which are not known from any other locality in the country. These species are :—

Acantholeberis curvirostris

Drepanothrix dentata

Leptorhynchus falcatus

Chydorus piger

Alona rustica.

The only conclusion one can draw from the occurrence of these species in this pond, little more than 100 years old, is that the Cladocera have unlimited powers of dispersal and are able to colonise all suitable waters in a very short time. They are not suitable material from which to draw conclusions regarding glacial history and the like.

SUBTERRANEAN CRUSTACEA

In 1899 Sir Sidney Harmer* recorded the finding of the subterranean Amphipod *Niphargus aquilex* in a well at Cringleford; but, so far as I know, the animal has not been seen since in Norfolk. Last year Mr. John Gurney sent me two specimens of a species of *Niphargus* taken from a pump at Walsingham. These were submitted to Prof. Tattersall, but he was unable to identify them with certainty as they were not mature. Apparently they belonged to the same species as the specimens from Cringleford, and this is now generally called *N. puteanus* (Koch). As these subterranean Crustacea are of exceptional interest I should like to appeal to members to look out for them. They are likely to be met with in wells sunk in the chalk, and could be got by tying a bag of fine muslin over the mouth of the pump.

ADDITIONAL RECORDS OF CRUSTACEA

CLADOCERA

Moina macrocopa, Straus. Pond at Titchwell. (D. J. Scourfield, August, 1912).

Macrothrix hirsuticornis Norm. and Brady. Dersingham, April, 1919. Drymere, Swaffham, hatched from mud, October, 1920.

Echinisca tenuicornis (Kurz). Larling Heath, May, 1927. (Syn. *Macrothrix rosea* auct. non Jurine).

Acantholeberis curvirostris (O.F.M.) Westwick Perch Pond. Newton Common.

Drepanothrix dentata (Euren). Westwick Perch Pond.

Alonopsis ambigua Lillj. Pond at Herringfleet. Hickling Broad, July, 1919.

Alona protzi Hartwig. Ludham Bridge, September, 1920.

Ceriodaphnia setosa Matile. East Ruston Common.

Kurzia latissima (Kurz). East Ruston Common.

Chydorus piger Sars (Syn. *C. barbatus* Brady) Westwick, Buxton Heath, East Ruston, Roydon Common, Felmingham.

Anchistropus emarginatus Sars. Sutton Broad.

* Trans. N. & N. Nat. Soc. VI. p. 489.

COPEPODA

CALANOIDA

Acartia biflosa Giesb. River estuaries (previous record of *A. longiremis* not confirmed).

Paracalanus parvus (Claus) Stokesby, September, 1910.

Parapontella brevicornis (Lubbock) Breydon.

CYCLOPOIDA.

Cyclopina elegans Scott. Estuary of Bure.

Cyclops gracilis Lillj. Larling Heath, 1927.

Cyclops languidoides hypnicola Gurney. In submerged moss, Sutton, Buxton Heath, etc.

Cyclops languidoides eriophori Gurney. Ingham.

Cyclops nanus Sars. Sutton, Felmingham, etc.

Cyclops vicinus Uljanin. This is the common plankton species of the Broads, previously recorded as *C. strenuus*.

Cyclops agilis Koch, *lilljeborgii* Sars, *speratus* Lillj. *macruroides* Lillj. All these "serrulatus-forms," as described by Sars, occur fairly frequently. *C. agilis* is by far the most abundant.

Thersitina gasterostei Pagenst. A common parasite of the Stickleback in rather brackish water.

HARPACTICOIDA.

Alteutha purpurocincta Norman. Stokesby, September, 1910.

Zaus goodsiri Brady. Breydon, June, 1921.

Dactylopusia neglecta Sars. Breydon ; 6-mile House ; Cley.

Stenhelia palustris (Brady) Burgh Castle, Wells, etc.

Amphiascus debilis Giesb. Holkham, Breydon.

Canthocamptus cuspidatus Schmeil. Holt Lowes.

Canthocamptus echinatus Mrazek. Flordon, Buxton, Holt Lowes.

Canthocamptus horridus Fischer. Sutton, East Ruston, Ingham, South Walsham, Breckles.

Canthocamptus weberi Kessler. Newton Common, Buxton Heath.

Canthocamptus zschokkei Schmeil. Sutton, Buxton, Honing, etc.

Moraria brevipes Sars. Newton Common, Buxton, Booton, E. Ruston, Roydon, Holt Lowes.

Moraria arboricola Scourfield. Tree-holes at Felbrigg (Scourfield).

Epactophanes muscicola (Richters) Buxton Heath.

Mesochra aestuarii Gurney. Acle Bridge, October, 1920.
Breydon, June 1922.

Mesochra rapiens Schmeil (previously recorded as *Canthocamptus hirticornis*).

Nitocra typica Boeck. Salthouse, Breydon, R. Bure.

Nitocra spinipes Boeck. (*Canthocamptus palustris*).

Nitocra lacustris Schmank. (*N. simplex* Schmeil). Cley ;
Horsey Mere, Hickling Broad.

Nannopus palustris Brady. Ludham Bridge (fresh water)
R. Bure, Cley salt marsh.

Laophonte nana Sars. Breydon.

Platychelipus littoralis Brady. Breydon.

Horsiella brevicornis (Van Douwe). Barton, Hickling,
Horsey, Irstead, Calthorpe Broad.

Tachidius incisipes Klie. Reedham.

APPENDIX I

EXAMPLES OF WATER ANALYSES

1. Well Water. SUTTON BROAD LABORATORY

Well 40 feet deep				Parts per 100,000.	
Grains per gallon					
Free Ammonia	...	.0021	...	...	.0030
Albumenoid ammonia	...	.0021	...	...	.0030
Chlorine as Chlorides	...	3.30	...	...	4.70
Temporary hardness	...	9.80 degrees†	...	...	
Permanent hardness	...	5.40 degrees	...	...	
Solids in solution	...	19.10	...	...	27.2
Containing suspended Iron Oxide derived from the Crag through which the tube is driven.					

2. *ORMESBY BROAD. 9/4/06

Chlorine	...	7.34	...	...	10.46
Sulphuric Acid	...	4.714	...	...	6.72
Free Ammonia	...	.0017	...	...	.0024
Organic Ammonia	...	.10	...	...	.1012
Loss on ignition	...	5.21	...	...	7.44
Total solids	...	37.65	...	...	53.68
Permanent hardness...	...	...	...	...	13.80 degrees
Temporary hardness	...	...	...	...	15.60 degrees

3. *RIVER BURE AT HORNING. 24/4/06

Sodium chloride	...	10.37	...	...	14.78
Magnesium Chloride	...	.814	...	...	1.16
Magnesium nitrate	...	.25	...	...	.35
Calcium Sulphate	...	4.43	...	...	6.32
Calcium Carbonate	...	11.26	...	...	16.05
Magnesium Carbonate	...	1.36	...	...	1.94
Silica and Iron Oxide	...	.25	...	...	.36

*F. Sutton. Minutes of Evidence, Great Yarmouth and Lowestoft
Water Bill. June 26th, 1906, p. 54, 55.

†One degree of hardness = one grain of Calcium Carbonate per gallon.

4. ANALYSIS OF SALINITY IN RIVER BURE

(a) March 13th, 1906, after high salt tide.*

	Grains per gallon			Parts per 100,000		
Wroxham	...	...	4.34	...	...	6.28
Horning	...	...	409.73	...	...	583.78
Thurne Mouth	...	...	1294	...	...	1834
Acle	...	...	1784	...	...	2434
Stracey Arms	...	...	1882	...	...	2577

(b) April 25th, 1906. Normal conditions nearly restored.†

Horning	...	...	8.66	...	...	11.34
Thurne Mouth	...	...	15.28	...	...	21.77
Acle	...	...	18.40	...	...	26.22
Stokesby	...	...	32.28	...	...	46.00
5-Mile House	...	...	398.2	...	...	567.4
3-Mile House	...	...	980.3	...	...	1396.9
Mouth of Bure	...	...	1922.5	...	...	2739.3

*Sutton. Minutes of Evidence. July 27th, 1906. p. 258, table 4.
 †ibid. June 26th, 1906, p. 53.

5. ANALYSIS OF WATER FROM A WELL AT INGHAM, 1904

	Grains per gallon		
Free Ammonia	...	...	.0021
Albumenoid ammonia	...	...	.0182
Nitrogen as nitrates	...	...	2.20
Chlorine in Chlorides	...	...	24.50

APPENDIX II.

EXAMPLES OF THE CRUSTACEAN FAUNA OF SPECIAL LOCALITIES

1. EAST RUSTON MARSH

Cladocera

Daphnia longispina
Ceriodaphnia laticaudata
 " *setosa*
Simocephalus vetulus
Scapholeberis mucronata
Lathonura rectirostris
Eurycercus lamellatus
Acroperus harpæ
Alona quadrangularis
 " *affinis*
 " *costata*
 " *guttata*
 " *rectangula*
 " *tenuicaudis*
Kurzia latissima
Graptoleberis testudinaria
Alonella excisa
 " *exigua*
 " *nana*
Pleuroxus aduncus
 " *lævis*
 " *trigonellus*
Chydorus sphaericus
 " *ovalis*
 " *piger*

Copepoda

Cyclops albidus
 " *fuscus*
 " *languidus*
 " *languidoides hypnicola*
 " *nanus*
 " *bicuspidatus*
 " *viridis*
 " *leuckarti*
 " *dybowskii*
 " *rubellus*
 " *bicolor*
 " *varicans*
 " *agilis*
 " *lilljeborgii*
 " *phaleratus*
 " *affinis*
Canthocamptus crassus
 " *staphylinus*
 " *trispinosus*
 " *horridus*
 " *minutus*
 " *gracilis*
 " *pygmæus*
Moraria brevipes

2. POND ON LARLING HEATH

Cladocera

Daphnia longispina
Scapholeberis mucronata
Ceriodaphnia reticulata
Simocephalus vetulus
Macrothrix rosea
Lathonura rectirostris
Acroperus harpæ
Alona affinis
 „ *rectangula*
Alonella exigua
 „ *excisa*
Chydorus sphaericus

Copepoda

Cyclops albidus
 „ *fuscus*
 „ *gracilis*
 „ *varicans*
 „ *agilis*
Canthocamptus trispinosus
 „ *minutus*
 „ *crassus*
 „ *staphylinus*
Diaptomus castor
 „ *vulgaris*

3. RIVER BURE AT MUCKFLEET 7/7/06

(A) In weeds by shore.

Bosmina longirostris
Diaphanosoma brachyurum
Sida crystallina
Ceriodaphnia quadrangula
Simocephalus vetulus
Eurycercus lamellatus
Alona affinis
Chydorus sphaericus

Cyclops leuckarti
 „ *agilis*
 „ *viridis*
Eurytemora velox

(B) Bottom fauna—brackish-water species

Heterotanaïs gurneyi
Cyathura carinata
Gammarus duebeni
Corophium grossipes
Melita pellucida
Microdeudopus versiculatus
Cytheridea torosa
Nereis diversicolor

An example of a sedentary euryhaline fauna holding its own at a point in the river where the water is commonly, as on this occasion, fresh at all states of the tide.

4. SUTTON BROAD

October, 1905. Crustacean fauna of *Sparganium minimum*

Cladocera

Sida crystallina
Diaphanosoma brachyurum
Daphnia longispina
Simocephalus vetulus
Scapholeberis mucronata
Ceriodaphnia pulchella
 „ *quadrangula*
 „ *megalops*
 „ *reticulata*
 „ *laticaudata*
Lathonura rectirostris
Polyphemus pediculus
Eurycercus lamellatus
Acroperus harpæ
Graptoleberis testudinaria

Copepoda.

Cyclops agilis
 „ *bicolor*
 „ *albidus*
 „ *distinctus*
 „ *viridis*
 „ *leuckarti*
 „ *hyalinus*
Diaptomus gracilis
Eurytemora velox
Canthocamptus staphylinus

Alona affinis
 „ *quadrangularis*
 „ *rectangula*
 „ *costata*
Peratacantha truncata
Pleuroxus lævis
Chydorus globosus
Alonella excisa
 „ *exigua*
 „ *nana*
Anchistropus emarginatus

5. EXAMPLES OF "SPHAGNOPHIL" FAUNA

(A) BUXTON HEATH. 30/5/27. Squeezing from moss

Canthocamptus weberi
 „ *pygmæus*
 „ *echinatus*
 „ *Zschokkei*
Epactophanes muscicola
Cyclops languidoides muscicola

(B) NEWTON COMMON. 13/5/21. Sphagnum pool

Acantholeberis curvirostris
Chydorus ovalis
 „ *sphæricus*
Canthocamptus weberi
 „ *pygmæus*
Moraria brevipes
Cyclops vernalis

6. EXAMPLES OF BRACKISH WATER FAUNA—ENTOMOSTRACA

(A) BREYDON WATER, in *Zostera*. 5/6/21

Halicyclops magniceps c.c.
Ectinosoma curticorne c.
Dactylopusia neglecta c. (Ostracoda omitted)
Nitocra typica
Mesochra lilljeborgii
Nannopus palustris
Platychelipus littoralis
Tachidius littoralis c.

In plankton

Acartia bifilosa
Centropages hamatus
Eurytemora affinis

(B) HORSEY WARREN. 19/11/20

Old Hundred Stream. Salinity 12.2 grms. Chlorine per litre

Mesochra lilljeborgii
Nitocra spinipes

Adjacent ditch. Salinity 11.6 grms. Cl. per litre

Nitocrs spinipes

Another ditch. Salinity 4.8 grms. Cl. per litre

Cladocera

Acroperus harpæ
Alona affinis
Chydorus sphæricus

Copepods

Cyclops viridis
 „ *agilis*
 „ *lubbocki*
Mesochra rapiens
Laophonte mohammed
Canthocamptus staphylinus
 Ostracod
Cypridopsis aculeata

7. BREYDON WATER. 1/12/20

Tide beginning to flow. Salinity at surface rising from 56.7 grs. per gallon to 116.9

Fresh-water species

(surface)

Daphnia pulex
 „ *longispina*
Chydorus sphaericus
Daphnia cucullata
Cyclops agilis
 „ *macruiroides*
 „ *leuckarti*
Diaptomus gracilis

Brackish species

Eurytemora affinis
Cyclops bicuspidatus-lubbocki
Dactylopusia neglecta
Ectinosoma curticorne
Mesochra lilljeborgii
Stenhelia palustris
Laophonte nana
Nannopus palustris
Tachidius brevicornis
 „ *littoralis*

8. ORMESBY BROAD. PLANKTON. 25/5/28

Phytoplankton (commoner forms)

Melosira varians dom. (*M. granulata* c)
Anabæna Spp. ccc.
Pediastrum boryanum c
Asterionella gracillima r
Ceratium hirundinella r
 (*Dinobryon* r)

Rotifera

Anuræa aculeata and *cochlearis*
Asplanchna priodonta
Notholca longispina

Entomostraca

(figures giving frequency per cent.)

<i>Daphnia lacustris</i>	...	...	23
* <i>Ceriodaphnia pulchella</i>			
<i>Bosmina longirostris</i>	...	...	60
<i>Diaptomus gracilis</i>			
adult	...	...	2
young	...	...	14
<i>Cyclops vicinus</i>			
adult	...	...	1
* <i>Cyclops leuckarti</i>			

*These two species were present, but not in the sample measured. They reach considerable numbers later in the year—*C. pulchella* to 53% in September.

9. RIVER BURE AT STOKESBY

I.

September 3rd, 1910, 12.30 p.m.

Slack-water of flood.

Daphnia longispina
Bosmina longirostris
Ceriodaphnia pulchella
Scapholeberis mucronata
Chydorus sphaericus
Cyclops agilis
 „ *hyalinus*
Eurytemora velox
Notodromas monacha
Neomysis vulgaris

II.

Sept. 4th, 4.45 p.m. tide ebbing about 4 hours.

Centropages hamatus
Acartia discandata
Cyclopina littoralis
Euterpina act uifrons
Tachidius littoralis

Oikopleura
Hormiphora
Noctiluca
Larval Polychæts, Molluscs and
Cirripedes

Melosira
Conochilus

Two collections taken at the same place within about 24 hours, showing complete replacement of fauna by salt tide.

10. COMPARISON OF THE CRUSTACEAN PLANKTON OF THE SCOTTISH AND CUMBERLAND LAKES WITH THAT OF THE NORFOLK BROADS

Northern Lakes	Norfolk Broad's
G— <i>Daphnia hyalina</i> and <i>galeata</i> large forms	<i>D. cucullata</i>
G— <i>Bosmina obtusirostris</i>	<i>B. longirostris</i> <i>Ceriodaphnia pulchella</i>
G— <i>Diaphanosoma brachyurum</i>	
G— <i>Leptodora kindti</i>	
O— <i>Holopedium gibberum</i>	
G— <i>Bythotrephes longimanus</i>	
O— <i>Polyphemus pediculus</i>	
G— <i>Diaptomus gracilis</i>	<i>D. gracilis</i>
O— „ <i>laticeps</i>	
O— „ <i>laciniatus</i> S	
O— „ <i>wierzejskii</i> S	
	<i>Eurytemora velox</i>
G— <i>Cyclops abyssorum</i>	<i>C. vicinus</i> <i>C. leuckarti</i> <i>C. hyalinus</i>

G—generally. O—occasionally. S—Scotland only.

LIST OF REFERENCES

1. 1927. Griffiths, M. B. The Phytoplankton of some Norfolk Broad's. Journ. Linn. Soc. Bot. XLVII. p. 595.
2. 1904. Gurney, R. The fresh and brackish-water Crustacea of East Norfolk. Trans. N. and N. Nat. Soc. VII. p. 637.
3. 1907. Gurney, R. The Crustacea of the East Norfolk Rivers. Trans. N. and N. Nat. Soc. VIII. p. 410.
4. 1909. Gurney, R. Estuarine Shells from Ludham. Trans. N. and N. Nat. Soc., VIII. p. 855.
5. 1911. Gurney, R. Some observations on the waters of the River Bure and its tributaries. Geog. Journ. Feb., 1911., p. 292.
6. 1912. Gurney, R. The Tides of the River Bure and its tributaries. Trans. N. and N. Nat. Soc., IX., p. 216.
7. 1915. Gurney, R. The Perch Lake at Westwick. Trans. N. and N. Nat. Soc., X., p. 23.
8. 1920. Gurney, R. A Bronze Shield from Sutton, Norfolk. Proc. Prehist. Soc. E. Anglia, III., p. 209.
9. 1921. Gurney, R. Some New or Rare British Crustacea. Ann. Mag. Nat. Hist. (9), VIII., p. 650.
10. 1923. Gurney, R. Notes on *Leander longirostris* and other British Prawns. Proc. Zool. Soc., 1923, p. 97.
11. 1927. Gurney, R. Estuarine shells in the beds of East Norfolk Rivers. Trans. N. and N. Nat. Soc., XII., p. 381.
12. 1924. Labbé, A. Introduction à l'étude des milieux marins hyperalcalins. Arch. Zool. Exp., 62., p. 401.
13. 1911. Pallis, M. On the cause of the salinity of the Broad's of the River Thurne. Geog. Journ., Feb., 1911., p. 284.
14. 1922. Redeke, H. C. Zur Biologie der Niederlandischen Brackwassertypen. Bijd. Dierk. Amsterdam, p. 329.

15. 1923. Robson, C. G. Parthenogenesis in the Mollusc *Paludestrina jenkinsi*. Brit. Journ. Ex p. Biol., I., p. 65.
16. 1872. Taylor, J. E. The Norfolk Broads and Meres geologically considered. Trans N. and N. Nat. Soc., 1871-72, p. 30.
17. 1908. Wesenberg Lund. Plankton Investigations of the Danish Lakes. General Part. p. 284.
18. 1911. West, G. S. The British Freshwater Phytoplankton. In Tansley. Types of British Vegetation, p. 201.

Further investigation of the well at Walsingham from which *Niphargus* is recorded (p. 573), shows that it is very common therein. The species has now been definitely named by Prof. Tattersall as *N. chianus* Sp. Bate, which is known also from Hampshire, Wiltshire and Dublin. Sir Sidney Harmer's specimens from Cringleford belonged to *N. aquilex*. Associated with the *Niphargus* were numbers of *Cyclops*, but these do not belong to any of the true subterranean species. They have not been sufficiently studied, but are apparently *C. languidoides hypnicola*.

III

THE SWAN-MARKS OF WEST NORFOLK

BY N. F. TICEHURST, O.B.E., M.A., F.R.C.S.

IN order to give a complete account of Norfolk swan-marks it remains to consider those that were used by owners having swans under the jurisdiction of the Deputy Swan-Master for Cambridge, Huntingdon, Northampton and Lincoln, that large area which I have elected for brevity to speak of as the Fenland. This included, as I have already shown, that part of Norfolk whose water drainage entered the Wash (*vide* Vol. XII., p. 426).

There is but little evidence as to the exact locality where the swans marked with any given mark lived. Changes of ownership were frequent, and what may be termed absentee owners were numerous. It can hardly be supposed that on the sale of a mark the birds bearing it were, as a matter of practice, caught up and transferred to the new owner's home waters, and I do not believe that in the vast majority of cases any such thing took place. It follows then that the owner's home did not necessarily coincide with that of his birds. They must indeed have often been a considerable distance apart and may even have been in different counties. Such absentee ownership was recognized and provided for in the Swan "Orders" by the granting of facilities for the appointment of deputies to act for owners at the upping and generally to look after their interests. In the west of the county, which, as we have seen, was only a part of one large swan-keeping

area, these conditions and circumstances must have been much more marked and frequent than in the more restricted and self-contained Broadland area.

Under the circumstances we have to take as Norfolk marks all those whose owners were resident in the county, though it is quite obvious that some of them must have been, and indeed had been originated outside its boundaries. It would be quite possible to divide the marks into three groups. (A) Those of Norfolk origin, which remained in the possession of Norfolk owners. (B) Those of Norfolk origin, which were later alienated out of county ownership; and (C) those of extra-Norfolk origin, which passed into Norfolk ownership. There seems to be no advantage, however, in considering such a classification, as the origin of each particular mark is quite sufficiently indicated in tracing its succession of owners. It is probable, moreover, that it is only in the case of quite a few that material is available for tracing back to the actual first owner.

In working out the changes undergone by the marks in course of time, and the successions of their ownerships, several points strike one. There is firstly the number of proprietors who possessed multiple marks, even up to five or six apiece, *e.g.*, the Megges, Finchams, Bedingfields, Hewars and Hunstons, Robert Everard, Francis Boulton, Sir Thomas Tindall and John Whetholme; and secondly the frequency with which marks changed hands within a comparatively short time. One cannot but suspect that in certain cases swans were kept quite as much, or even more, for profit as for pleasure or prestige. A third point is the remarkable length of time that it has been possible to establish that some marks were in use. Pedigrees of a century are frequent, but those of Nos. 28, 63, 99, 110 and 184 extend to two, while those of Nos. 8 and 9, the Prior of Thetford and the Prioress of St. George, cover 250 years at least, and probably considerably more.

The differences in character, tenure, usage, and method of record between Fenland and Broadland marks have already been dealt with, so it may suffice here just to mention, as examples of the comparative complexity and simplicity of the respective groups, those of proprietors who were owners in both areas, *viz.*, The Duke of Norfolk, the Earl of Sussex, the Earl of

Suffolk (the Countess, in Broadland), the Earl of Oxford, Henry Hawe, Sir James Hobart, Sir Thomas Lovell, Sir Thomas Tindall, William Yelverton, and Mr. Anguish. Curiously enough the list of dual owners also includes a marked exception, Sir Thomas Lovell's Fenland mark being essentially of a simple Broadland type, while Sir Francis Lovell's Broadland mark was distinctly more elaborate. As has already been pointed out those of Henry Hawe and Mr. Anguish were actually Fenland marks transferred at a later date to Broadland. Another exception is the exceedingly simple Fenland mark, almost unique in this area, of Henry Doyle (No. 92). It is perhaps significant that this man was not Fenland born, but a native of Suffolk, and probably took up swan-keeping on acquiring his wife's Fenland estates.

Amongst the marks are certain groups to which special attention may be drawn.

Curiously enough it appears to have been quite unusual for a swan-mark to have been derived from its owner's coat of arms. Several antiquarian writers have remarked on this and have only been able to quote one or two instances. One example was given in my paper on Broadland marks, and amongst the marks that follow some eight will be found that with a considerable degree of probability had this origin, viz. :—The Earl of Leicester (No. 22), Robert Balam (No. 37), Everard (No. 104), and Edmond Gawsell (No. 105), Thomas Guybon (No. 126), Humphrey Kervyle (No. 151), Reppes (Nos. 196—200), and Steward (Nos. 212 and 213). Then there are examples of foot- and leg-marks, *e.g.*, Robert Balam (No. 38), John Drewry (No. 158), and Francis Parlett (No. 186). Though fairly numerous in the Fenland generally, it so happens that these are the only Norfolk ones. As already pointed out this form of marking was not used in Broadland. Neither was it used on the Thames, but it was frequent in Yorkshire and examples are also to be found from the Trent, the Sussex Arun, and the Dorset Stour.

Thirdly, we have examples of lower mandible marks in No. 99 Thomas and William Coney, No. 115 Francis Gardener, No. 116 Gawsell, No. 121 John Grendell, No. 128 Reppes, and No. 167 Robert Fincham, quite a good proportion considering that their use was dying out in Elizabethan times. They

must have always been an unsatisfactory method of marking, requiring close handling of the bird to be seen, but were very frequent up to the beginning of the sixteenth century in the Fenland. Beyond the single example given in my Broadland paper I can find no evidence of their use elsewhere.

Fourthly, amongst the marks of the religious foundations we have one representative (No. 12) of a small group of Fenland Churches, in which the swan-rights appear to have belonged to the living, while a second (Thomas Gardener, No. 114) also originally belonged to the same group. With them special mention must be made of Nos. 13, 14 and 15, once owned by certain of the village Guilds. Except for the one Broadland example already given, and one from the Thames, this particular tenure is only known from the Fenland, and Norfolk can claim half the total.

While on the subject of the marks of religious houses mention may be made here of two that have been lost, or at any rate cannot now be identified. This is much to be regretted for they both go back to a very early period, the first indeed being the earliest that I can find mention of. It is referred to in a deed which Blomefield appears to have seen and which he quotes in the course of his remarks on the manor of Cokesford in Kilverstone (*H. of Norfolk*, Ed. II., vol. I., p. 544). "In 1230, there was a dispute between Richard, Prior of Thetford, and William, Prior of Cokesford, concerning their separate fisheries belonging to their manors here; 'concerning the use and propriety of all the fishing lying between the territory of Snareshill, and the territory of Kilverstone, the Prior of Thetford claiming the whole of the water or river from his mill called Melford Mill, to the extent of his town of Snareshill', viz., the whole of Snareshill side, as belonging to his free fishery there, and this side, as belonging to his manor here; but the Prior of Coxford having a free fishery to his manor here, claimed an equal share on this side; and it being proved to be so, the Prior of Coxford let his right for ever to the Prior of Thetford for 8s. a year. But the Prior of Coxford reserved to himself his swan-mark, belonging to his manor, throughout the whole river, with liberty to gather reed and grass at all times in the said river, with the consent of Richard, Bishop of Norwich."

Blomefield goes on to state that there was then (1736) a

swan-mark belonging to this manor. If this was the same mark, as to which there is no evidence, it would constitute a remarkable record of use for over five centuries. The manor passed through the hands of only three families after the dissolution, the Duke of Norfolk, the Cornwallis's and the Wrights of Kilverstone. The latter purchased it in 1587, so that if they used the swan-mark the name Thomas Wright ought to be found on a swan-roll somewhere. So far it has not come to light.

The second early mention of swan-keeping concerns the little Priory of Mirmound in the parish of Upwell, and must refer to very much the same date. The Priory was founded in the reign of Richard I. (1189-1199) by Sir Ralph Hauvyle and was endowed by him with certain property in Upwell and Outwell. "Sir Thomas, his son and heir, confirmed the same, and granted liberty of pasture for four mares with their foals; also four couple of swans, paying 5s. rent per annum" (*l.c.*, vol. VII., p. 477).

Fifthly, attention may be drawn to the colloquial names by which certain of the marks were known. Of these there are quite a number of instances. I have remarked elsewhere (*Brit. Birds*, Mag. XIX., p. 294) that most marks probably had names by which they could be spoken of or written about, but that few of them have come down to us. Most of them are curious and seem somewhat far-fetched as descriptive of the marks, and not a few are incomprehensible. This may to a slight extent in one or two cases be due to faulty reading, as the ink in the MS. from which they were taken is very faded in places. One or two are obviously abbreviated and must be guessed at, but others about which there can be no error seem to be old provincialisms, whose meaning is not at all apparent. I need not add that any suggestions as to the meaning of these would be welcomed by the writer.

The material on which this paper is based is derived from the following nineteen rolls:—Additional MSS. 4977, 6301, 6302 and 40072, Harley MS. 3405 and Egerton MSS. 2412 and 2413 in the British Museum; MSS. Rawlinson B42 and B277 in the Bodleian Library, The Colville and Wisbech Museum Rolls in the Wisbech Museum, the Bromhead Roll in the Public Library at Lincoln, the Roll in the Public Record Office and the

Stow Bardolph, Cooper, Marriott, Burghley, Swatman and Towneley Rolls. I must here record my indebtedness to the custodians of the different public institutions named, as well as to Sir Thomas Hare, Bart., (the late) Mr. Henry F. Cooper, the Rev. H. S. Marriott, the Marquis of Exeter, and Messrs. Quaritch for the facilities they have granted me for examining the rolls in their several possession. Of the above, the Colville and Bromhead Rolls are modern copies, all the others are original documents. All are books except the Public Record Office Roll and Add. MS. 40072. The Public Record Office Roll, MS. Rawlinson B277 and the Colville Roll show the whole of the birds' head in profile; the others the bills only in plan. The same three with MS. Rawlinson B42 and the Wisbech and Towneley Rolls only are coloured. Egerton MS. 2412, the Stow Bardolph and Towneley Rolls are on paper, all the others on vellum.

Besides noting all those cases where marks from different rolls are quite identical and recording their owners' names, it has been necessary to draw and note the ownership of over 870 that differed sufficiently to convince one that the variations were intentional and of purpose.

In arranging the marks in the annexed list I have followed the general order of the rolls, the Royal marks coming first, then those of the Religious foundations and allied bodies, those of Peers and then those of Commoners in alphabetical order. It has thus been necessary to assign each mark to a single owner and, so far as it has been possible, I have awarded it in each case to the earliest certain Norfolk man to own it. It must be obvious nevertheless that in dealing as we are with a considerable period of time and with the constant changes of ownership that were taking place both within the county and outside it, the owner given is frequently not the actual earliest. With regard to the owners themselves there must inevitably be cases where information about them is not as full as is desirable and I shall be only too grateful for any help or suggestions for filling up gaps in this respect. Many owners no doubt belonged to the yeoman class, or to well-to-do merchant families, and details of their pedigrees seem to be hard to gather. In particular more exact information is desirable about the numerous owners who were citizens of King's Lynn,

but especially I should like to know more about the families of Damett, Lambert, Laverocke, Megges, Norman and Walsingham, who were all settled in the Upwell-Outwell district.

1, 2, 3, 4. These four were the royal marks used in the Fenland. Nos. 1 and 2 were used throughout the whole area, and are probably the oldest. No. 2, known as the mark of the Sword, was restricted in use to Swans belonging to the manors of the Duchy of Lancaster. These two are found on every Fenland roll except the one at Stow Bardolph, which only catalogues the marks of owners having Swans in the waters on either side of the Norfolk-Cambridge Ouse. The royal marks given on this and on some other rolls are Nos. 3 and 4, so that it seems probable that these were restricted in use to the southern half of the Fenland. No. 3, which goes back at least as far as the reign of Henry VIII., was used then with a gap at either extremity of the inverted chevron; as drawn here it dates from the reign of Elizabeth. In Stuart times it was restricted in use to the Swans owned by the Queen Consorts. No. 4, which remained in later use for the birds of the Stuart Kings, antedates the accession of Elizabeth and so from its character and obvious origin cannot be of later date than the reign of Edward VI. and may of course be even older.

5. THE PRIOR OF CASTLEACRE.—After the dissolution this mark became the property of Arthur Hewar of Oxborough (*vide* No. 131) and then of Thomas Welby of Sutton in Holland and so passed out of Norfolk ownership.

6. CASTLEACRE PRIORY.—After the dissolution this mark also passed out of Norfolk ownership. It was granted to William Thomasin of Parson Drove, who was alive in 1549, and after him was held by a succession of proprietors, who belonged to the Wisbech area.

7. THE ABBOT OF DEREHAM.—The mark belongs to a very small class in which a reference is traceable to the owner's calling. This one and the mark of Swineshead Abbey in Lincolnshire are the only two examples in the Fenland that contain a representation of an Abbot's staff. On the Thames nearly every monastic house adopted this as part of its mark. After the dissolution this mark passed with the grant of the

site of the Abbey to Thomas Dereham of Crimplesham in 1541 and seems to have continued in his family (*vide* No. 85).

8. THE PRIOR OF THETFORD.—Martin (*Hist. of Thetford*, p. 293) in giving this mark as that of “The Prior of the Canons’, now Lord Petre’s” is clearly in error, and this double title is in a sense contradictory. Two swan-rolls give this mark quite distinctly for the Prior of Thetford, *i.e.*, the Prior of the Monastery of the B.V. Mary. After the dissolution the possessions of this house were granted to the Duke of Norfolk, under whose name the mark is to be found on six other rolls. Robert Edward, 9th Baron Petre, who married in 1762 Anne, the niece, and in 1777 one of the co-heirs of Edward, 9th Duke of Norfolk, would quite probably have been the owner at the time of publication of Martin’s *History* (1779). The possessions of the Canons of Thetford, as Martin himself states, were granted to Sir Richard Fulmerstone (*vide* Nos. 10 and 113).

The modern roll in the Castle Museum gives this mark for J.S.N.N. Skipworth, and its inclusion in this roll presumably indicates that it was transferred at the end of the 18th century to the Broadland area.

9. THE PRIORESS OF ST. GEORGE, Thetford.—The ascription of this mark to the Prioress of St. George is on Martin’s authority, for on the swan-rolls it appears under no other name than that of Sir Richard Fulmerstone, to whom the possessions of the Priory were granted at the dissolution. He seems to have varied the position and number of the gaps from time to time and to have added an annulet at the right tip, presumably for use in different waters or in order to keep account of the birds’ ages and relationships. In 1771 Martin tells us that the mark then belonged to Henry Campion.

10. THE CANONS OF ST. SEPULCHRE, Thetford.—This mark is also taken from Martin, and is not to be found as here drawn and named on any swan-roll that I have seen. I am of opinion, however, that marks Nos. 113 and 72 *infra* are direct derivatives of it and show two successive steps in “differencing.” The possessions of the monastery were granted at the dissolution to Sir Richard Fulmerstone, whose modification of the mark is given at No. 113.

11. THE HOSPITAL OF ST. MARY MAGDALEN, Gaywood.

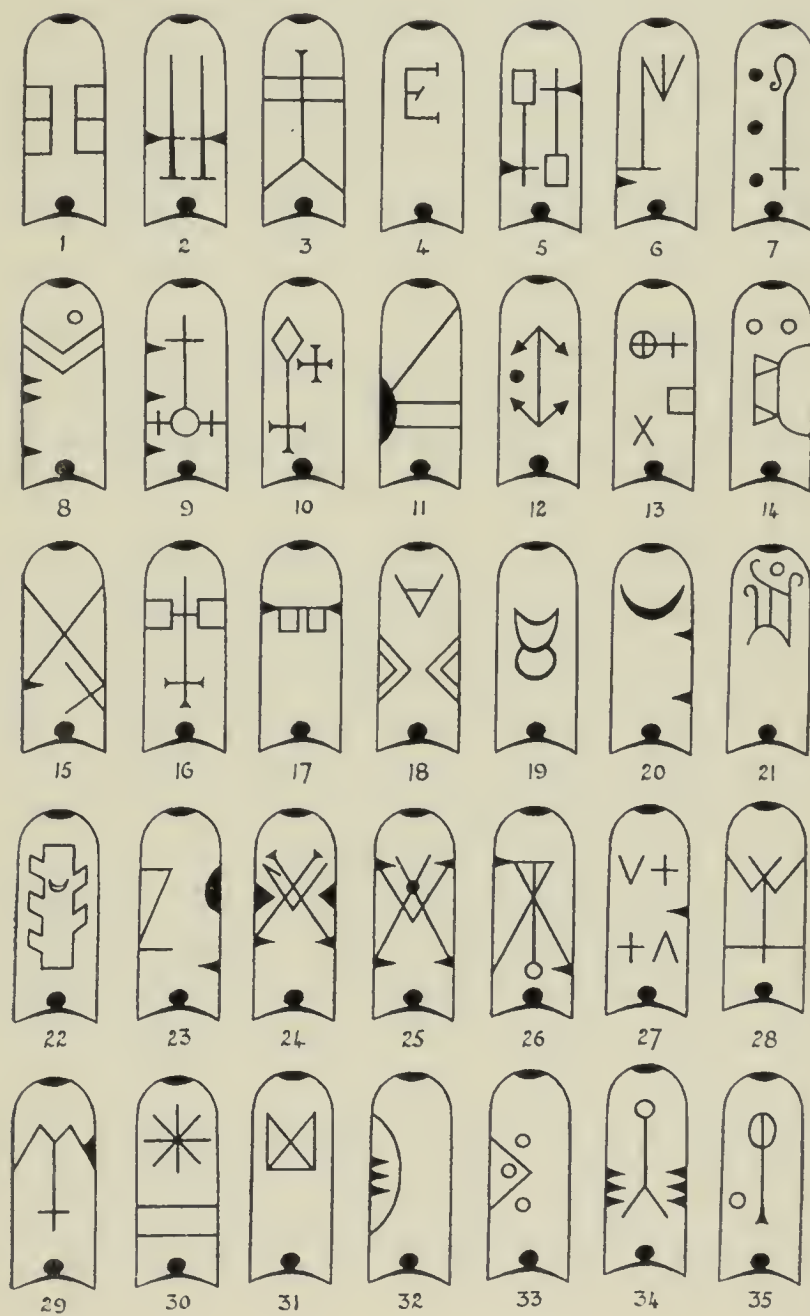


FIGURE 1

12. THE CHURCH OF ST. CLEMENT, Outwell.—This is the only Norfolk member of a group of some six or eight south Fenland Churches that anciently possessed a swan-mark and whose ownership seems to have been vested in the living. What became of this one after the dissolution is not recorded.

13. THE GUILD OF ST. JOHN, Upwell.—After the dissolution this mark was owned by Thomas Hilbrande, whom I have not identified, and then by James Hobart (1524-1615), who succeeded to Hayles Hall in Loddon in 1561. Both “differenced” the mark by adding a gap within the lateral square.

14. THE GUILD OF ST. CLEMENT, Upwell.—After the dissolution it was used in succession by the Townsend and Pratt families, presumably of Rainham and of Hockwold, or Ryston, respectively, but as no christian names are giving, identification must be uncertain.

15. THE GUILD OF THE HOLY TRINITY, Walsoken.—The ownership of this mark after the dissolution is not recorded.

The last three marks are an interesting group and, together with the Stalham one given in my Broadland paper, make four out of the total of eight that are known to have been owned by these old village Guilds. Of the remainder, no place name is given with one, two belonged to Croyland in Lincolnshire and one to Holme in Huntingdonshire.

16, 17. THE DUKE OF NORFOLK.—No. 16 was probably, at any rate originally, not used in Norfolk waters, as it belonged to Lord Willoughby D'Eresby and then passed by the marriage of Catherine, Baroness Willoughby, to her husband Charles Brandon, Duke of Suffolk, who died in 1545, possessed, like the Lords Willoughby, of large estates in Lincolnshire. How it subsequently became owned by the Duke of Norfolk does not appear. As originally used by Lord Willoughby the mark included a gap on the left side at the tip of the bill. No. 17 seems to have been the family mark of the Howard Dukes of Norfolk.

18. THE EARL OF SUSSEX.—Sir Robert Ratcliffe of Attleborough, Lord Fitzwalter, was created Earl of Sussex in 1530, and the title continued in his family till 1641. How far back the use of the mark extended is uncertain. The Dukes of Norfolk and the Earls of Sussex both had large possessions

in Norfolk and owned Swans in both the Broadland and Fenland areas. As was usual in such circumstances each used quite different marks in each area. A comparison of the two sets illustrates very well the comparative simplicity and complexity of the two types.

19. THE EARL OF WILTSHIRE.—Sir Thomas Boleyn of Blickling, created Earl of Wiltshire in 1529, was Steward of the Duchy of Lancaster for Norfolk, Suffolk and Cambridgeshire and died in 1539, when the title became extinct. What afterwards became of the mark is unknown.

20, 21. THE EARL OF OXFORD.—No. 20 appears to have been the original mark of the de Veres, Earls of Oxford, but how far back its use extended is unknown. In the seventeenth century it belonged, presumably having been sold, to a family named Parris, perhaps the Cambridgeshire one of that name.

No. 21 is a mark of considerable antiquity, the earliest owner being an unknown named Davies. He was succeeded by Earl Rivers, a title that became extinct at the death of Richard Woodville, 3rd Earl in 1491. The first Earl of Oxford to own it therefore was probably John, 13th Earl, who died in 1513. They owned large estates in West Norfolk especially in the Marshland division, where no doubt their Swans were kept and whither presumably the Swans marked with No. 21 were imported by them from Northamptonshire about the end of the fifteenth century. The later owners would have been John, 14th Earl, 1513-1526; John, 15th Earl, 1526-1539; John, 16th Earl, 1539-1562; Edward, 17th Earl, 1562-1604 and Henry, 18th Earl, 1604-1625.

22. THE EARL OF LEICESTER.—Robert Dudley, created Earl of Leicester in 1564, died 1588, was connected with Norfolk by his marriage with Amy, the daughter of Sir John Robsart of Siderstone. His mark is of interest because of its heraldic origin, having been taken from his well-known Badge of the ragged staff.

23—26. WILLIAM ATKIN, of King's Lynn, Mayor in 1619. Nos. 24 and 25, evidently variants of one another, are only found on a single roll and so probably had no earlier owner. No. 23 had previously been owned by someone named Bayston and No. 24 by Robert Raymond and William Stalton, whom

I have failed to identify, though I suspect that all three were also citizens of Lynn.

27. THOMAS ATTHOW, of Well Hall, Beechamwell and King's Lynn, Sergeant-at-law. He presided at a Court of Swan-mote held at Wisbech in 1578, whose proceedings are recorded in a manuscript in the Bodleian Library. This mark had previously been owned by James Boulton, whom I have not been able to find.

28. JOHN ATTHOW, SENIOR, of Brisley.—This mark had a long succession of owners, John Harrison of Soham, Cambs., who died in 1541; the Faunts, presumably of Foxton, Leicestershire, though originating at Whistow in Huntingdonshire and possessed of a family mark of their own; then the present owner, who seems to have been the first Norfolk man to hold it. He cannot have held it long, for early in the seventeenth century (or before) it belonged to the Fennes, who were considerable landholders in Wiggenshall, Tilney, Terrington and Lynn at that period. It first belonged to William, whether that one who was at Wiggenshall in 1589 I am not sure, but it came to Thomas Fenne in 1622 and evidently continued in the same family until the failure of the male line, when it passed by marriage to the Harwicks of Eaubrink and was held by Fenn Harwick in 1710.

29, 30, 31. PHILLIP AUDLEY, of Palgrave Magna, born before 1563, alive in 1592. All three marks had previously belonged to the Lords Dacres of the South. There is no evidence as to how the Audleys became possessed of them, but perhaps they were allowed by grant from the crown to Phillip, or more probably his father Edmund, after the attainder and execution of Thomas Fiennes, 9th Baron Dacres, in 1541. His son Gregory was not restored to his honours until 1558. In most instances the marks are recorded under the surname only and Phillip is the only member of the family definitely given anywhere, so that we do not know whether Edmund held the marks or not. Phillip died without male issue and they were subsequently owned by Lord Thomas Howard, who was created Baron Howard de Walden in 1597 and Earl of Suffolk in 1603.

32, 33. BADGECROFT, of Bexwell.—Nowhere is any christian name given with either of these marks, but No. 33 was probably the original family mark as it never occurs under

any other name. In some rolls the mark is drawn as here, with annulets, and in others with roundels, presumably a method of "differencing." No. 32 had an earlier owner, Thomas Vowell, whom I have failed to find, though there was a family of that name connected with Creke Abbey, of whom William was alive in 1551. One of the Badgcroft owners must have been Richard, who died in 1549, for on three rolls a later owner, Skipwith, is given. There cannot be much doubt therefore that Richard devised the mark to his daughter Ellen, or to her husband William Skipwith of Snowre Hall in Fordham, who died about 1588. He "differenced" it by moving the design to the opposite side of the bill. One of his descendants used it on both sides at once.

34. EDWARD BAKER, of King's Lynn, Common Councillor in 1523 and 1537 and Mayor in 1540, died 1540. A second Edward Baker was Mayor in 1550. This mark was held by a succession of Lynn families of whom the Bakers seem to have been the earliest. Thomas Waters, who was Mayor in 1551 and 1558 and M.P. in 1542 and 1553-57 succeeded and was followed by Segrave and Fenne (no christian names given), John Atthow senior of Brisley (*vide* No. 28) and Thomas Atthow, sergeant-at-law (*vide* No. 27).

35. WILLIAM BAKER, of East Walton.—There were two earlier owners of this mark, Robert Sumpter and Thomas Boyes, but I cannot find either of them. The former used it with the addition of a gap at the left base, while the latter used it with a gap on the left, half way down the bill, a semi-circular mark opposite to it, and no annulet.

36. RICHARD BAKER *alias* LADDE, of Terrington, who was alive in 1558 and 1590.

37. ROBERT BALAM, of Walsoken, alive in 1547. He succeeded to this mark from his uncle Alexander, who was a Wisbech man, Alderman of the Guild of the Holy Trinity there in 1524-5 and 1531-39, and died without issue. It is probably derived from the family arms, though altered in the process, the fesse being changed into a bend. The arms were :—Sable, on a fesse between three estoiles argent as many pellets.

38. ROBERT BALAM, *idem*.—This mark originally belonged to Thomas Maltward of King's Lynn, who was alive in 1548,

and was obviously compounded of his initials. It must be presumed to have been purchased from him by Robert Balam, who added the foot-mark and the gap by way of "difference." From him it descended to his first cousin and heir John Balam of Barton Mills in Suffolk, and so to his son Alexander of Beaufort Hall in Elm, Isle of Ely.

In the inscription, describing the foot-mark, "heelee" means the hind-toe, a comparatively degenerate structure in the Anatidæ and one whose loss would have been no detriment to the bird. Curiously enough not one roll states which of the two hind-toes had to be removed.

39. THOMAS BARROW, of Shipdam.—The mark was "differenced" by one of his successors (christian name not given) by adding a gap at either end of the larger triangle. An earlier owner was William Wolsey, whom I cannot identify.

40. NICHOLAS BEAUPRE, of Beaupre Hall, Outwell, d. 1513. There is no record of this mark having descended to his son Edmond, but it evidently did so as it afterwards followed the same succession as his marks, Nos. 41 and 42, to Sir Robert Bell and his son Sir Edmund. A mark which is almost indistinguishable from this one is recorded on several rolls for Robert Hall of Outwell or for Thomas Rearby, but I have failed to find any particulars about either of them. The mark was known by the name of "ye acre staffe and shard." Acrestaff is another name for plough-staff and I suspect that shard is a misreading for share.

41, 42, 43. EDMOND BEAUPRE, of Beaupre Hall, son and heir of Nicholas (No. 40) whom he succeeded in 1513. At his death in 1567 he left his daughter Dorothy his heir. In 1559 she had become the third wife of Robert Bell, Sergeant-at-law, who was knighted in 1576 and made Chief Baron of the Exchequer in 1577, dying the same year at the Black Assize at Oxford. Their son Sir Edmund Bell succeeded to the Beaupre Hall estates together with marks 41 and 42.

No. 43 is only recorded for Edmond Beaupre, unless No. 84 *infra*, given on every roll for Deane is a "differenced" variant of it.

No. 41 was known by the name "sp. graynes" and No. 42 as "ye chevins," as to the meaning of which I am unable to offer any suggestions.

44—48. SIR EDMUND BEDINGFIELD, of Oxborough, knighted 1523, died 1553. It is possible that some or all of these marks belonged to an earlier owner of the same name, but I take this man as being the earliest certain one. Nos. 46 and 47 are catalogued for him only, but the others, as they occur on different rolls, give, except for one generation, a complete succession of the Oxborough family, viz. :—Sir Henry, who was knighted in 1548 and died in 1583, Edmond who succeeded him and died in 1585 and (Sir) Henry, who succeeded as a minor in 1590 and died in 1657. Thomas his father, who succeeded in 1585 and died in 1590, does not occur. Nos. 44 and 45 are obviously variants of one another and were perhaps created by Sir Edmond or one of his predecessors from a still earlier original. There can be no doubt however that they were used as distinct marks, probably in different waters, as they occur together on several different rolls and each was further “differenced” by successive owners. Thus, Sir Henry added an additional gap at the middle of the left margin to 44, Edmond omitted the annulet and distal gap and the later Henry omitted the distal gap in No. 45.

49. BEDINGFIELD, of Oxborough.—This mark is probably a later-made variant of No. 45. It occurs on two rolls, as here drawn with the two basal gaps on the right, but in neither case is any christian name given. The probability is, however, that either Edmond (1583-5) or Thomas (1585-90) originated it. Sir Henry, who succeeded in 1590, was Sheriff of Norfolk in 1620 and died in 1657, used it with the gaps omitted.

50. ANTHONY BEDINGFIELD, of Holme Hale, *viv.* 1559. His son and heir Lawrence “differenced” the mark by moving the gap to the right-hand end of the basal bar.

51. JOHN BEDINGFIELD, of Quidenham, d. 1545, a nephew of Sir Edmund Bedingfield of Oxborough. The mark was also used by Humphrey his son, who sold Quidenham in 1572 and moved to Wiggenhall St. Mary, being still alive in 1584. He “differenced” it by placing the gaps on the left side one in front of and one behind the distal cross-bar, as in No. 52.

52. EDMOND BEDINGFIELD.—It is difficult to decide the identity of this owner, as several people of the same name are possible. The mark is obviously a variant of No. 51, and it is not improbable that Humphrey sold it (he had no male heir to

succeed to it) when he disposed of Quidenham in 1572. Edmund Bedingfield of Eriswell, his second cousin, who succeeded to the Oxborough estates in 1583, may have been the purchaser. At the beginning of the seventeenth century it belonged to Robert (or Roger ?) Hobart, whom I cannot find.

53. RICHARD BINKNORTH.—The name also occurs as Binkworth and Bukworth on different rolls, but Martin (*t.c.*) gives it as here spelt. The owner was presumably a Thetford man and bequeathed the mark to the Town, since it was afterwards the Corporation mark.

54. RICHARD BINKNORTH, *idem.*—This mark passed to Sir John Springe of Hitcham in Suffolk (knighted 1546, died 1547) and was afterwards one of four used by Thomas Gray of Wisbech (d. 1593-4), and so for about half a century it passed out of Norfolk ownership. After Gray's death, however, it became the property of Francis Parlett of Wiggshall, who was Recorder of Lynn, and died in 1605. By a process of exclusion I believe this mark to be the one referred to in Gray's will by the name of "the Bowne Copelles or Copell Spares," the meaning of which is obscure. It was devised to his nephew Henry Gray after the death of Ralph Gray testator's uncle. Shortly after it was the subject of proceedings in the Court of Chancery in which Henry Gray was plaintiff and William and Francis Parlett defendants (*Cal. Proc. in Chanc. temp Eliz.*, vol. I). In the *Calendar of Proceedings* the result of the action is not given, but Francis Parlett evidently obtained possession, as the mark appears on several rolls under his name and is nowhere given for either Ralph or Henry Gray. In the *Calendar* the name of the mark is written "Bound Coples or Copled Sparres." As used by Sir John Springe it was "differenced" by the addition of a small cross placed centrally between the cross-bar and the gaps.

55. FRANCIS BOULTON, of Burston, married in 1571, dead before 1583. Although resident outside the Fenland area this man was a very extensive owner of Swans and possessed no less than six marks. His son Edward died without issue and they seem to have been dispersed to other owners. The present one passed to Edward Hudson of Castleacre and then to John Elkin, whom I have not identified.

56—58. FRANCIS BOULTON, *idem.*—Neither 56 nor 57 are

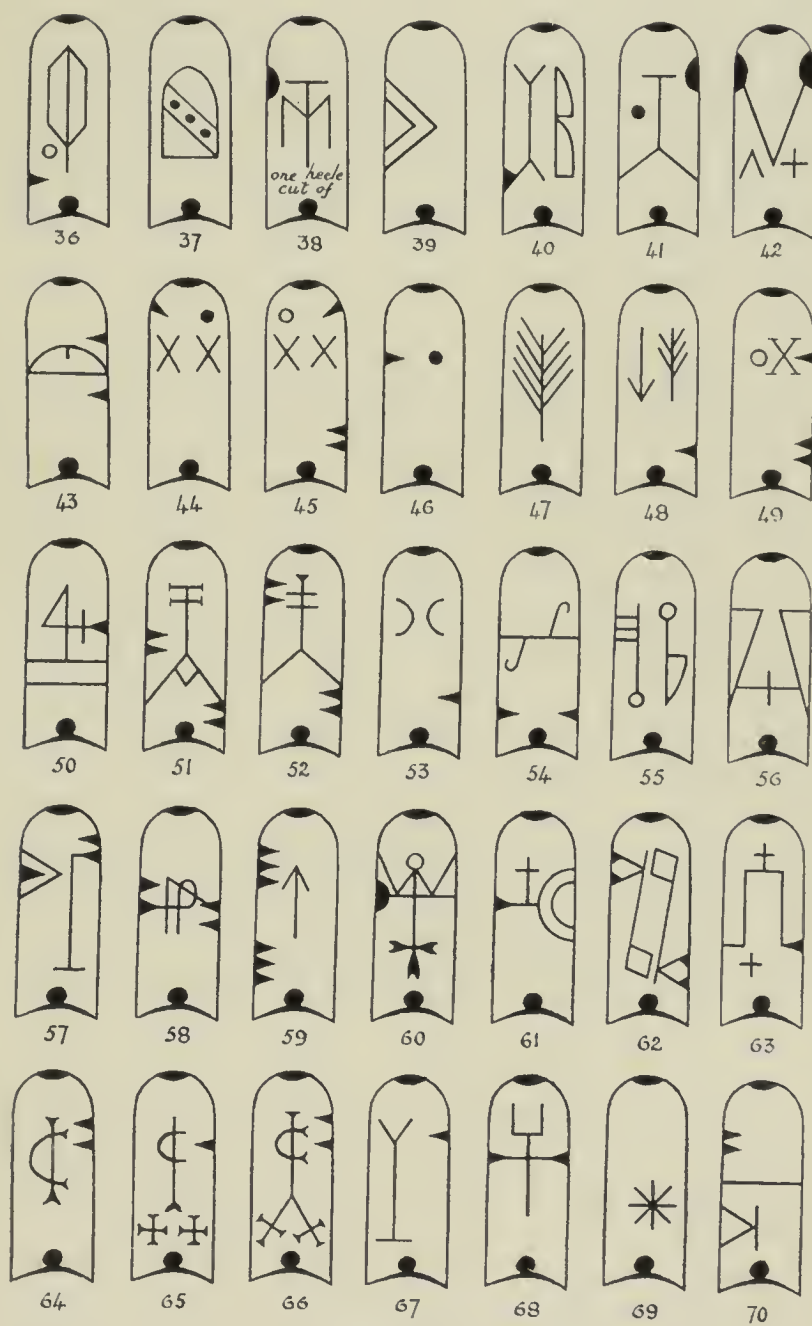


FIGURE 2

catalogued for anyone else, but No. 58 passed out of Norfolk ownership becoming the property of Sir John Stanhope of Harrington, Northants., who was created Baron Stanhope in 1605, and died in 1620. It was known by the name of "ye wrangle" and whether there be any connexion or not it is identical with the device, which combined with his initials, was used by William Caxton, first at the beginning and later at the end of the books printed by him; see Plomer, *English Printers*, where it is stated to be a monogram of the date 1474. (For Francis Boulton's other two marks, *vide* Curson, Nos. 77 and 78).

59. THOMAS BRADBURY, of Ashill, *viv.* 1571.—On most rolls no christian name is given, but the mark evidently belonged to a succession of owners of this family. One of them "differenced it by adding a fourth gap to the distal group of three; another by transferring all six to the right side of the bill, while a third grouped them all together in a continuous series.

60. JOHN BULL, of Hockwold, Bailiff and Farmer of Methwold Warren under the Duchy of Lancaster in 1550. After his death it was used by his son Edward Bull, who apparently sold it to Thomas Wattes of Cockfields Manor, Hockwold, who owned it in 1609.

61. JOHN BULL, *idem.*—This mark was presumably devised to his daughter Joan, for it is recorded in one roll for her husband, Leonard Barrett of Deforden, Cambs. Like No. 60 it was afterwards acquired by Thomas Wattes.

62. ROBERT BUTLER, of Walpole, d. 1630.—There was a succession of earlier owners of this mark, Richard Field, Blinkhorne, and John and Robert Rodgman, but I have not succeeded in identifying any of them. It was alienated to Robert Butler about 1610. After his death it belonged to the Coneys of Walpole, but is nowhere recorded with a christian name.

63. ROBERT BUTLER, *idem.*—This too had several earlier owners, Richard and Robert Gibson and John Keye, who although unidentified were almost certainly Lincolnshire people. Butler's immediate predecessor was John Wright, from whom he acquired the mark by his marriage with Elizabeth, either John's daughter or widow. Like No. 62 it passed after Butler's death to the Coneys of Walpole, the earliest

recorded of whom is Robert, who was born in 1633 and died in 1707. He dropped the gap by way of "difference." The last recorded owner is his grandson Edwin, who was Sheriff of Norfolk in 1734 and died in 1755, aged 68. He "differenced" by omitting the cross and adding an , evidently derived from his christian name, centrally placed, proximal to the main design

64. JAMES CALTHORPE, of Cockthorpe, died about 1558.

65, 66. CALTHORPE.—These two marks are evidently successive elaborations of No. 64, and form an interesting example of the evolution of a somewhat complicated mark from one that began as a simple monogram of the original owner's initials. Unfortunately the latter two are nowhere given with a christian name attached, so that it is not possible to be sure who made the changes. The original James, however, was succeeded at Cockthorpe by his son Christopher, his grandson Sir James who died in 1615, aged 57, his great-grandson Christopher, who died in 1625, and his great-great-grandson James, alive in 1643, which brings us near to the end of the period with which the swan-rolls deal.

67. CALTHORPE, *idem*.—This mark was originally the property of Robert Wright, whom I have not identified, but as his name appears in the Stow Roll, he was probably a Norfolk man, or perhaps the London man of that name who owned property in Thetford in 1555. It was then held for a time by Robert Tigh of Deeping St. James in Lincolnshire and subsequently came to the Calthorpes and after to the Walpoles, presumably of Houghton.

68. GREGORY CARTER, of West Walton, *viv.* 1564.

69, 70. RICHARD CLARKE, of King's Lynn, Collector of the Port, Alderman and M.P. 1586 and 1588, died 1603.

71. JOHN CLARKE, of King's Lynn, Mayor in 1606.

72. SIR EDWARD CLERE, of Blickling, Sheriff of Norfolk in 1567 and 1580, knighted 1578. This is the mark, "differenced" by the addition of the two short bars at the tip of the bill, which came to him through his marriage with Frances, the daughter and heir of Sir Richard Fulmerstone, who died in 1566. He in turn had succeeded to it on acquiring the property of the Canons of St. Sepulchre at Thetford (*cf.* Nos. 10 and 113).

Being an absentee owner, Sir Edward Clere, appointed John Tirrell to act as his deputy to look after his Swans in Fenland waters. The original appointment, dated May 24th, 1576, was formerly amongst Martin's MS. collections.

73. FRANCIS COLVILE.—Although the Colviles of Newton Hall near Wisbech were not strictly speaking a Norfolk family they owned at one period large properties in Marshland. Francis, who died in 1494 possessed of manors in Walsoken, Walton and Walpole, was the original owner of this mark, but his successors cannot be traced as it is nowhere given with any other christian name.

74, 75. HUMPHREY CONEY, of Wiggshall St. Peter.—Both these marks are given on most rolls, but in nearly every case under the surname only or as "Coney of Marshland." Humphrey, who died some time before 1581, is the only member of the family definitely mentioned. No. 74 was at one time owned by the Hartes, presumably of Walpole, but whether before or after the Coneys is uncertain. In the seventeenth century it belonged to Richard Reynolds, at present unidentified.

76. WILLIAM CONINGSBY, of Eston Hall, Wallington, which he bought in 1525. He was Recorder of Lynn, was knighted on being made a King's Bench Judge in 1540 and probably died in the same year. The mark occurs on many rolls under the surname only, so there is no evidence as to whether it was used by his son Christopher or not, and what became of it after the latter's death without issue in 1547 is unknown. It appears to be a rather striking elaboration of the owner's initials.

77, 78. ROBERT CURSON, of Carleton Rode.—After his death both marks became the property of William Boulton of Boyland Hall in Bressingham, who had married Robert's daughter and heir Elizabeth. From him they passed to his son Francis of Burston (*vide* No. 55). No. 78 was differenced by the Boultons by transferring the gap to the opposite side of the bill. No. 77 was afterwards owned by John Wingfield, perhaps John of Winch (*vide* No. 234), while 78 went to James Boulton, but what his relationship was to Francis, who had no surviving son, does not appear.

79. WILLIAM DAMETT, of Upwell, d. 1527.—The mark went from him to Thomas Welby of Moulton in Lincolnshire and so passed out of Norfolk ownership.

80. WILLIAM DAMETT, *idem*.—This mark, known by the name of the “Dobyll byll,” was afterwards owned by the Laverocks of Outwell. The only one of them definitely named is John, and he “differenced” it by moving the two gaps on the left close together near the tip of the bill and omitting the one on the right.

81, 82. DAMETT.—Presumably these marks belonged to William or to some other member of the Upwell family, though no particular one is mentioned on any roll. No. 81 is not given for any other owner, but No. 82 passed to John Peyrse (also spelt Perys, Perris, Perry, Perse or Percey !) of Northwold and his son Robert after him.

83. WILLIAM DAY, of Feltwell, who died about 1548. The mark, known by the name of “ye sheris nedill and thm” (presumably “thimble”), was earlier the property of Robert Sumpter, whom I have not identified. Robert Day of Feltwell, alive in 1605, afterwards owned it and it subsequently went to John Wace of Feltwell, who died in 1672.

84. DEANE.—This mark, though it occurs on every Fenland roll, is nowhere given with a christian name attached, but there can be little doubt that it belonged to the Deanes of King’s Lynn, Wiggenhall and Tilney. Successive members of the family “differenced” it by altering the position of the gaps on the right edge of the bill, or by omitting the cross. It is not improbable I think that it is a derivative of Edmund Beaupre’s mark No. 43.

85. THOMAS DEREHAM, of Crimplesham, who was granted West Dereham Abbey in 1541 and died in 1554. Though it is quite certain that the mark goes back to this owner, it may be a good deal older, as there were three generations of Thomas’s before him, the earliest of whom was alive in 1404. One roll in fact gives the owner as John Dereham, and if this is not an error for Thomas, it would carry it back a generation further still. Sir Thomas Dereham, who was knighted in 1617 and died in 1645, Thomas’s grandson, used the mark “differenced” by the addition of a gap on each side opposite the centre of the catherine wheel.

86, 87. JOHN DETHICKE, of Wormegay, which was granted him in 1540. No. 87 is not given for any other owner, but No. 86 was used by his son Edmund, who died in 1566, after

which there is a gap in the succession, though the fact that seven rolls give the mark under the surname only probably represent further generations of the Dethicke family. Early in the seventeenth century, however, it passed to Robert, 3rd Baron Rich, who was created Earl of Warwick in 1618 and died the same year. He owned the manors of West Winch, Little Buckenham, Hilburgh, the Abbot of Dereham's manor in Barton and Overhall in Boughton, all in the Fenland part of Norfolk.

88. EDMUND DETHICKE, of Wormegay, d. 1566, son of John, No. 86. After his death the mark probably passed to one of his sons, for three rolls give it under the surname only, but "differenced" with an additional gap at the right-hand end of the cross-bar. It afterwards became the property of Francis Gawdy of Wallington, who was knighted in 1603, made Lord Chief Justice of Common Pleas in 1605 and died in 1606, after which it passed like No. 86 to the Earl of Warwick.

89. WILLIAM DICHER, of King's Lynn.—Earlier owners were Robert and Richard Blewitt and Robert Knight, whom I have not identified. They may have been, but I am inclined to think were not, Norfolk men. The mark was also owned at one time by Audley Baker of Terrington, who died before 1646, but whether before or after William Dicher is uncertain.

90. JOHN DIGGLE, of Walpole, *viv.* 1564.

91. JAMES DOWNES, of Bodney, alive in 1558 and dead before 1571. The mark occurs in eight rolls under the surname only, in three of them without any gap and in two others with two gaps, so that it probably descended to James's son Thomas, who was alive in 1615 and the latter's daughter Elizabeth.

92. HENRY DOYLE, of Pondhall, Suffolk, knighted in 1546, died 1564. It is noteworthy that this mark, almost unique in character in the Fenland and so typical of Broadland, was not originated by a Fenland man. He presumably became an owner of Swans on the Fenland property of his wife, Jane the daughter and heir of William Elwyn of Wiggenshall St. James.

93. WILLIAM DUNTHORNE, merchant, of King's Lynn.

94. JOHN EDWARDS, of Thetford, Mayor 1582-3.

95. ROBERT EVERARD, of Walpole, who lived in the time of Henry VIII., was a very considerable swan-owner and possessed at different times at least five marks. The present

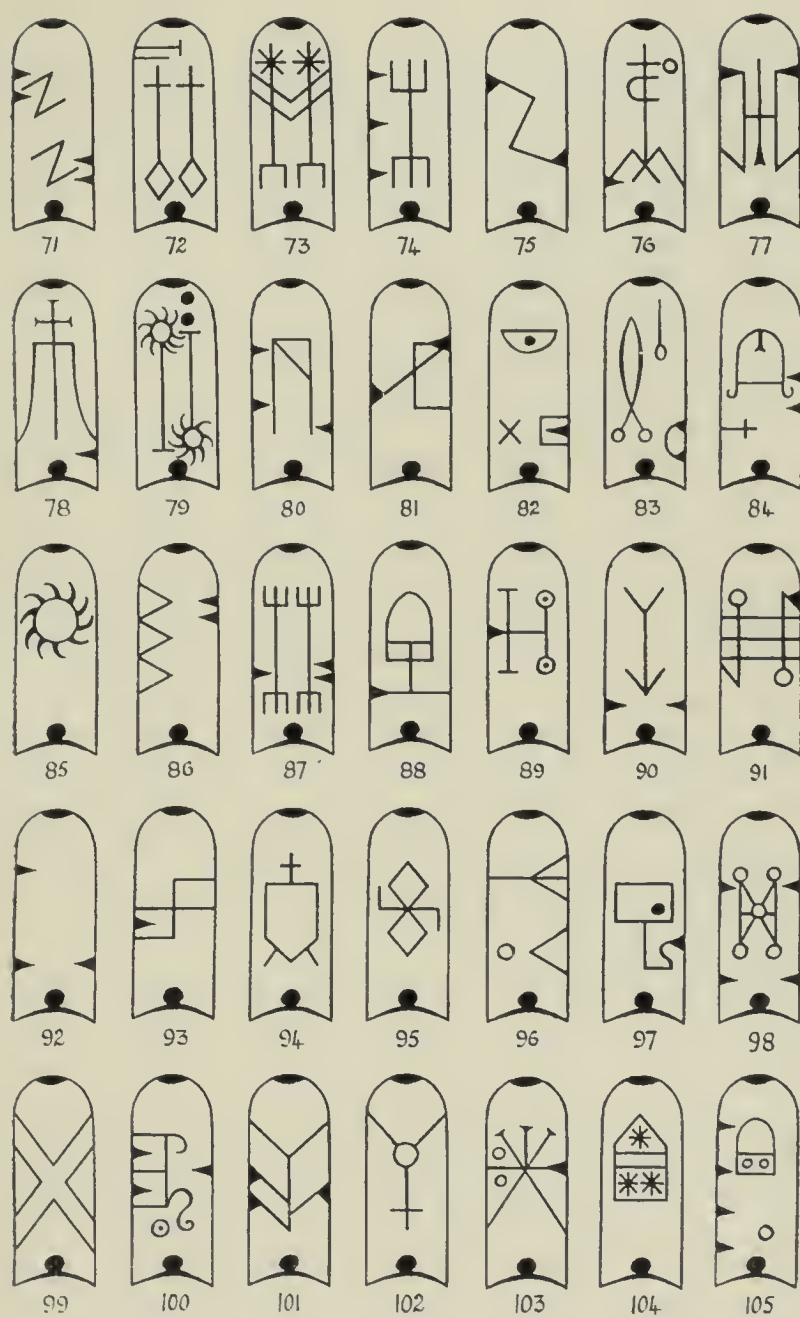


FIGURE 3

one was disposed of, either by him or his son Henry, to Sir Thomas Golding of Belchamp St. Pauls, Essex, who was alive in 1571. His father, Thomas Golding, had bought Dunham Magna in 1547.

96. ROBERT EVERARD, *idem*.—After his death this mark passed to his son and heir Henry, and then to Adam Harte of Walpole (d. 1573), who had married Henry's sister Maud. Then for a time it appears to have been owned by one of the Lincolnshire family of Irby and finally to have returned to Norfolk ownership in the person of William Gurlinge of King's Lynn, who was Mayor of Lynn in 1593 and 1600.

97, 98. ROBERT EVERARD, *idem*.—These two marks are only recorded for him and his son Henry. No. 98 was known by the name of "the v Blotts," the reference evidently being to the five annulets (*cf.* "the iiij Blotts," No. 180).

99. ROBERT EVERARD, *idem*.—This mark, known as "the iiij Dawds," does not appear to have remained in the Everard family after Robert. It was next owned by John Wright, perhaps of Walpole, and then by Edmund Thompson of Sutton St. Mary, Lincolnshire. From him it went to Robert Leman of Walpole and then to Thomas Coney of Sutton St. Mary, who had married his daughter and heir Dorothy. Thomas died in 1616 and was succeeded by his son, William Coney of Walpole and Sutton, who was born in 1609. From him it went to his son and heir Robert Coney of Walpole, who was born in 1633 and died in 1707.

Edmund Thompson "differenced" the mark by adding a small annulet in the centre of the saltire and by assuming a lower mandible mark, thus described in the Swan-master's certificate:—"this mark allowed wth a tick att the bills end on the farr side on the nether chappe." Thomas Coney "differenced" by adding a second, "2 ticks in ye mouth," and William a third, "3 ticks on the mouth." Robert "differenced" by omitting all these, but retained the annulet.

100, 101. HENRY EVERARD, of Walpole.—No. 100 is not recorded for any other owner, though it occurs in several rolls under the surname only. No. 101 passed from him, out of Norfolk ownership, to the Pulvertofts of Whaplode in Lincolnshire. On this family coming to an end in 1604, it was acquired by the Oxboroughs of King's Lynn and was used by

William Oxborough in 1622. Sir William Dramy, whom I have not been able to find was the next owner and he was succeeded by Benjamin Holly of Lynn, who was Mayor in 1657 and 1665.

102. RICHARD EVERARD, of Fittons manor, Wiggenhall St. Germans, who died in 1566. The ownership of the mark followed the ownership of the manor, Richard being succeeded by John, who died without issue in 1573 and was succeeded by Henry Everard of Linstead, Suffolk.

Earlier owners whom I have not identified were Zacharias Adam and Smartfoot. As originally used by Adam the mark included a gap on the right edge of the bill in the basal third. Smartfoot "differenced" by moving the gap to the opposite side, Richard and Henry Everard omitted it altogether, while John restored it to the original place.

103. EVERARD.—There is no clue as to the identity of this owner, but it seems probable that it belonged to some branch of the Norfolk family, as it was afterwards owned by the Gurlinges, either of Outwell or of Lynn, but again no christian name is recorded.

104. EVERARD.—There is again no clue to this owner, which is a pity as the mark was evidently derived from the family coat of arms. That of the Norfolk branch, to which the mark without much doubt belonged was:—"Gules, on a fesse between three estoiles argent, a mullet sable." It was "differenced" by successive members of the family, first with a gap on the right side opposite the middle of the shield and later with three gaps at the left base and an annulet at the right base. It was subsequently (presumably) sold to the Gawsells of Watlington and was so altered by them, that were not the intermediate steps recorded on different rolls, the ultimate result could never be connected with the original. As first altered the fesse became a single line and the stars roundels, the gaps and annulet being retained.

105. EDMOND GAWSELL, second son of Thomas Gawsell of Watlington, alive in 1600. There is no clue as to which Gawsell purchased this mark from the Everards, but the final stage in its evolution is shown in this drawing.

These last two marks illustrate the importance, to which I have already drawn attention, of comparing a number of

different rolls together. Without having done so it would have been impossible to deduce that Edmond Gawsell's mark had its origin in the coat of arms of the Everards.

106. JOHN FAULKES, of Mundford.—A later member of the family (christian name unrecorded) "differenced" by adding two gaps on the left edge at the ends of the outer limbs of the W and one on the right edge in the centre of the distal W.

107. EDMOND FINCHAM, of Rougham, will dated 1471. The mark is not given for any later owner.

108. JOHN FINCHAM, of Outwell, died 1527.—This mark descended in the elder branch of this family through John's eldest son Thomas (who is not recorded on the rolls) to the latter's son Richard, who died without issue in 1602. It then passed to his nephew and heir Edward, son of his brother Robert, who was born in 1566 and died in 1631. Richard "differenced" it by omitting the basal gap, which was restored again by Edward.

109. SIMON FINCHAM, of Outwell, d. 1538, the founder of the younger branch of the family. It probably descended to his son Simon (d. 1615) and was sold by him to a member of the Warner family, but no christian name is given. It had previously been owned by Robert Sumpter, whom I have not identified.

110. SIMON FINCHAM, *idem*.—This mark descended to Simon the younger (d. 1615) and to his son and heir John. At the latter's death in 1621 it passed to his younger brother Balam, who was baptized in 1569. Subsequently it was owned by Phillip Bell of Wallington, who was alive in 1707, and had presumably bought it from a later John Fincham, who sold the Outwell estates about 1709.

111. SIMON FINCHAM, *idem*.

112. FOLSHAM, of Outwell.—This is nowhere given with a christian name, but it passed from that family to Thomas Gurlinge of Outwell, by his marriage with Ellen Folsham. He "differenced" the mark by inverting it.

113. SIR RICHARD FULMERSTONE, of Stow Bedon, Thetford and Halwick, knighted 1560, died 1566. This is the mark ("differenced") that he acquired with the property of the dissolved Canons of St. Sepulchre of Thetford. After his death it passed to his daughter and heir Frances and her husband Sir Edward Clere of Blickling (*cf.* Nos. 10 and 72).

Martin (*t.c.*) prints the Inquisition Post-mortem of Sir Richard, in which the following passage refers to this swan-mark:—
“ Dominium et manerium de Thetford tenetur de R^a in soccagio ut de duc. Lanc. scil’ nuper cannonicor’ ib’ m cum libertatibus lib’e warrenne faldagiis, etc., in Thetford ac piscar’ et libertat’ habere cignos in rivolis et aquis de Thetford ” and Sir Edward Clere and Frances made, amongst others, the following claims
“ House and scite of the Church of St. Sepulchre, with sac, soc ” . . . etc., etc. . . . “ Free warrens, fisheries, swanneries ; all the commons, turbaries, breweries, late belonging to the Canons. ”

114. THOMAS GARDENER, of Cokesford.—This mark was originally the property of the church of St. Wendreda, March, in Cambridgeshire and was obtained, at the dissolution by Hugh Gardener of March and descended to this Thomas, his son. It afterwards went to the latter’s son Humphrey, who was of Histon, Cambs. and alive in 1619. The semi-circular gap was Hugh’s “ difference ” mark.

115. THOMAS GARDENER, *idem*.—This mark also came to Thomas from his father. After him it went to Francis, either his younger brother or his grandson, the secondson of Humphrey, who differened it by adding a lower mandible mark “ 3 tycks within ye mouth,” one in the middle on the left, and one near the base and one near the tip on the right.

116, 117. JOHN GAWSELL, of Wallington and Watlington, *viv.* 1504.—Both marks are frequently recorded under the surname only and John is the only member of the family definitely named. It is clear, however, that they descended to the next two generations, Thomas who sold Wallington in 1525 and Richard, who died in 1538, for No. 116 is found “ differenced ” with a lower mandible mark “ wth a tyke one ye mouth ” and both passed into the possession of William Buttes of Shouldham Thorpe (alive in 1563, died before 1569) who married Ursula (Walcott) the widow of Richard Gawsell. They both then probably descended in the Buttes family, but this is impossible to prove as the two succeeding generations were also named William, the second dying without issue in 1624. In four rolls (which are virtually copies of one another) this later owner is called *Sir* William Buttes. There seems to be no record that any William Buttes of Shouldham was

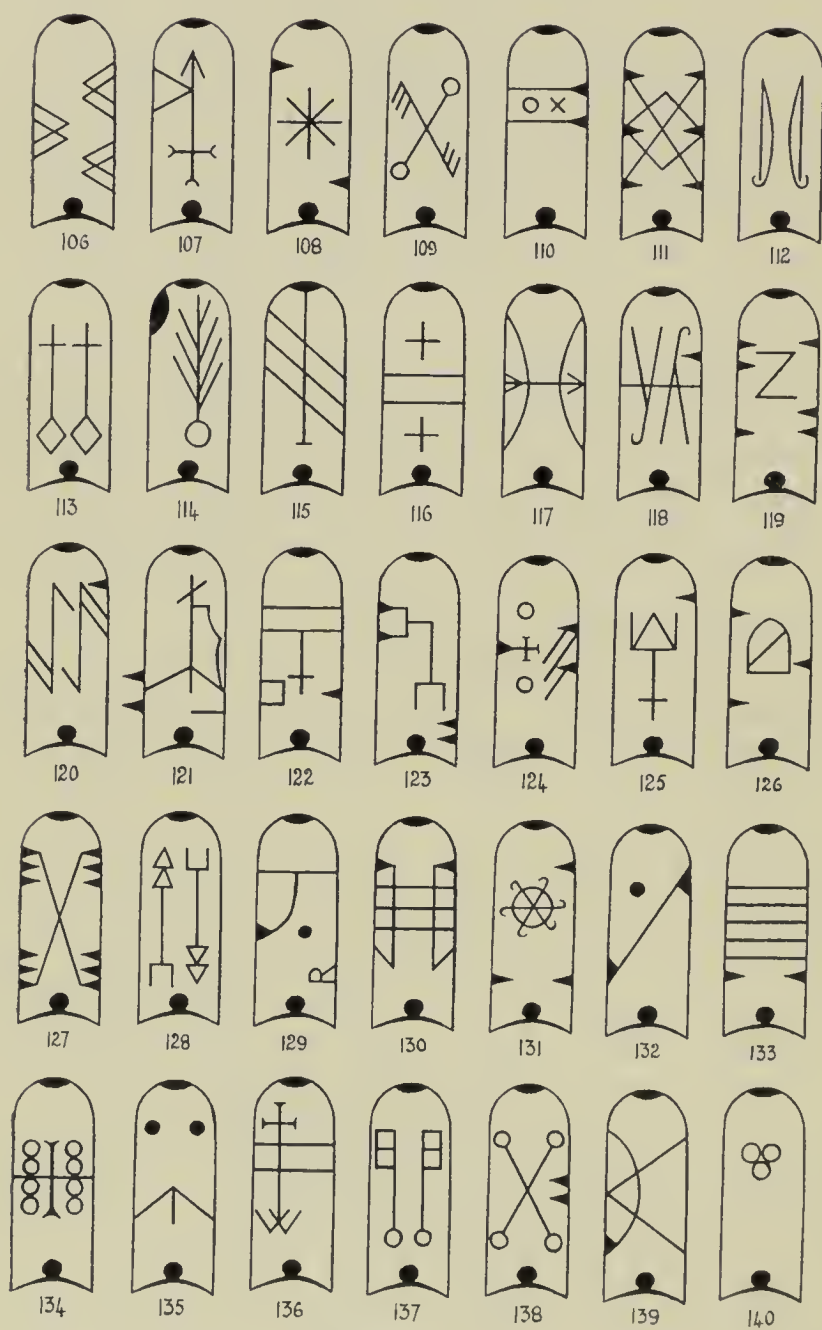


FIGURE 4

knighted, so if this title is correct one would have to identify this owner with Buttes of Thornage, either the elder who died in 1545, or the younger who died in 1583. I believe, however, that these entries are erroneous and that the direct descent traced above is the correct one. Three exactly similar errors are to be found in each of these same four rolls.

118. THOMAS GURLINGE, merchant of King's Lynn, Mayor in 1621, 1634 and 1642, died 1644. This mark was called "ye Dobill esis."

119. RICHARD GODBOLD, of Fincham, alive in 1612.

120. THOMAS GRAVES, of King's Lynn and Pinkneys manor, Tatterset, Mayor of Lynn 1567, 1574 and 1584, M.P. 1571, dead before 1594.

121. JOHN GRENDALL, of King's Lynn, Alderman 1506, alive in 1515. John Grendell junior was Alderman in 1524.

122. EDMUND GRYMSTON of Oxborough, died 1570.—The mark was afterwards owned by one of the Hobart family, but no christian name is given.

123, 124. ANTHONY GUYBON, alive in 1566, was the second son of Thomas Guybon of King's Lynn, but I can find nothing more about him.

125. THOMAS GUYBON, of King's Lynn, Mayor in 1503 and 1509, Sheriff of Norfolk 1513 and still alive in 1528. His son Thomas, who was living in 1562, "differenced" the mark by omitting the gap.

126. THOMAS GUYBON, of King's Lynn, the younger.—This mark, which is apparently derived from the family arms:—"Or, a lion rampant sable, over all on a bend gules, three escallops argent," was used by Thomas senior with the right-hand gap only and was "differenced" as here drawn, by his son. It afterwards descended to the latter's son Humphrey of Lynn and Stradsett, high sheriff in 1596 and still alive in 1599 and was further "differenced" by a still later member of the family (unspecified) by moving the right-hand gap to the base and adding two more beside it.

127. WILLIAM GUYBON, of Watlington, *viv.* 1590, the half-brother of Humphrey (*supra*). This mark is nowhere recorded with any christian name, but it occurs on two rolls for Skipwith, which makes it fairly certain that it must have belonged to this William Guybon and then to Edmund Skipwith of Snowre

Hall in Fordham (*viv.* 1620) who married his daughter Elizabeth (or Anne). The latter "differenced" the mark by drawing the ends of the saltire right to the edges of the bill and so enclosing within them all the gaps on each side, except the proximal pair, which were left free at the base of the bill.

An earlier owner was Barmeson, or Bermyston, whom I have not identified, unless it be the Suffolk family of Barnardiston.

128. JOHN HARTE, of Walpole.—Afterwards the property of his son Adam, of Walpole, who died in 1573. In the seventeenth century it was used by Henry Reppes of West Walton (d. 1628), who "differenced" it by adding a lower mandible mark "3 ticks in ye neere side."

129. ADAM HARTE, of Walpole, d. 1573.—This mark, known later by the name of "the Hammer head and Roman R," has a long history. The earliest owner was one Perse, or Parres, unidentified unless he be John Peyrse of Northwold, which is possible. Adam Harte then held it and both these earlier owners used it without the "Roman R," which was a "difference" mark added by Robert Knight the next in order, whom I have failed to find. From him it passed to Audley Baker *alias* Ladde, of the Bishop of Ely's manor, Terrington St. Clement, who used it in 1622. Robert Baker *alias* Ladde, his son, sold it in 1646 to Anthony Williamson of Kenwick in Tilney. The deed of sale will be found printed in full in *Eastern Counties Collectanea*, vol. I. (1872-3) p. 77.

130. JAMES HAWE, Steward of the Duchy Manor of Woodhall, Hilgay, bought Modneye Hall, Hilgay, in 1545, died 1552-3. The mark descended to his son Henry, who died in 1592 and then to Sir John Willoughby of Risley, co. Derby, who had married his daughter and heir Frances. Henry also became an owner of Swans in Broadland and used the same mark for them, but "differenced" it by making the gaps semi-circular, instead of triangular (*cf.* mark No. 144, vol. XII., p. 453).

131, 132. ARTHUR HEWAR, of Oxborough.—I can find but little about this man except that he was the younger brother of Thomas Hewar of Oxborough Hall in Emneth, must have been living quite early in the sixteenth century, up to about

1540, and apparently died without issue. Both these marks then became the property of the Bedingfields of Oxborough, first of Sir Edmund, who died in 1553, then of Sir Henry (d. 1583), Edmund (d. 1585) and Thomas (d. 1590). From the last named they passed to Henry Jerningham of Costessey, on his marriage with Thomas's widow, Frances, daughter of John Jernegan of Somerleyton. Henry died in 1619.

133. ARTHUR HEWAR, *idem*.—This mark passed to Thomas Hewar, either his elder brother, or the latter's son, who died in 1585, aged 66. It afterwards belonged to the latter's son Sir Thomas (No. 135).

134. THOMAS HEWAR, of Oxborough Hall, Emneth.—It is not possible to be sure how far back this mark goes as there were at least four successive generations of Thomas Hewars. I think, however, there can be little doubt that it goes back at least to Thomas (the elder brother of Arthur, No. 131) who was alive about 1518. On the other hand it cannot have been used for very long by Thomas his son, for he must have disposed of it quite soon to the next owner, Edmund Peyrse of Oxborough, the second son of John Peyrse of Northwold, who "differenced" it by adding two gaps at the left base and by increasing the number of annulets. The latter seem to have been varied in number from time to time by each owner.

135. SIR THOMAS HEWAR, who succeeded his father at Emneth in 1585, was Sheriff of Norfolk in 1613 and died without issue in 1630. This mark occurs only as an additional entry at the end of an early seventeenth century roll and so was probably not granted till about 1620.

136. SIR CHRISTOPHER HEYDON, of Baconsthorpe, knighted about 1550, died 1579. This mark was afterwards used by a Mr. Fenne, whether of Wiggshall or Lynn is uncertain, and was "differenced" by him by the addition of a gap on the right edge between the bars.

137. SIR JAMES HOBART, of Hales Hall, Loddon, knighted 1503, died 1517. It was afterwards used by a Mr. Rudhall, whom I cannot identify.

138. SIR JAMES HOBART, *idem*.—This mark afterwards passed through the hands of the same Mr. Rudhall, John and C. Harte, Mr. Ashon and Nicholas Halge, none of whom I

have been able to identify, and was finally owned by Thomas Howson and his son Sir William, both of Wigtoft in Lincolnshire.

139. HOLLYER.—In most rolls the surname only is given, though in one the initial “ A ” appears before it. I have little doubt that the mark belonged to the Lynn family of Hollyer of whom John was one of the Common Council in 1523, and Robert, Mayor four times between 1564 and 1585. A. Hollyer I take to be an even earlier member of the family. The mark was afterwards owned by Thomas Might (*vide* No. 171).

140. ROBERT HOUGHTON, of Bereford Manor, Anmer, to which he succeeded in 1544, Town Clerk of Lynn 1557-8, dead before 1570.

141. HENRY HUNSTON, of Walsoken, *viv.* 1582.—An earlier owner was John Hype, whom I believe to have been of Sutton St. James in Lincolnshire. A later owner was Mr. Adamson, who was possibly a Marshland man. The Hunston family appears to have been a large one of several branches in Marshland and Holland and they were undoubtedly large swan-owners. Unfortunately no very satisfactory pedigree of them is available, so that the identification of individual members must be somewhat tentative and the succession in their different marks difficult to establish.

142. RICHARD HUNSTON, of Walpole, d. 1547.—He was succeeded in the ownership of this mark by his son Henry (No. 141), who “differenced” it by adding a gap at the left base.

143. HENRY HUNSTON, of Walpole, *viv. temp.* Henry VIII. This mark was known by the name of “the Clickett keys,” and was owned by three (or four) members of this family, Henry, William and Thomas. The Henry is certainly an earlier man than Henry of Walsoken (No. 141), so I take it he must have been Henry of Walpole, who married Jane, the daughter of Sir John Audley of Swaffham. William I take to be William of Walpole, who died in 1567 and elder brother of Henry (No. 141), but what his relationship to the original Henry was is not clear. He was presumably succeeded by his eldest son William of Walpole and Boston, who was Sheriff of Lincolnshire in 1572 and died in 1582, when the mark went to his eldest son, Thomas of Walpole. One or other of the Williams “differenced” it with a gap on the right edge,

cutting into the annulet. It subsequently belonged to William Atkin of King's Lynn, who was Mayor in 1619 (*vide* No. 23) and in 1626 to Elizabeth Cooke of King's Lynn, who sold it in that year to John Wallis, merchant and Alderman of Lynn.

The original deed of sale is preserved in the British Museum (Add. Ch. 16, 550) and as these documents are extraordinarily rare, and this one has never before been printed, it may be of interest to give it in full. It is a vellum deed $7\frac{1}{8}$ by 13 inches and contains a drawing of the mark down the left margin.

" Be it knowne to all men by theise presents that I Elizabeth Cooke of Kyngs Lynne in the County of Norff. widowe for dyvers, good and reasonable causes and considerac'ons me movinge Have bargayned sold given, and granted and by theise presents doe bargayne, sell, give, and grant vnto John Wallis of Kyngs Lynne aforesaid Merchant one of the Aldermen there All that Swanmarke comonly called or knowne by the name of the Clickett Keys wth one Gappe under the feathers, marked formed or fashioned, as in the Margent hereof appeareth Together wth All Swannes Staggs and Signetts of the same marke or wth the same marked, or thereunto in any wise belongeinge or apperteyninge To have and to hold thesaid Swanmarke, and all and singular the Swannes Staggs and Signetts aforesaid to the said John Wallis his executors administrators and assigneys as his and their owne proper goods forever. In witness whereof I the said Elizabeth Cooke have herevnto sett my seale the Sixt daye of November in the Second Yere of the Reigne of our souerigne Lord Charles by the grace of God Kynge of England Scotland france and Ireland defendor of the faith, etc. 1626."

[Signed] " Elizabeth Cooke."

[Witnesses] " Nathaniel Mapen."

" John Lecett."

Tag for seal, wax gone.

144, 145. HENRY HUNSTON, *idem*.—No. 144 was known by the name of "ye Hamar hedde." Both followed the same succession in the Hunston family as No. 143.

146. HENRY HUNSTON, *idem*.—This mark went to Clement Hunston of Ruskington, in Lincolnshire (another brother of Henry No. 141), who died without issue in 1582. He was succeeded by John Hunston and by William Hunston of Tydd, neither of whom I have been able to fit into the pedigree.

147. JOHN JENNEY, of Great Cressingham, d. 1575. The mark passed by the marriage of his widow, Elizabeth, daughter of Robert Spring of Lavenham, to her second husband Edward Fludd, who was Gentlemen Usher to Queen Elizabeth and leased Shropham Hundred from the Crown 1573 to 1584 and died in 1588.

148. EDMUND JERMYN, of Sturston, died before 1606.

149. HUMPHREY JORDAN, of Congham; his Inq: P.M. dated 1561.

150. HUMPHREY KERVYLE, of Wiggshall St. Mary, d. 1540. Afterwards owned by his third son Edmund, and the latter's nephew Henry of Wiggshall.

151. HUMPHREY KERVYLE, of Watlington, son of Humphrey Kervyle of Lynn, who was alive in 1535. The mark is derived from the family arms:—"Gules, a chevron or, between three leopards faces argent."

152. KNEVETT.—This mark is nowhere recorded with a christian name, but fortunately we find it on one roll under the name Springe, which makes it certain that it belonged to the Buckenham Castle family. Though it is not possible to say how far back the ownership extended, it must have belonged to Sir Thomas Knevelt, who died in 1594, leaving his son Phillip a minor of eleven. His widow Lady Catherine, daughter of Sir Thomas Lovell of East Harling, re-married Edward Springe, a grandson of Robert Springe of Lavenham, Suffolk, and died in 1610.

153. LADY KNEVETT.—This mark is also mostly given with the surname only, though on five rolls it occurs with the present title. The lady intended might have been the wife of one of the Knevetts of Buckenham Castle, but female owners (as apart from their husbands) are uncommon, so that on the whole I feel fairly confident in identifying her as Jane, the daughter and heir of John, 2nd Baron Berners, who died in 1532. She was *de jure* Baroness Berners, owned several manors in Walpole and many in the Holland division of Lincolnshire and married Edmund Knevelt of Ashwellthorpe. She died in 1561 and was succeeded by her grandson Sir Thomas.

154, 155. H. LAMBERT, of Well (*i.e.*, Outwell, or Upwell). I can find nothing about this owner, or his family. The mark as originally recorded without any gap dates from the time of Henry VIII., and these two are evidently later variants of it. It afterwards belonged to one of the Walpoles, presumably of Houghton.

156. JOHN LAVAROCKE, of Outwell.—Later owners were Richard Howlett, who was perhaps one of the Howletts of

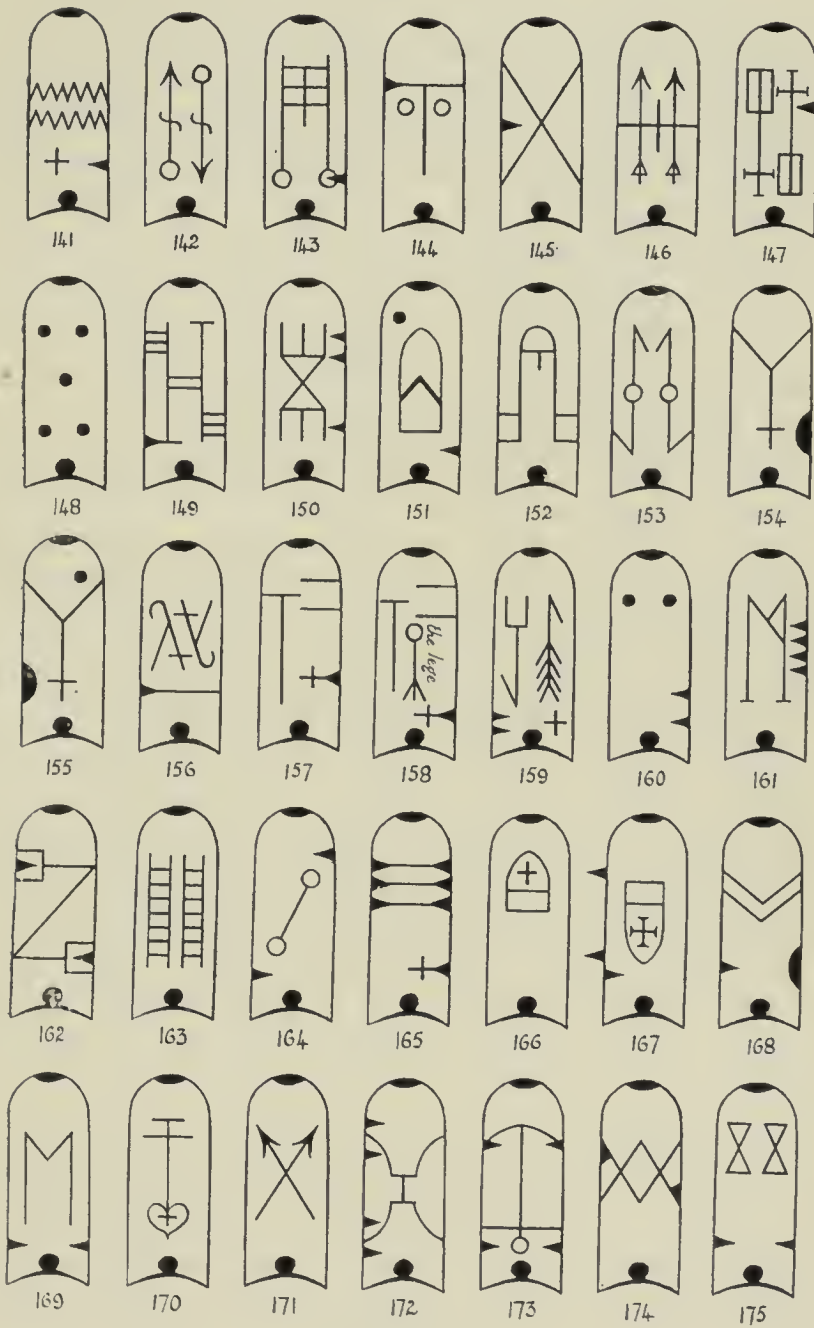


FIGURE 5

King's Lynn, but I have not been able to find him, and John Byrde of Hilgay, who was alive in 1601.

157. LAWRENCE LAVAROCKE, of Outwell.—This mark, known as the “yelt staffe and ij bars,” was owned successively by Lawrence and John Lavarocke, of whom I can learn nothing except that they belonged to Outwell. It then passed to John Drewry of Swaffham, Cambs., through his marriage with Elianor, the daughter of John Lavarocke, and was “differenced” by him by the addition of the leg-mark as drawn in No. 158. It subsequently became the property of one of the Bishops of Ely, but which it is impossible to say. He used it without the leg-mark, but “differenced” it by reversal.

158. JOHN DREWRY, of Swaffham, Cambs.

159. WILLIAM LEXHAM, of Lexhams manor, Burnham Westgate, d. 1500.

160. SIR THOMAS LOVELL, of East Harling and Barton Bendish, knighted 1553, d. 1567. The mark descended to his son, Sir Thomas, who died in 1604 and his grandson Sir Francis, who was knighted in 1603 and died in 1623, without issue. One of the Sir Thomas's used the mark with only one gap, while Sir Francis “differenced” it by moving one of them to the left side of the bill opposite to the remaining one. Another member of the family (unspecified) used it with two gaps on the right and one on the left. Three rolls give the mark as here drawn for “Sir J.” and “Sir John” Lovell and two for “Sir E.” and “Sir Edward” Lovell. I cannot find that there was ever a Sir John or a Sir Edward in this family and suspect that mistakes have been made in copying from older rolls.

161. LAWRENCE MALE.—I can find nothing about this man except that he died before 1527. I suspect, however, that though he may have belonged to Norfolk, both he and Robert Hill, the next owner of the mark, belonged to Sutton St. James in Lincolnshire. From the latter, however, it came into Norfolk ownership, being acquired by the Anguish family of Great Melton. It was afterwards used by one of them in Broadland waters, but differenced by reversal, as already recorded (Vol. XII., p. 459, No. 178).

162. NICHOLAS MEGGES.—I have not succeeded in fixing this man with certainty. He was alive in 1547 and was

I imagine the brother of Thomas Megges (No. 163) and a native either of Wisbech or of some adjacent place in Norfolk. From him the mark passed through the hands of the Wisbech families Lind and Crosse and thence by the marriage of Ann, the daughter of Thomas Crosse, some time before 1592, to her husband Robert Poulter of Broughton in Huntingdonshire. He, however, disposed of it before many years, presumably by sale, to Sir Thomas Hunt, a soap-boiler of London and a member of the Fishmongers' Company, who had bought Byntre Hastings Manor in Brandeston, Hackford, Guton, Folsham and the Hundred of Eynford in 1582. He was knighted in 1603 and died in 1616.

163. THOMAS MEGGES, of Upwell, was granted Thurning Manor, Upwell, in 1539, was Constable of Wisbech Castle in 1531 and Chief Bailiff of the Isle of Ely in 1546. After him the mark, which was known as "the latheres" (ladders), was used by John de la Hay of Terrington and then by Thomas Harvey of West Walton, who was alive in 1564. From him it went to Thomas Gray of Wisbech, who, dying in 1593-4, devised it to his nephew Henry Gray. Soon afterwards it was acquired by Francis Parlett of Wiggshall, who died in 1605 (*vide* No. 186).

164. THOMAS MEGGES, *idem*.—After him the mark belonged to William Humberstone of Mildenhall, who was M.P. for Thetford and died between 1572 and 1583. It then passed to the Edens of Thetford and was used by Edward, who was Mayor in 1584 and Town Clerk in 1601 and by George, who was Mayor in 1622. William Humberstone "differenced" it by reversing the position of the gaps and Edward Eden by sloping the main design in the opposite direction. George Eden reverted to the original mark.

165. MEGGES.—There is no evidence as to who this owner was, though presumably he was either Nicholas, or Thomas, or related to them. After him the mark belonged to Lawrence Johnson, whom I have been unable to find and then passed to the Balams of Walsoken and was used by Charles who died in 1592 and Robert, but the pedigrees available are so imperfect that it is not possible to follow the exact succession. The latest, however, would appear to have been Robert, for in 1609 it belonged to Sir Richard Coxe of Brame near Ely, who

married Mary, the daughter of Sir Robert Peyton of Isleham, and widow of Robert Balam. There can be little doubt but that it was in this way that he obtained possession. After him it came back into Norfolk ownership in the person of John Fincham, junior, of Outwell, who succeeded his father John in 1621 and died in 1649. Sir Richard Coxe "differenced" the mark by transferring the gapped cross to the other side of the bill.

166. MEGGES.—Here again there is no clue to the owner's identity, nor whether he was actually the earliest, for the mark is given also for Damett another Upwell family (*vide* No. 79) that may well have owned it before Megges. It then belonged to the Sapcottes, but whether the Huntingdonshire family or not I cannot say, but I think it improbable. Two later owners are given, E. Smyth, whom I cannot identify and Robert Fincham of Outwell, who was alive in 1579. I think it very likely that all these owners were natives of the Upwell-Outwell district.

Though of an heraldic appearance I cannot find any heraldic derivation of the mark, but I can find no arms recorded for either Megges or Damett, if they were entitled to any. The Dametts and Sapcottes made the mark with the point of the shield towards the base of the bill as in No. 167. E. Smyth used it as here drawn, but added a gap at the right tip, while Robert Fincham's modification is shown in No. 167.

167. ROBERT FINCHAM, of Outwell, *viv.* 1579.—This mark is Megges No. 166 reversed and further "differenced" by the addition of a gap at the left base and two ticks in the lower mandible on the left side.

168. WILLIAM METHOLD, of Langford and South Pickenham, whose will was proved in 1539; or possibly his second son, William of Rusworth.

169. METHOLD.—Though given on nearly every roll, no christian name occurs, but I have little doubt that this was the mark used by the later Metholds of Langford and South Pickenham, namely John, who died in 1552 and Thomas, who died in 1632. It is obviously taken from the initial letter of the family name. In the middle of the seventeenth century it belonged to Sir Thomas Grant, whom I have failed to find.

170. ROBERT MILLER, of King's Lynn, *viv.* 1558. He was granted the Abbot of Ramsay's manor, Wimbotsham, in 1545.

171. THOMAS MIGHT, appears to have been a Norfolk man, though I cannot locate him with certainty. He was married at Feltwell in 1582 to Elizabeth the daughter of Osbert Mondeford, was patron of Dunham in 1591 and was still alive in 1601.

An earlier owner of the mark was William Brown, possibly the wealthy merchant of Stamford, who died in 1489, but this is uncertain. Thomas Might was succeeded by Anthony, the fifth son of Richard Buckworth of Wisbech. As originally used by William Brown and later by Anthony Buckworth the mark was made with the arrow heads towards the base of the bill.

172. ADAM MONDEFORD, of Feltwell, d. 1463.—The mark descended through his son and heir Osbert (d. 1490) to his son and heir Francis (died about 1538) who was succeeded by his second son Francis, the founder of the Wereham branch of the family. To this branch the mark was thereafter attached, but in the absence of christian names on the rolls it is uncertain how many generations used it. It was "differenced" by this branch by removing the basal pair of gaps to the right side opposite to the distal pair.

173. OSBERT MONDEFORD, of Feltwell, d. 1580.—The mark may possibly have belonged to his grandfather Osbert (d. 1490), but there is no means of telling. After his death it went to his son Edmund, who was knighted in 1603 and died before 1617, and then to his grandson Sir Edmund, who died without issue in 1643. It then became the property of John Cockayne, who was presumably a Bedfordshire man and in 1656 it belonged to John Cutts of Childerley in Cambridgeshire.

174. OSBERT MONDEFORD, *idem*.—After his death it went to his sixth son Richard, about whom I can find nothing, except that he left no issue.

175. MONDEFORD.—There is no clue as to who owned this mark as no christian name is given. It is also found without the right-hand gap.

176, 177. MARTIN MONDEFORD, of Wereham.—Both marks are to be found on several rolls under the surname only, and No. 176 with the left-hand gap only, so that they may have belonged to his father Francis (*vide* No. 172).

178, 179. RICHARD NICHOLLS, of Tilney, was granted West Dereham Abbey Manor, Tilney, in 1559, alive in 1562, but died

without issue. After his death both marks were acquired by the Prentis family of Wighenhall St. Mary Magdalen and were used in succession by Thomas and his son John and then by William and "E.," neither of whom are to be found in the printed pedigree. No. 178 was "differenced" by them by moving the device to the base of the bill.

180. WILLIAM NORMAN, of Outwell.—The mark, known as "the iiij Blotts" (*cf.* No. 98) was afterwards owned by Robert Caster and Edmund Fakins, neither of whom can I find. The latter "differenced" it by adding an inverted V on the left basal quarter of the bill.

181. SIR HENRY OGARD, of Hackbeach Hall, Emneth, d. 1511. After his death it passed to his son and heir Andrew (d. 1526), who "differenced" it by omitting the two basal gaps on the right. It then went to Andrew's second son Henry, who appears to have died without issue. Though not actually recorded for him, it must have then passed to his younger brother William, who owned Hackbeach Hall. His widow Winifred, daughter of John Reppes of West Walton, married secondly Thomas Hewar of Oxborough Hall, Emneth (d. 1585), who thus acquired both Hackbeach Hall and the mark. He "differenced" by restoring the basal gaps and moving the annulet to between the proximal bar and the diagonal. The mark was later owned by William Atkin of Lynn (*vide* No. 23).

182. SIR HENRY OGARD, *idem.*—The succession of this mark was the same as No. 181, except that it is recorded for George, Andrew's eldest son (who like Henry seems to have died without issue) and so was held by the three brothers in succession, ultimately going to Thomas Hewar. After the latter's death in 1585 it went to his son and heir Sir Thomas, who died without issue in 1630. Lawrence Oxborough, the second son of Thomas Oxborough of King's Lynn, and grandson of his sister Thomasin was his heir and inherited both Hackbeach Hall and the mark.

183. ANDREW OGARD, of Walsoken, *viv.* 1646, the third son of Andrew of Walsoken (*viv.* 1561) and grandson of William of Hackbeach Hall (*vide* No. 181).

184. DAVID ORRELL, of Overhall in Boughton and Wereham Hall, who was married in 1449. In one roll the mark is given for Mistress Orrell, so that it is to be presumed that his wife,

Elizabeth, daughter and heir of Alexander Marshall of Overhall in Boughton, outlived him. It is also recorded on one roll for his son Sir Lewis. From him it seems to have passed to the Cressener family, presumably of Morley, though I can find but little about them, and no christian names are given on the rolls. After them it was held by a succession of Wisbech families, Crosse, Freeman and Swaine, the last of whom, Robert Swaine, was alive in 1643.

185. JOHN PALGRAVE, of Palgrave, d. 1467.—No other christian name is given with this, but in several rolls he is called *Sir* John. I cannot, however, find any titled member of this family until 1641, which is much too late for the entries on the rolls. Apart from this there is a difficulty in identifying this owner with certainty. Besides the one given above, whom I fix as the most likely, there were John (2) his grandson and John (3) his great grandson as possible owners. John (2) was the son of Henry, who died in 1513-14, and himself died before 1524 and probably a minor, so that he cannot have been an owner for more than a year or two, if at all. John (3) was a nephew of John (2) and died in 1611, aged 80. He was of Barningham Norwood, a long way from the Fenland, and therefore he is not very likely to have been the originator of a Fenland mark. Moreover he would have had to have been an owner at about the age of twenty-four to have got his name on to one of the rolls on which the mark is entered, while his father Clement was still alive in 1581 and resident on the borders of the Fenland. I have no doubt, however, that the mark descended to, and was used by both of them, and that it is John (3) who is recorded in some of the rolls with the mark "differenced" by inversion. Despite the heraldic character of the mark it has no relationship to the Palgrave arms.

186. FRANCIS PARLETT, of Wiggenhall, Recorder of Lynn, d. 1605.—This mark was known as "ye trosses" and originally belonged to Thomas Gray of Wisbech, who died in 1593-4, but is not one of the three mentioned in his will (*vide* Nos. 54, 163 and 187). As used by him the foot-mark consisted of a slit in the *outer* webs of both feet, Parlett thus "differenced" by slitting the inner webs. After the latter's death it passed back to Wisbech ownership in the Edwards family, several of whom are given as owners on different rolls.

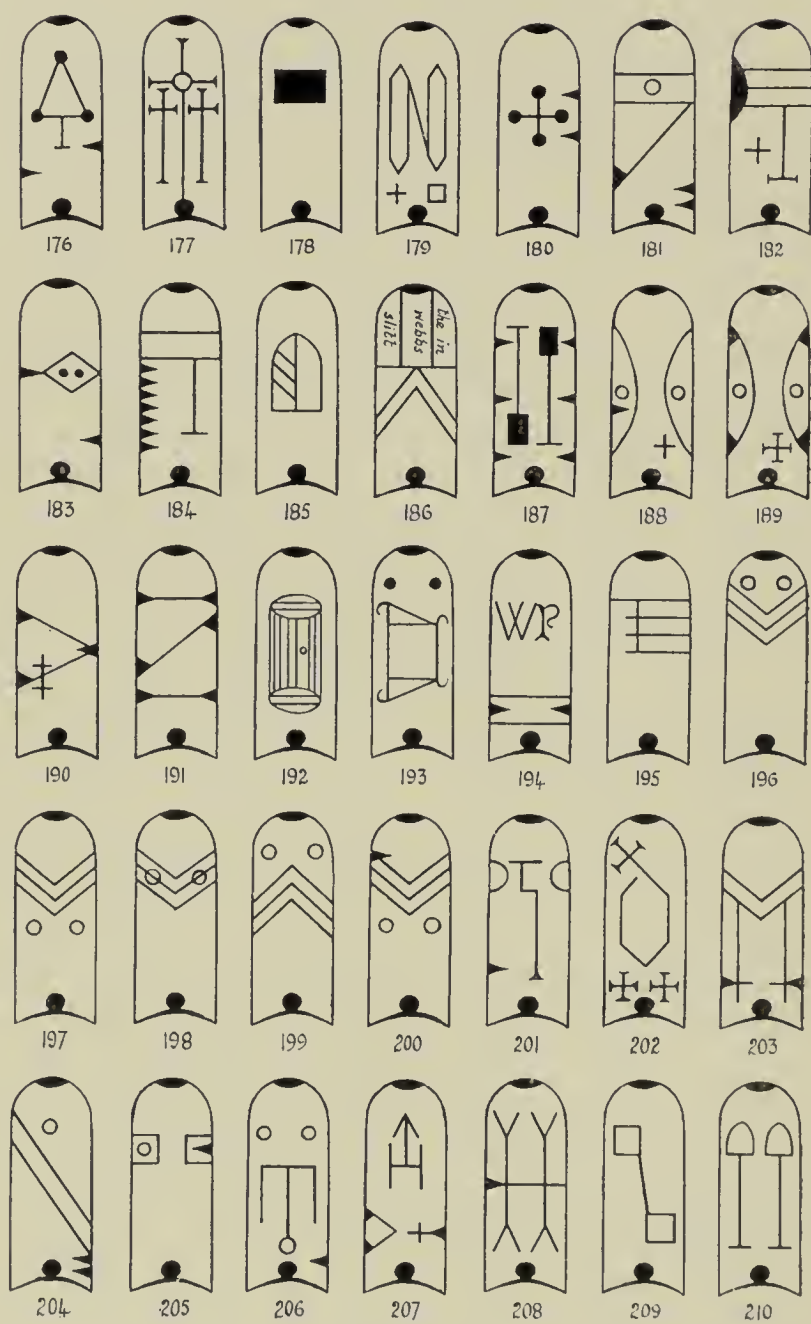


FIGURE 6

187. WILLIAM PARLETT.—I imagine this owner to have been a brother of Francis (No. 186), though I can find nothing about him except that he was co-defendant with Francis in the Chancery action respecting one of Thomas Gray's marks (No. 54, *q.v.*) of which this was another. It was known as "the dobell pelles" (double peels) or as described in Gray's will "the Pelles with six gapes." It was devised by him in the same way as Nos. 54 and 163, but was evidently soon after acquired like the others by the Parletts. Like No. 186 it afterwards belonged to the Edwards family of Wisbech.

188. EDMOND PEYRSE, of Oxborough.—This mark known as "the Double Bowes" has quite a remarkably full pedigree covering nearly two centuries. The earliest owners, who must have been living quite early in the sixteenth century, were John and Richard Crofts. They used the mark without any annulets and belonged I believe to Swaffham, but their identification is not certain. The next owner was William Craye of Ely. From him it came back to Norfolk again in the person of Edmund, the second son of John Peyrse of Northwold, and was used by him as here drawn. From him it went to Mathie Walsingham of Reepham, who owned it in 1599 and "differenced" it by adding a second gap beside the first. His formal appointment of John Mann of Upwell to act as his deputy at the upping has been printed by me in *Brit. Birds Mag.* XXII., p. 81. The next owner was Edmund Bedingfield of Huntingfield in Suffolk, who used it without any gaps, and sold it in 1622 to James Tiffin of Emneth. In 1626 he (or another James) described as of Crimplesham, appointed John Deane of Emneth to act as his deputy for seven years. In 1641 James Tiffin, then described as of Rockland, who "differenced" the mark as drawn in No. 189, sold it to Thomas Reeve, clerk, Rector of Upwell. William Reeve of Upwell, presumably his son, sold it in 1666 to William Fenne of King's Lynn and from him, or one of his descendants, it passed by marriage to the Harwicks of Eaubrink and was owned by Fenn Harwick in 1712.

189. JAMES TIFFIN of Rockland, *viv.* 1641 (*vide* No. 188). The alienation deeds of this mark are the property of the Rev. H. S. Marriott of Wilby. The earliest of them transferring it from Edmund Bedingfield to James Tiffin is a parchment 6¼

inches by $12\frac{1}{2}$ inches with fragments of a plain seal on a tag, and a drawing of the mark in the left margin :—

“ To all true xpian people to whome this p’sent wryting shall come Edmond Beddingfeild of Huntingfeild in the County of Suff. gent. Sendeth greeting in our Lord God eu’lastinge Knowe ye that I the seid Edmond Beddingfeild for dyu’s good iuste causes and reasonable consideracons me herevnto movinge have gyven gr’unted b’gayned and sould and by these p’sents doe fully and absolutely gyve gr’unte b’gayne and sell vnto Jeames Tyffyn of Emneth in the County of Norff. yeoman As well all those my Swannes and Signetts whatsoeu’ marked wth the marke made or conteyned in the Margeaunt of these p’sents comonly Called or knowne by the name of the Doble Bowes nowe being Swy’m yng or remayninge in nigh or vpon any the waters Streames or Ryvers w hin the Isle of Elye in the Countye of Cambridge or else where wthin the Realme of England As also the seid Marke Called the doble Bowes And all my Estate right tittle Interest property and demaund of in and to all and eu’y the seid Swannes Signetts and the seid marke called the Doble bowes and eu’y of them To have and to Holde the seid Swannes Signetts and the said marke called the Doble Bowes estate right tittle prop’tye and demaund aforesaid to the seid Jeames Tyffyn his Execut’ and assignes freelie and quietly for eu’ as his and ther owne p’per goodes wthout any mann’ of accompte money or other thinge therefore to be yelded payde or done vnto me the seid Edmond Beddingfeild my Execut’ admyn’ or assignes or to any of us In witness whereof I have herevnto sett my hand and Seale Gyven the three and twenty day of the moneth of July in the twentieth yere of the Reigne of our Sou’aigne Lord Jeames by the grace of god of England ffr’unce and Ireland Kinge defendo’ of the ffayth and of Scotland the fyve and ffifteth

p’ me Edmunde Bedingfeld.”

“ Sealed and delyu’ed
in the p’sence of
Jo. Pulham
Raffe Hurrell.”

190, 191. EDWARD PRATT, of Hockwold, *viv.* 1550.—Both marks were afterwards used by Henry Pratt (*vide* No. 193).

192. GREGORY PRATT, of Ryston, *viv.* 1573, the younger brother of Edward (No. 190). Also afterwards used by Henry (No. 193), who “differenced” it by adding three gaps at the right base and two at the left tip.

193. HENRY PRATT.—I am unable to place this owner, though he undoubtedly belonged to the Hockwold-Ryston family. The only Henry given in the pedigree was the grandson of Gregory (No. 192) and settled in London. The present Henry must have belonged I think to a generation earlier. Before 1615 the mark passed to Thomas Dereham of West Dereham, who was knighted two years later and died in 1645. An earlier owner still was E. Clements whom I have not found.

194. WILLIAM PRENTIS, of Wiggshall St. Mary Magdalen, *viv.* 1523.—The mark was afterwards used by his second son Thomas, who “differenced” it by inversion.

195. JOHN READE, of Walpole.—He was the second son of John Reade of Weston Hall by Beccles, who was alive in 1561.

196. JOHN REPPES, of Lovells Manor, West Walton, alive in 1540.

197. JOHN REPPES.—There is no evidence as to who this John was. He may have been John of Wisbech, who died in 1561, the nephew of John (No. 196) and of Henry of Mendham.

198. REPPES OF TILNEY.—I can find no record of a Tilney branch of the family.

199. JOHN REPPES, of Walpole and Emneth; alive in 1563 and 1577, but possibly father and son of the same name.

200. HENRY REPPES, of Mendham, died without issue 1558.—This series of five marks is interesting from two points of view. In the first place they are true heraldic marks, being derived from the family arms:—“Ermine, three chevrons sable.” In the second place they illustrate very clearly the system of “differencing” by separate branches of one family, who used a single mark for their swans, but by the “difference” marks were able to distinguish the birds belonging to one branch from those of any of the others.

201. EDMUND RERAY, Rector of South Runcton 1493, d. 1504.

202. RICHARD SAUDELL, of Saham Toney, d. 1557.

203. ROBERT SAYE, of Tilney, d. 1633, *æt.* 60. There was an earlier owner, John White, whom I believe to have belonged to King’s Lynn. There was a Lynn man of this name in 1523, but I am not satisfied that he was the owner. In some rolls it is given without the gaps, so that there were probably two or more earlier owners of the same name.

204. SIR JOHN SHELTON, of Deopham, knighted 1596.

205. JOHN SHERING, of Thetford, Mayor 1570, 1577 and 1592. It was afterwards owned by William Kaye and in 1614 by John Stanford, but I have not been able to identify either of them.

206. JOHN SHOULDHAM, of Marham and Shouldham, d. 1551.

207. THOMAS SIDNEY, of Walsingham, granted Walsingham

Priory 1540, died 1544; and/or his son Thomas, who was Customer of Lynn and died in 1586.

208. EDWARD SKIPWITH, of Snowre Hall in Fordham, d. 1558. At or before his death it passed to John Hare of Stow Bardolph, who was alive in 1561, but died before 1577. A later member of the Hare family "differenced" it by adding a second gap, at the opposite end of the cross-bar.

209. THOMAS SNELLING, of King's Lynn. He died during his mayoralty in 1622. The mark is perhaps an adaptation of one of those of Spalding Priory.

210. EDWARD SOME, probably of King's Lynn, where Robert Somes were living in 1512 and 1542-1609. The mark was afterwards owned by the Fennes, either of Lynn or of Wiggshall.

211. ROBERT SOUTHOUSE, of Downham Market.—The mark had had three previous owners, all of whom I believe to have belonged to Wisbech. The last of these was Thomas Peirson, who was Town Bailiff of Wisbech in 1641. The present owner married his daughter Lucretia in 1639.

212. SIR JOHN STEWARD, of Swaffham, *viv.* 1436.—I have not seen this mark on any of the rolls for an earlier owner than Simeon Steward of Lakenheath, who was Sir John's great-great-grandson and alive in 1557. It answers however to the description of the mark (*baculus nodatus*) granted by Sir John to his son Thomas on the Vigil of St. Dunstan, 14 Henry IV. (May 18th, 1436), the grant of which is given in full in "*The Reports of Sir Edward Coke*," 1826, Vol. IV., p. 82:—

"*Notum sit omnib' hominib' præsentib' et futuris, quod ego J. Steward, miles, dedi et concessi Tho' fil' meo primogenito et hæredib' suis, cigninol' meam armor' meor' prout in margine laterali pingitur, quæ mihi jure hæreditar' decendeb' post mort' J. Steward mil' patris mei: haben' sibi et hæredib' suis, una cum omnib' cignis et cignicul' cum dicta nota baculi nodati signat' "* . . . etc. etc.

Sir Edward Coke adds "And in the margent was printed a little ragged staff."

It is to be noted that Sir John refers to the mark as derived from his coat of arms and that he had inherited it on the death of his father, so that its use extended back some time before 1436.

213. NICHOLAS STEWARD, of Outwell, alive in 1520. At his death the mark passed to his son Simeon Steward of Lakenheath, who "differenced" by inverting the central design. It was owned later by Sir Simon Steward of Stuntney, Isle of Ely.

214. RICHARD SUTTON, of Feltwell, alive in 1599.

215. SIR GILBERT TALBOT, of Peverels Manor, Great Melton, d. 1542. He was succeeded in the ownership of the mark by J. Allen, whom I cannot identify.

216. SAMUEL TERRAND, appointed Rector of Mundford in 1662. The previous owner was Miles Forrest of Morborne, Hunts.

217. THOMAS THURSBY, of Haveless Hall, Mintling, and Gaywood, *viv.* 1572.

218, 219. SIR THOMAS TINDALL, of Poinings, Scales, Mundefords and Stewkeys Manors, Hockwold, knighted 1553, High Sheriff 1561, still alive in 1578. No. 218 afterwards belonged to his second son Sir John, of Much Maplestead, Essex, to Miles Tindall, whom I have not been able to find and then to one of the Paston family. No. 219 passed to a Mr. Felton.

220. DR. PETER TYE, Rector of Southery 156—, of Wimbotsham 1574-5, of Watlington 1583-1592 and of St. Mary's, Barton Bendish 1592-4.

221. JOHN WALPOLE, of Harpley.—The mark originally belonged to the Holtofte family of Whaplode, in Lincolnshire, and came to the Walpoles through the marriage of Henry of Harpley with Margaret, one of the Holfofte co-heirs. The first Walpole owner given on the rolls is Henry's eldest son, Thomas of Whaplode, who seems to have made the mark over to his younger brother John of Harpley.

222. WALPOLE, of Houghton.—The only owner definitely named is Sir John, who died in 1494. He used the mark without the distal gap. Later owners used it (A) as drawn here, (B) without the basal gap, (C) with two gaps close together at the middle of the right edge of the bill, and (D) with no gaps at all, but in no case is a christian name given.

223. ANDREW WALSINGHAM, of Upwell.—The mark, known by the name of "ye halfe mones and peschok," was also owned by another member of the family, William, who was alive in 1560, but whether he preceeded or succeeded Andrew is uncertain.

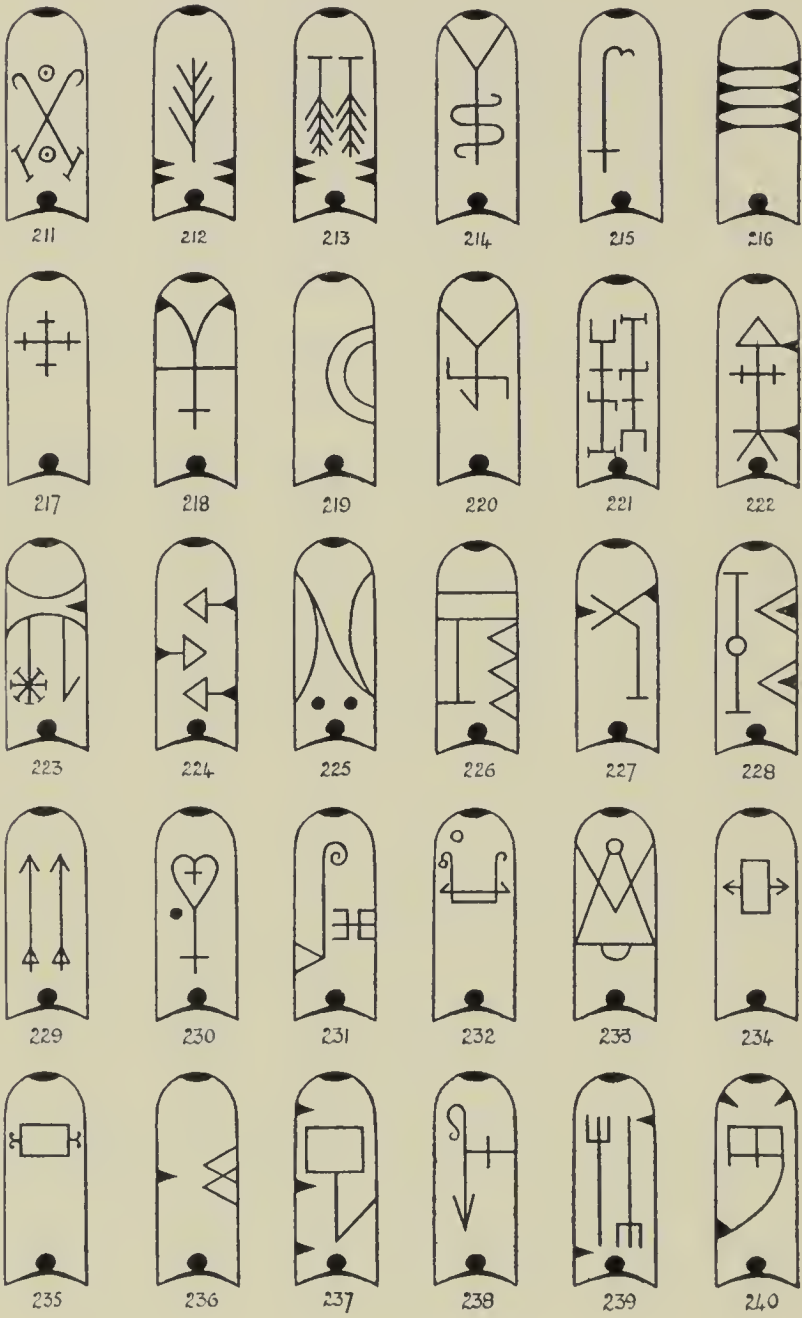


FIGURE 7

224. JOHN WELBY, of King's Lynn, born 1577, married 1601. He succeeded John Dennis, whom I have not been able to identify, as owner of the mark in 1609, and was succeeded by Thomas Hedley of Brampton, in Huntingdonshire.

225. RICHARD WETHERLEY, of Thetford, Mayor in 1505 and coroner in 1506. The mark occurs on nearly every roll, but usually under the surname only.

226. JOHN WHETHOLME, Vicar of Walpole St. Peter 1525, died 1537. He was succeeded as owner by Sir Thomas Tindall (*vide* No. 218) who was followed as No. 218 by Sir John and Miles. Sir John "differenced" by adding a fourth triangle, between the bars.

227. JOHN WHETHOLME, *idem* (?).—This owner is entered in some rolls as plain John, but in one the entry is "Johes Whitholme mil:."—If this is correct I cannot find anything about him; but my impression is that it is a mistake made in copying from an earlier roll in which, as that of a parish priest the name had been written in the then usual manner "Sir" John.

The next owner was Thomas Waters of Lynn (*vide* No. 34) and a later one still was named Williamson, perhaps Anthony (*vide* Nos. 129 and 231).

228. JOHN WHETHOLME, *idem*.—This mark had a long succession of later owners and the next in order belonged to Lincolnshire, viz. :—Ashton of Spalding and William Brian of Bolingbroke, who died in 1573. It then came back to Norfolk, being acquired by Francis Gawdy of Wallington (*vide* No. 88) who died in 1606. After him it was held by Dr. Cropley, John Hutchinson and Mr. Wriglesworth, none of whom can I identify.

229. JOHN WHETHOLME, *idem*.

230. HENRY WHINBURGH, of Whinburgh, Yaxham, Garveston, Reymerston and Thuxton, whose will is dated 1544.

231. ANTHONY WILLIAMSON, of Kenwick in Tilney, *viv.* 1646. This mark, known by the name of "ye priars staffe, and . . (?)" had previously belonged to a succession of Wisbech owners, Henry Goodricke, Edward and William Wilkes. In spite of its character and name, its origin is not traceable, on the evidence available, to any monastic house.

232. JOHN WILLOUGHBY, of East Hall, Denver, d. 1557, and his son and heir William.

233, 234, 235. ROBERT WINGFIELD, of Dunham Magna. No. 234 is also given for his son John Wingfield of Winch, who died in 1584.

236. SIR ROGER WOODHOUSE, of Kimberley, succeeded his grandfather 1560, knighted 1578, died 1588.

237, 238. THOMAS WYNDE, of South Wooton, *viv.* 1602.

239, 240. WILLIAM YELVERTON, of Rougham (d. 1541) and/or his son William, who died in 1587.

IV

REPORT OF THE BLAKENEY POINT RESEARCH STATION, 1927-1929

BY F. W. OLIVER, F.R.S.

FURTHER NOTES ON THE DEVELOPMENT OF THE FAR POINT

SOME account of the history of the origin and modification in relief of the Far Point was included in the last Report (1924-26) as well as of the arrival and establishment of the pioneer plants and breeding birds. As the opportunities are limited in which new land is arising and the settlement thereon of pioneer populations can be recorded, the dates of arrival of the various species of plants and animals have been included in the table which follows :—

First Records

Year.	Species of Plants.	Nesting Birds.
1918	None	None
1919	Arenaria peploides*	Common Tern*
	Psamma arenaria*	Little Tern*
	Salsola Kali	Ringed Plover*
	Triticum junceum*	
1920	Cakile maritima*	Sandwich Tern*
1923	Plantago maritima	Arctic Tern
	Polygonum aviculare	Roseate Tern
1924	Armeria maritima	

*Becoming numerically important.

First Records—continued

Year.	Species of Plants.	Nesting Birds.
1925	<i>Artemisia maritima</i> <i>Glyceria maritima</i> <i>Obione portulacoides</i> <i>Salicornia europæa</i> <i>Silene maritima</i> <i>Suæda fruticosa</i> *	Redshank
1926	<i>Atriplex glabriuscula</i> <i>Atriplex littoralis</i> <i>Carduus arvensis</i>	
1927	<i>Aster Tripolium</i> <i>Beta maritima</i> <i>Sedum acre</i> <i>Senecio Jacobæa</i> <i>Senecio vulgaris</i> <i>Statice reticulata</i> <i>Trifolium sp.</i>	
1928	<i>Elymus arenaria</i>	Oyster Catcher

This synchronising in the appearance of plants and birds probably means no more than that by 1919 the beach having emerged sufficiently to provide the necessary stability, plants established automatically from the drift lines and terns came to take possession of new vacant ground, admirably situated from the point of view of food supplies.

Nutritively, the terns have no direct need of plants, whilst as cover the plants present at the time were negligible.

Dune Building

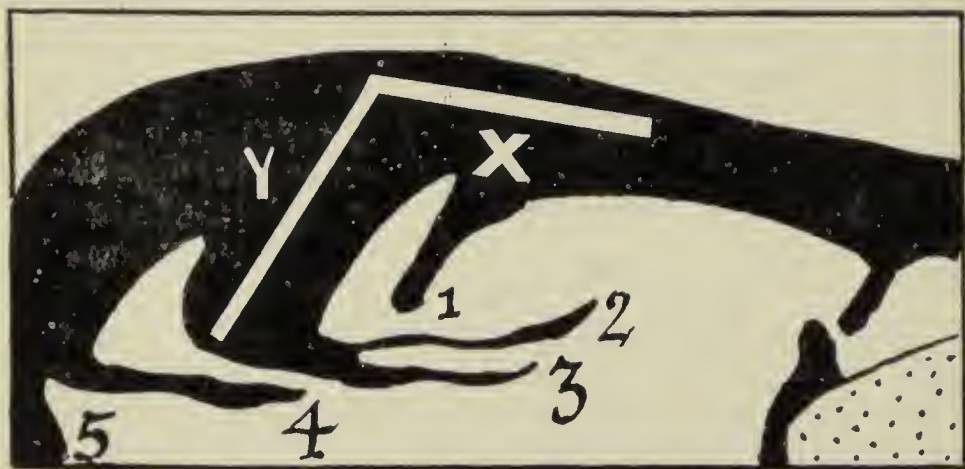
Shingle as originally piled up is relatively free of sand, but with lapse of time sand is blown from the foreshore and riddled through the open-textured surface into the interior of the beach. As vegetation establishes the tendency is for much sand to be held on the surface, with eventual production of dunes. In this connection the behaviour of the leading plants is different and complementary; this is well illustrated by the appropriate stages of dune development on the Far Point.

By "leading plants" are meant *Triticum* (*Agropyrum*) *juncceum* and *Psamma arenaria* (Marram Grass) of the perennials,

*Becoming numerically important.

and *Cakile maritima* and *Salsola Kali* among the annuals. In addition to these *Arenaria peploides* forms low, cushion-like dunes in which the sand is securely held.

In our case original colonisation was largely by *Triticum* and *Psamma*, from seed left on the drift lines, especially in 1920-22. As it happened, by the luck of the deal, the first area colonised (line x , text-fig 1.) consisted mainly of *Psamma*, whilst in 1922-23 the extension along axis y was chiefly *Triticum*. This chance occurrence has the advantage of making perfectly evident the differences in dune building procedure proper to these two species of plants.



TEXT-FIG. 1. Chart of Far Point, showing hooks 1 to 5. The lines x and y mark the axes of the two original vegetated areas in the order of their appearance; x mainly *Psamma*, y mainly *Triticum*. The vegetation has spread in all directions since. The distance from left to right of chart is half a mile.

Broadly speaking, whilst x (under *Psamma*) had a two years start of y (under *Triticum*), the latter area has quickly overtaken the former, so that by 1927 a much larger portion of the *Triticum* area was covered by small dunes than in the case of the *Psamma* (Typical *Triticum* dunes are shown in two stages on Pl. 1).

Differences between Triticum and Psamma

In the first place *Triticum* is a halophyte, whilst *Psamma* is not. That is to say when the Far Point is overrun by a very high tide, the *Psamma* leaves are killed, whilst *Triticum* is unaffected. Where the ground is concave and the sea water remains, the *Psammas* may be killed out altogether. This difference in osmotic organisation renders *Psamma* less fitted

BRITISH

MUSEUM

BRITISH
MUSEUM

25 FEB 60

NATURAL
HISTORY.



Triticum dunes arising on the Far Point in 1925



The same view as above, 1927

as a pioneer in colonisation at levels near high water mark. But in addition *Psamma* is in other respects less well equipped for operations at this stage. The leaves of *Triticum* are prostrate and tend to cover and shelter the sand hummock, whilst those of *Psamma* stand bolt upright, like a shaving brush. As a consequence, with changes in the direction of the wind, the *Psamma* hummocks lose much more of their collected sand than do those under *Triticum*. Nor is this all. Both species form underground runners (stolons) freely, but *Triticum* produces them deep in the shingle, whilst *Psamma* forms them mainly in the removable pile of sand it has collected. In consequence, when the wind blows sand away, there is much greater liability to exposure of the runners of *Psamma*, with eventual wind pruning, than in the case of *Triticum*. The result is that *Triticum* hummocks rapidly spread so that in a few years a single seedling may form a dune 15-20 ft. across, and 3-4 ft. in height (cf. Pl. XLVI).

Psamma on the other hand does not spread like this, and for years remains in the shaving brush phase, unless something happens to bring and retain around it quantities of sand. In other words, whilst *Psamma* branches preferably into pure sand or very sandy shingle, *Triticum* is perfectly at home in shingle with a moderate admixture of sand.

The further History of Psamma

Psamma remains in a state of arrested development until sand is *made to stay* around it. Sand is brought in two ways.

1. By the establishment of seedlings around the original plants further dune forming units become available, and as these grow, their little dunes blend with the original one so that a composite structure arises, the several parts of which give one another mutual protection.

2. The same result is reached when some *other plant* does the work of holding the sand around the *Psamma*. Most efficient in this is *Cakile* (occasionally *Salsola*), the plants of which sometimes arise in dense aggregation, building up low dunes (under 1-ft.), and having the further advantage that although *Cakile* dies at the end of the summer its persistent dead body continues to hold the sand through the winter. This quasi-permanent patch of sand the *Psamma* utilises to push its

stolons, and eventually occupies the whole ground. The function of *Cakile* in dune building is thus a conspicuous one, as it enables *Psamma* to become effective much sooner than would be the case had it to wait till its own seedling offspring come to the rescue. (Pl. XLVII., lower photo, shows isolated marram plants with matrix of blown sand held by *Cakile* of preceding year).

Occasionally, when *Psamma* seedlings are produced in quantity their joint action in holding the sand is extremely marked. Thus in the autumn of 1928 the full grown plants of *Psamma* ripened great quantities of seed, which, being scattered round about by the wind, germinated profusely to form in 1929 continuous lawns of seedlings occupying the bays and spaces between. By July these young plants, often present to the number of 80 per sq. yard, had 5 or 6 leaves and were about 6-ins. high. Sand was being actively collected and was already about 3-ins. deep (cf. Pl. XLVIII., lower photo).

Thus we see that observations on the Far Point contribute important links in the chain of events leading up to well grown sand hills. *Triticum* thrives conspicuously at first, building up hillocks to about 4-ft., which spread rapidly; but in the long run, when *Psamma* gets entrance, the *Triticum* is overwhelmed and is rarely to be found on a fully-grown dune.

For some reason, not ascertained, *Triticum* thrives best at not more than a few feet above beach level—perhaps questions of water supply are involved—and in the end fails in competition with *Psamma*. The point to be noted is that *Triticum* is the true pioneer, whilst *Psamma* (although it may establish as a pioneer) is unable to make good till supplied with ample sand either by other plants or by a multitude of its own offspring. In other words *Psamma* belongs to a later phase (or “succession”) of the sand dune formation, than *Triticum*.

The stage which the colonisation of the Far Point has now reached is very interesting. The proximal portion (x, Text-Fig. 1) is largely under *Psamma*, whilst further West (y, Text-Fig. 1), though *Triticum* is yet dominant, the *Psamma* is beginning to get a footing in the sand hills which *Triticum* has built up. Still further West are young, isolated dunes (mostly under *Triticum*), and beyond these bare shingle recently thrown up. In the aggregate the Far Point provides ideal



Aerial view of Blakeney Point Headland, seen through fleecy clouds; Morston Marshes in front of picture



Marram Plants with continuous mantle of sand held by associated Kakiles of previous season



ground for the demonstration of all the earlier phases of dune building, and it is to be expected that in the near future (apart from some catastrophe) marked vertical rise of these sandhills will be apparent.

Differentiation of Habitats

From a more general point of view, the area commands attention as illustrating different types of maritime habitat in process of differentiation. At first we have a succession of beaches of shingle thrown up, of which some parts are slightly higher than others; whilst between are minor discontinuities or gaps in the system of construction. Plants spring up where drift lies and this is mainly, through the law of buoyancy, along the crests and higher slopes. As yet the future distinctive habitats are not differentiated, and one finds at this stage a *mixed* community of plants of which the individual species are usually to be found on dunes, or bare shingle, or in salt marshes. Thus, such a typical salt marsh plant as *Aster Tripolium* will be found establishing on pure shingle—possibly on a buried layer of drift which for a time holds the necessary moisture. This is no incipient marsh, and as conditions change by drying out and the addition of blown sand, the Asters will depart.

Elsewhere, at rather lower levels accessible to tides, silting will regularly occur and the beginnings of a salt marsh habitat come into being. On these, presently, *Salicornia*, *Vaucheria*, etc., will appear. A good example of a partly covered salt marsh is to be found just west of the point where the "Caretaker" is anchored. This is the work of about five years. We find that once the annual *Salicornia europæa* gets a footing it faithfully reproduces by seed, most of which falling on the mud close by, ensures recurrent establishment from year to year.

Elsewhere are incipient "lows"—little valleys cut off from all but the highest tides—and in some of these have already appeared such characteristic members of this type of habitat as *Statice reticulata*.

THE TERNERY.

The nesting ground on the Far Point has continued to prosper during the three seasons under review, the number of Sandwich Terns in relation to Common showing a continuous increase.

It is difficult to make an accurate estimate of the number of birds, but 4,000 Terns of all five species should not be far from the mark. The numbers culminated in 1928, though 1929 is not far behind. The Roseate Tern has now bred with us (usually 2 pairs) without intermission since 1923. In 1929 2 pairs nested near their usual spot, and one chick was safely reared from each of the nests. (Photo of Sandwich Terns on Pl. XLVIII.)

Though the 1929 season started late the ground was well covered with nests by the end of May. Cold weather and strong winds in June were responsible for some losses among the young chicks; but on the whole the season has been a good one.

As in 1928 Redshanks, and one pair of Oyster Catchers successfully brought off their chicks on the same area.

The small, covered houseboat "Caretaker," which has been moored on the breeding ground, has proved most useful as a base for the closer supervision of the ground. It is also a good observation point, and provides sleeping quarters for the Watcher during the season.

Matters of Policy

As regards terneries, bird sanctuaries, nature reserves, and the like, no standardised procedure has yet been reached. There is the one extreme favoured by the Swiss in their great National Park in the Engadine which is treated as an absolute sanctuary, never disturbed by man apart from the periodic, authorised visits of experts to record progress.

The other extreme is illustrated by our own ternery. When the National Trust took over in 1912, no Far Point was in existence. The Terns bred mainly in Great Sandy Low (to the seaward of the Laboratory) and consisted of about 1,000 pairs of Common Tern and 100 Little. With the development of the Far Point, Terns began to nest there in tentative fashion in 1919, and from year to year in increasing numbers. To-day practically all nest here, and include the five species, Sandwich, Common, Roseate, Arctic and Little. The outstanding feature is provided by the Sandwich Terns, which are probably to be seen here under more favourable conditions than anywhere else in the British Isles. The policy of the National



Sandwich Terns on Blakeney Point, from a photograph
by Mr. Geo. Marples



Lawn of Marram seedlings arising alongside established
Marram plants, 1929

BRITISH
MUSEUM
25 FEB 30
NATURAL
HISTORY.

Trust, as interpreted by its Blakeney Point Committee of Management, has been definitely to maintain the ternery as such, and to give it protection by destroying ground vermin and by discouraging such birds as are destructive of Terns, their eggs or young. Crows, Black-headed Gulls and Little Owls are consistently removed. The Gulls, for instance, are prone to pick up the young chicks, and at a safe distance devour them. Owls will even beliead the sitting birds.

Our Watcher, Mr. R. J. Pinchen, does everything possible to protect the Terns from their foes, with the result that collectively they form a magnificent and inspiring spectacle, whilst providing incomparable material for study in a variety of fields. One of these, as yet hardly explored, is the scientific study of the social relations of the members of this great assemblage of birds.

Visitors, expert and non-expert alike, are admitted to the ternery, and so long as there is no evidence that the birds suffer, this policy will be continued. It is not necessary to be a trained naturalist to be tremendously impressed by the grandeur of the spectacle; and the inspiration of a visit is a thing not likely to be forgotten, especially by the young. We believe therefore that our policy of giving admission to this unique spectacle is the best propaganda for implanting and encouraging a love of nature.

There is just one restriction we would wish the public to observe, viz., to refrain from visiting the ternery after 7 p.m., so as to give the birds a chance. This regulation will come into force in 1930.

Our neighbours at Scolt Head have pursued latterly yet another policy. Here also Terns breed, sometimes in large numbers. Excepting Gulls, all birds are welcomed—Owls, and even Harriers, if they will. It is left to Nature to determine which shall be the survivors. The experiment is the more interesting, as the two terneries lie near enough together to be visited on successive days, and results compared. At Scolt Head, non-intervention is not pushed to the point of excluding human visitors.

INFLUENCE OF THE TERN COLONY ON NEW SOILS

The presence of so many birds nesting gregariously for three months of the year on a small area of ground like the

Far Point must have a marked influence on the development of the soil, especially in the direction of enriching it with combined nitrogen derived from their food.

The available sources are (1) the fish ("whitebait" and young sand eels) consumed by the old and young birds, which reaches the soil in the form of droppings (conspicuous everywhere about the nests in the case of the Sandwich Tern); (2) the unconsumed fish left lying about; (3) the bodies of such chicks as die on the nesting ground in cold and windy periods; (4) the bodies of insects, etc., which feed on the dung.

To investigate the matter a few preliminary determinations of nitrogen in these soils were made in 1927. The materials were collected in July by Dr. Mukerji and supplemented by a November collection, whilst the actual determinations were made by Miss R. Dowling of University College.

The method was as follows.—A large *Triticum* dune on the Far Point (about 25-ft. long) where Sandwich terns were known to have nested for 5 years was selected, and about 30 samples of soil were taken from 2 to 6 inches depth; and from the mixing of these the determinations were made.

As a control, a similar dune of like age was chosen near the Boathouse, where birds do not nest, and the soil samples were treated in precisely the same way.

The loss on ignition in the soils from the nesting ground averaged .65 per cent., and in the soil from the Boathouse dune .26 per cent. Further samples from the nesting ground taken in November showed a loss on ignition of .48 per cent., this diminution (.17 per cent.) being attributable partly to leaching by a very high autumn tide which partly submerged our *Triticum* dune, partly to the admixture of additional wind-carried virgin sand.

Nitrogen is present in all samples from the nesting ground (July) in three forms, viz., nitrates, ammonium salts, and protein. The November samples of the same show a marked fall in ammonium salts, which have probably undergone leaching, whilst in the Boathouse dune, though nitrates and protein are present, no ammonium salts were detected.

The presence of phosphates was also verified but not determined quantitatively.

The carbonates present in all soils were about the same, and showed no significant diminution in the winter samples.

The amounts found were .48 per cent. nesting ground (July), .47 per cent. (November); Boathouse dune (July) .43 per cent.

These preliminary observations serve to show that the presence of the birds has a marked effect on the nitrogen content of the soil of the nesting ground, and forms a basis for possible change in the flora comparable to that of the bird islands in Spitsbergen.*

This enriching of the soil *ought* to have some effect on the vegetation, but there are other factors in operation which stimulate the leading plants and we are not yet in a position to differentiate between them. The leading plants are *Triticum* and *Psamma*, and both grow and flower with the utmost vigour—conditions which are also promoted by shingling and sanding over, and in general by hard buffetting. So we shall have to wait and see whether particular species of plants appear in the next successions on the manured ground.

We have been impressed with the rapidity of colonisation of the Far Point by new species of plants (see Table, p. 630), but this I incline to attribute to tidal drift rather than to any interference by the birds.

THE ALGÆ OF BLAKENEY POINT

The lists and notes, which are printed here for the first time, were drawn up some years ago by Mr. A. D. Cotton, Keeper of the Herbarium of the Royal Botanic Gardens, Kew, who worked partly with University College parties, partly on independent visits at other seasons.

The total number of marine and salt marsh species enumerated reaches about sixty—a high figure for a sandy and muddy foreshore such as the Point and Harbour of Blakeney provide. This richness in forms depends especially on two circumstances ; (1) The presence of mussel beds in the harbour which give secure anchorage to many species, especially of red algæ, and (2) The great variety of algæ which enter as components of the salt marshes, especially habitat forms of brown seaweeds. These latter formed the subject matter of the researches of the

*V. S. Summerhayes and C. S. Elton. Further contributions to the Ecology of Spitsbergen, *Journ. of Ecol.*, 1928, pp. 238—247.

late Dr Sarah Baker, and were described in conjunction with Mrs. Blandford, in Blakeney Point Publication, No. 16.

To complete the list of our algæ the freshwater forms are required. These are accessible only on the rare occasions when freshwater stands for some time on the Point, the principal localities being Glaux Low and Long Low, which lie to the N.W. and S.E., respectively, of the Laboratory. These forms, which are not numerous, have yet to be worked out in detail. The late Prof. G. S. West examined a few samples in one of which he discovered a new species, *Carteria Oliveri* (cf. our Report, 1915-16, p. 12); but the investigation of the remainder has never been completed.

The only permanent source of freshwater on the Point is the Well, dug at the Boathouse end of Long Low to the W. of the Flagstaff. This is kept covered and does not yield algæ.

LIST OF MARINE AND SALT MARSH ALGÆ

CYANOPHYCEÆ

Chlorococcus turgidus, Naeg., epiphytic on various algæ.

Spirulina subsalsa, Oersted.

Oscillaria limosa, Ag. Common in pans. Sometimes holding sand and forming plateaus.

Lynbya aestuarii, Liebur. Very common forming pure felts or mixed with other species in large felts.

Lynbya confervoides, C.Ag., not uncommon in felts, especially in summer.

Lynbya semiplena, J.Ag.

Lynbya majuscula, Harv., epiphytic and free floating.

Microcoleus chthonoplastes, Thur., abundant at certain levels as a mud and sand binder.

Microcoleus tenerimus, Gom., rare.

Calothrix confervicola, Ag., epiphytic.

Rivularia atra, Roth., on firm ground at the Hood.

Rivularia nitida, Ag.

Microchæta æruginea, Batt., epiphytic.

Anæbæna torulosa, Lagerh, occurs as greenish black discoid or circular colonies on mud.

CHLOROPHYCEÆ.

Protoderma marina, Rke., on stones under Aster.

Percursaria percursa, Rosenv., a not infrequent species in felts, though not in large quantity.

Monostroma sp.

Monostroma Grevillei, Wittr., abundant in spring on algæ and pebbles in channels.

Enteromorpha intestinalis, Link., abundant.

Enteromorpha compressa, Grev., abundant.

Enteromorpha micrococca, Kütz., common near h.w. mark.

Ulva Lactuca L., common in main channel on mussels, and in free floating form; (*var. latissima*) in dikes on Salthouse marshes.

Ulothrix pseudoflacca, Wille., frequent on *Fucus vesiculosus*.

Ulothrix flacca, Thur., frequent.

Chaetomorpha ærea, Kütz., abundant in dikes on Salthouse marshes.

Chaetomorpha linum, Kütz., rare.

Rhizoctonia riparium, Harv., not uncommon.

Cladophora sericea, Kütz., not uncommon.

Cladophora gracilis, Kütz., a form apparently referable to this species, not uncommon.

C. fracta, Kütz., in felts and washed ashore.

Vaucheria Thuretii, Woron, not uncommon especially on Samphire Marsh (S. of Hood) where it forms apparently a fairly broad zone about 30 yards wide and 3-4 feet deep.

Vaucheria squandra, Woron, apparently rare.

Vaucheria sphærospora, Nordst., apparently rare.

Vaucheria coronata, Nordst., not uncommon; once at very high level (Glyceria).

Species of *Vaucheria* can only be determined when the reproductive (sexual) organs are present. Several scores of samples were taken at various dates and at various levels. These were washed out later at Kew and examined, and the four species named were found.

PHÆOPHYCEÆ

Phæococcus adnatus, West., occurs on mud banks near H. W. M.

Punctaria latifolia, Grev., scarce, a few specimens found in April.

Phyllitis fascia, Kütz., not uncommon on pebbles in channels in Spring.

Ectocarpus littoralis, Kütz., not uncommon.

Ectocarpus siliculosus, Kütz., not uncommon.

Ectocarpus Hincksii, Harv., rare, on Lam. *Saccharina*.

Elachista fucicola, Fr., a few specimens found.

Myrionema strangulans, Grev., on *Ulva Lactuca*.

Chorda filum, Stackh., in the main channel.

Laminaria Saccharina, Lamx., in the main channel.

Fucus vesiculosus, L.

Fucus vesiculosus, var. *volubilis*.

Fucus spiralis, L.

Fucus serratus, L., in main channel.

Pelvetia canaliculata, Decne et Thur.

FLORIDEÆ

Erythrotrichia carnea, J.Ag., epiphytic.

Porphrya umbilicalis, Kütz., in main channel.

Chantransia virgatula, epiphytic on various algæ in the main channel.

Catenella opuntia, G. and W., on *Suæda fruticosa*.

Gracilaria confervoides, Grev., in main channel.

<i>Polysiphonia nigrescens</i> , Grev., in main channel	} On large stones in the scour near Lifeboat House.
<i>Polysiphonia elongata</i> , Grev., in main channel.	
<i>Polysiphonia urceolata</i> , Grev., in main channel.	
<i>Polysiphonia atro-rubescens</i> , Grev., in main channel.	

Bostrychia scorpioides, Mont., on Aster, etc., in creeks. May be attached to *Pelvetia* or forming a mulch.

Callithamnion roseum, Harv., Epiphytic on various algæ.

In main channel in Spring.

Ceramium rubrum, Ag., in main channel.

The bed of the main channel itself is for the most part sandy, and owing to strong tidal scour is, except for stones or where the ground is held by mussels, devoid of vegetation. Mussels occur immediately below the Lifeboat House (and also further west) and they provide the finest purely marine vegetation on the area.

In the spring the growth is fine and luxuriant, though only composed of about a dozen species; in the summer it is still copious, although the delicate red forms have disappeared, and there is much diatom growth.

The dominant species in spring are *Ulva Lactuca*, *Ceramium rubrum*, *Polysiphonia nigrescens* and *P. elongata*. On the mussels more to the west, where they stretch right across the channel, there are in addition, *Polysiphonia atra-rubescens*,

P. urceolata, *Ectocarpus littoralis* and *E. siliculosa*, *Porphyra umbilicalis*, *Fucus serratus*, *Laminaria Saccharina*, with *Ectocarpus Hinksii*, *Enteromorpha intestinalis*, *Callithamnion roseum*, *Gracilaria confervoides*, and *Cladophora* sp. As is usual in rapidly running water, the plants are characterised by great length—*L. Saccharina* 8-10-ft., *Porphyra* 4-ft., *Ulva* 2 -ft., *Enteromorpha* 3-ft., *Polysiphonia elongata* 1 -ft. In spring, when the plants are young and in good condition, the effect on a fine day of *Polysiphonia* and *Callithamnion* against the bright green background of *Ulva* is equal to rock pool scenery. It is seen at its best at the close of the ebb. In summer, all the *Polysiphonia* disappears except *P. nigrescens*, and apparently the only additional species is *Chorda filum*, which develops in abundance.

The luxuriant growth here is due to the solid substratum provided by the mussels and the never failing current bringing a constant supply of oxygen.

BRYOPHYTES AND LICHENS

During July, 1927, Mr. Paul W. Richards, a member of the Department of Botany, made an ecological investigation, especially of the Bryophytes. The results of this have recently been published in the Journal of Ecology (1929), and reprinted as Blakeney Point Publication 29. Mr. Richards also revised the systematic enumeration of our Bryophytes and Lichens, in connection with lists drawn up by W. H. Burrell, W. Watson and V. S. Summerhayes (Bryophytes), and by R. C. McLean and W. Watson (Lichens).

These lists as revised by Mr. Richards are here appended.

The dune ridges are named according to the lettering on the map published in B.P. Report, 1924-26, p. 2.

MUSCI

1. *Polytrichum piliferum* Schreb. Old grey dune and on neighbouring high shingle, Hood : on shingle near the "Yankee."
2. *P. juniperinum* Willd. Grey dunes and neighbouring shingle, Hood.
3. *Ceratodon purpureus* Brid. Abundant on grey dunes, older white dunes and high shingle in most parts of the Point.

4. *Dicranum scoparium* Hedw. var. *orthophyllum* B. and S. Locally abundant on older grey dunes (C, B, and Hood) ; a very few young plants on D.
5. *Grimmia pulvinata* Smith. On shell in high shingle, Hood, Watson.
6. *Tortula muralis* Hedw. High shingle, Marrams, Watson.
7. *T. subulata* Hedw. Outer part of dunes, Hood, Summerhayes.
8. *T. ruraliformis* Dix. Abundant on the older white dunes ; frequent on the high shingle and grey dunes except where very old and undisturbed (as on parts of C, D, H and at the Hood)
9. *Trichostomum flavovirens* Bruch. On high shingle, descending into the zone of *Suaeda fruticosa* ; Marrams, main bank and Hood ; sparingly in Long Low.
10. *Funaria hygrometrica* Sibth. High shingle, Marrams. Watson.
11. *Bryum pendulum* Schp. On shingle, main bank near the Marrams, with fine fruit in 1927.
12. *B. Warneum* Bland. " Probably ; but without capsules." High shingle, Marrams, Watson.
13. *B. inclinatum* Bland. Grey dunes (hollows at Headland), Watson ; on high shingle, main bank at the Marrams.
14. *B. pallens* Sw. Fruiting on shingle, main bank ; a plant with imperfect fruit from the grey dunes probably also belongs here.
15. *B. turbinatum* Schwaeg. " Probably ; but no fruit." High shingle, Marrams, Watson.
16. *B. capillare* L. Grey and derelict dunes and on high shingle, Marrams, Watson. Probably frequent on the dunes, but no fruiting plants were seen in 1927.
17. *B. Donianum* Grev. Grey dune, top of Long Low, Watson
18. *B. argenteum* L. High shingle, Marrams ; grey and derelict dunes, Watson ; a few young plants in Glaux Low. var. *lanatum* B. and S. Dunes, Watson : here and there on the dunes, sepecially on E. Nearly all the plants of the species examined belonged to this variety. Other species of this genus probably occur, but cannot be identified, owing to the lack of fruit.

*These were published in the Blakeney Point Report in 1914.

19. *Brachythecium glaucosum* B. and S. Grey dune, Headland, *Watson* : outer edge of dunes, Hood., *Summerhayes*.
20. *B. albicans* B. and S. High shingle, Marrams, *Watson* : abundant on older white dunes, frequent on grey dunes.
21. *B. rutabulum* B. and S. Marrams, *Watson* : main bank ; grey dune (D and Hood).
22. *B. purum* Dix. Grey dunes, hood.
23. *Eurhynchium prælongum* Hobk. " Grey dune, often in shade of *Psamma* ; abundant, *Watson*. Not seen there in 1927. Shingle, main bank and Marrams: old grey dunes, Hood (chiefly among *Juncus maritimus*).
24. *E. confertum* Milde. High shingle, Hood, *Watson*.
25. *Amblystegium serpens* B. and S. High shingle, Marrams. *Watson* : main bank.
26. *Hypnum cupressiforme* L. Grey dune, abundant ; with *Corynephorus*, abundant ; high shingle, abundant, *Watson*. The only specimens I have seen which did not belong to one of the following varieties came from the old grey dunes at the Hood.
var. *ericctorum* B. and S. Old grey dunes, Hood.
var. *tectorum* Brid. Abundant on the dunes (Hood, B-D. Very rare on E).
var. *clatum* B. and S. Old grey dunes, Hood.
27. *Hylocomnium splendens* B. and S. Grey dunes, Hood, *Watson*.
28. *H. squarrosum* B. and S. Grey dune, Hood, *Burrell* and *Watson*.
29. *H. triquetrum* B. and S. Grey dune, Hood.

HEPATICÆ

30. *Lophocolea cuspidata* Limpr. Old grey dune, Hood.
31. *Cephaloziella Starkii* Schiffn. (= *C. byssacea*). Old grey dune, Hood, in shelter of *Psamma* on grey dune C.

LICHENS

A number of lichens not previously recorded for the Point were found by Dr. Watson in 1920. A list of them, copied from his manuscript notes, is given below, together with a few records made by Mr. Richards. Five new species were found in 1927. Two of them were represented by a very few small specimens only and were presumably new arrivals. It is

remarkable that both these species usually grow on the bark of trees.

Collema glaucescens Hoffm. "Grey dune near Long Low.

Material insufficient to make determination certain."

Peltigera canina Willd. Grey dunes.

P. polydactyla Hoffm. Grey dunes.

Parmelia physodes Ach. forma *labrosa*. Present with type on grey dunes. var. *tubulosa* Mudd. Present with type on grey dunes.

P. caperata Ach. One plant on dune E, Richards.

P. fuliginosa Nyl. "The very dark typical form of rocks was not noticed. All the specimens I examined on the high shingle of Marrams and Hood belong rather to var. *laete-virens* Nyl."

Usnea florida Web. var. *hirta* Ach. One plant on grey dune D and another on C, Richards.

Placodium lobulatum A.L.Sm. "Very abundant with *Verrucaria maura* in very low shingle, occasionally on shells and stones on high shingle. This is probably the *Lecanora citrina* or *L. incrustans* of McLean's paper."*

P. (Callopusma) phloginum A.L.Sm. On drifted wood, high shingle, Hood.

P. (Callopusma) cerinum Hepp. On *Suæda* stems, high shingle, Hood.

Rinodina demissa. On pebbles and shells, low shingle, Marrams and Hood.

"*R. exigua* of McLean's paper refers to the preceding (*R. demissa*). The specific name *exigua* is now usually restricted to lignicolous forms."

Lecanora Hageni Ach. "Low shingle on decaying leaves of *Suæda*, etc. High shingle on *Suæda* stems (often almost crusted with *Pleurococcus viridis*) and drifted wood.

L. umbrina Massal. On shell, high shingle. "Probably frequent."

Lecania prosechoides Oliv. Low shingle, Marrams, Long Hills and Hood ; high shingle.

L. prosechoidiza A.L.Sm. Low shingle between Long Hills and Hood ; high shingle.

*McLean, R. C. The Ecology of the maritime lichens at Blakeney Point, Norfolk. *Journ. Ecol.* III., 1915.

- L. erysibe* Mudd. Low shingle between Long Hills and Hood.
- Cladonia rangiferina* Web. "Not noticed." Also not seen in 1927.
- C. pyxidata* Hoffm. var. *chlorophæa* Floerke. Grey dunes. forma *lepidophora* Floerke. Grey dune.
- C. fimbriata* Fr. Grey dunes, Richards.
- C. furcata* Schrad. var. *scabriuscula*. Grey dune.
- C. rangiformis* Hoffm. Grey dune H and probably elsewhere, Richards.
- C. Floerkeana* Fr. Locally abundant on the grey dunes. Richards.
- Lecidea uliginosa* Ach. On decaying mosses and ground with humus, grey dune, Hood; bare patches on bound shingle with grasses, etc., Marrams. Also on dune ridge C in 1927, Richards.
- L. expansa* Nyl. Bound high shingle, Marrams.
- Bacidia muscorum* Mudd. On decaying mosses, high shingle, Hood.
- L. expansa* Nyl. Bound high shingle, Marrams.
- Bacidia muscorum* Mudd. On decaying mosses, high shingle, Hood.
- B. inundata* Koerb. On low shingle near *Suæda*, Marrams.
- Buellia spuria* Koerb. On shell, high shingle, Marrams.
- B. myriocarpa* Mudd. On drifted wood, Hood.
- Rhizocarpon confervoides* D.C. The common form is forma *cinereum*; forma *albicans* was noticed on low shingle, Hood.
- Lecania Nylanderiana* Massal. "A plant found on pebbles on the margins of the Pelvetia marsh is probably referable here. It differs in some respects but, considering the material I have, I do not feel inclined to create a new species for it."

We have to thank Miss A. Lorrain Smith and the Referees of the British Bryological Society for several determinations.

FLORAL BIOLOGY

Latterly attention has been given to various features connected with the biology of reproduction of selected species of flowering plants on the Point.

Thus, one of the species selected for intensive study of the duration of individual flowers and the opening and closing times of floral members showing periodic movements was

Erodium neglectum, the results respecting which will serve to illustrate the kind of phenomena investigated. The flowers last about three days, opening about 7 a.m. and closing between 11.30 and 1 p.m. On the third day, however, from 10 in the morning to about 2 in the afternoon the petals are shed in succession at intervals ranging from five to ninety minutes. Usually this shedding starts soon after eleven. The flowers are usually slightly protogynous but, rarely, protandrous individuals occur; in either case, however, the stamens dehisce in two groups, and not infrequently some of the anthers are shed before dehiscence.

Similar studies carried out on other species shewed that the different individuals of a species may vary in respect of the incidence of these periodic phenomena.

A number of the shingle species were also studied with respect to the normal seed output and shewed the great range in productivity between species and species. *Senecio Jacobæa*, which is one of the commonest of the dune plants, and in some years occurs in great numbers, may produce as many as 32,800 fruits on a single individual, and even average-sized plants will produce over seven thousand. By contrast, *Convolvulus Soldanella* spreads almost entirely by vegetative means and the seed output is small, as not only is the number of seeds per capsule small (3-4) but a large proportion of the flowers are infertile owing to the reproductive organs having been bitten off by rabbits. A few examples from the shingle flora well illustrate the wide range in respect of seed output. *Rumex crispus* v. *trigranulatus* produces from 4,000 to 25,000 fruits, *Beta vulgaris* up to 130,000, whilst *Lepturus filiformis* has a fruit output of only about 9 to 90 per plant, and *Statice binervosa* has a seed output that averages about 400 and rarely exceeds 1,000. These data however only present a partial picture and the percentage germination of most of these species has yet to be determined.

BLAKENEY POINT FROM THE AIR

Ever since the Air Survey of Blakeney Point was undertaken in 1921-22, it has been my ambition to see the Point from aloft. The opportunity came on August 19th, 1928, when, accompanied by one of my sons who holds a pilot's certificate, we flew

over from Mousehold in one of the Moth machines of the Norfolk and Norwich Aero Club.

We took off punctually at 4 p.m., and thanks to the Moth's fine climbing powers, quickly reached the comfortable height of 2,500 feet. As ever on these occasions, the untidy edges of parcels of ground had vanished, there was no appearance of sordidness visible anywhere, and except for our two selves, the human ant was off the map. Spread below was a patchwork of angular pieces like the choicest fabrics; this was Norfolk in harvest time. Standing grain crops, others partly cut, or in sheaf; all different shades of yellow, buff or silver, with splashes of green where the weeds showed through. The network of hedges was made conspicuous by little toy brooms which were trees. Marl pits in the fields stood out, and so too ponds and lakes, whilst parks like Gunton and Blickling, formed oases in the Joseph's coat of many colours of arable. It is the duty of a pilot continually to select good ground for a possible forced landing, and for this purpose (luckily not required) fields with midget sheep grazing were chosen. These promised a smooth landing; for Moths are not like Handley-Pages, capable of going through anything—even hedges.

Our course had been set by compass, and we made the coast between Sheringham and Weybourne, where the fore-shortened view of Blakeney Harbour spread itself below us to the west. The sun and cloud effects above were indescribable, and would need a Turner to do justice to them. At this height clouds have edges and upper surfaces, as well as the undersides familiar to dwellers on the ground. Coming lower, we passed over Salthouse—the Heath appeared deep purple, not crimson—and so by the inner edge of the beach, the Watch House, Hood and other well-known features of Blakeney Point (Pl. II., upper photo) to its recent extension, the Far Point, where the terns have their breeding ground. The birds still remaining looked from above like small grey insects crawling on the beach, and it was hard to realise that they, like ourselves, were in flight. The relief of the Far Point, with its rather formal curved beaches, looked clear cut like a model. The tide had about half ebbed, and the usual flotilla of boats was returning to Blakeney before the water should have run away. Individual boats were easily recognised.

Three outstanding things deserve mention. First, the apparent smallness of Blakeney Point, which on the ground seems a spacious territory. This is perhaps a consequence of the second, the exposure of every detail, bare and unobscured, at the same moment. The third was the wonderful colour scheme. All ground colours seemed modified. The sandhills with marram grass looked merely drab; the younger marshes a most vivid green, the water in the channel and beyond, deep blue like a Pacific island lagoon; whilst the yellow of the sands between the mouth and Wells was luminous, even dazzling. Some day a course of flying will be included in the education of every landscape painter.

An unexpected colour effect that may interest those having intimate knowledge of marsh zonation, was the inversion of the intensity of the green of the main *Salicornia* area and of the narrow, marginal *Suaeda maritima* zone of the large *Salicornia* marsh which lies between the sandhills of the Headland and the Long Hills ("The Beach Way.") From the ground the *Salicornia* area appears a vivid green, whilst the marginal zone is not only less vivid, but rather glaucous in tint. From the air these colour relations are reversed. The marginal zone was, under the conditions of the visit, appreciably more vivid than the inner *Salicornia* area.

This effect is perhaps to be explained by the fact that the *Salicornia* plants, consisting as they do mainly of vertical succulent stems which are seen from the air end on, allow a good deal of the brown matrix of *Pelvetia* to become visible, so that the green colour undergoes dilution or rather contamination. On the other hand the *Suaeda maritima* plants of the outer zone carry spreading foliage leaves, so that relatively less of the ground between becomes visible from the air.

Having circled once or twice round the flagstaff as a parting salute, we crossed the harbour and marshes on the Morston side, the meanders of the Agar Creek forming the most conspicuous and characteristic ground object. Blakeney shows well from the air, and the same is true of Holt, where we picked up the railway line to guide us back to Norwich. It is easy enough to hit the shore from Norwich, but to find this pin's point far inland needs guidance—the county as a whole being without conspicuous topographical features. The Cathedral

was disappointing as a landmark, nor did the roofs of Norwich show red, like Holt and Blakeney. It is not surprising that the Germans never found this city. Once in sight, however, the aerodrome, with its geometrical sheds and hangars, is very easy to recognise. Here we had to circle overhead for some minutes till the sheep, which had strayed all over the place, had been rounded up by the ground staff.

We are greatly indebted to the Officers of the N. and N. Aero Club for affording facilities for this flight, including the use of their new Moth machine.

VISIT OF GEOGRAPHERS.

On Sunday, July 22nd, 1928, some 60 or more members of the International Congress of Geographers, then meeting at Cambridge, paid a visit to Blakeney Point.

The party came over from Cambridge by road and were taken across to the Point in motor-boats from Blakeney and Morston. They were received on the Point by Lord Ullswater, the Vice-Chairman of the National Trust, who, in a happy speech—repeated in French for the benefit of those not too familiar with the English language—warmly welcomed the distinguished guests.

The party was split up into sections—those interested especially in coastal topography being shown round by Professor Oliver and Mr. E. H. Chater; others, whose interests were more in the direction of shore vegetation, were in the hands of Dr. E. J. Salisbury and Dr. Violet Anderson; and those ornithologically inclined were taken round the Ternery by Dr. S. H. Long. The occasion was one of great interest, not only from the point of view of seeing this shingle spit where problems connected with coastal erosion, etc., have been under investigation for so many years, but it was also the means of bringing into personal contact with the workers at the Blakeney Point Research Station many distinguished scientists from the Continent, America, and from Japan, who were previously only known to each other by repute or by correspondence. The party were entertained to tea at the Old Lifeboat House by Professor F. W. Oliver, his staff and students, and before leaving each guest was presented with an illustrated account of the Point as a souvenir of the visit.

DOMESTIC MATTERS

The Point House

With the close of the 1928 season Mr. and Mrs. Pinchen withdrew from their tenancy of the Point House, at the same time relinquishing the catering in the tea room which they had held since 1923. As successors in the house the Committee have appointed Mr. and Mrs. Eales, and they are now acting as Joint Managers of the Tea Room. Mr. Pinchen retains his position as Watcher to the Trust. To Mrs. Pinchen and to her daughter, Miss Edith Pinchen, who helped her, the Trust are much beholden for the high standard maintained and in other ways.

Litter

In the last Report reference was made to the litter problem from which we suffer in a slight degree. And the suggestion was made that a picture poster would be helpful. A copy of this Report by chance came into the hands of *Fougasse*, the well known artist of *Punch*, and he most generously offered us a cartoon drawn for the purpose. This cartoon is used on the Point and has also been adopted by the National Trust for display on other of their properties. In agreement with our experience here, I understand that the *Fougasse* cartoon makes the right impression wherever it is used. It is also much in demand in Boy Scout and Girl Guide circles for educational purposes. To complete the 'good 'work young Teddy Eales has been appointed for the summer months "litter collector" of such trifles as survive the *Fougasse* caustic.

Landing Stage

For the convenience of visitors arriving by water a landing stage on wheels has been provided at the usual landing place.

Carnser

An unwelcome item of expense has been incurred through the collapse of the bridge on the Carnser at Easter this year. This ground belongs to the National Trust and one of the obligations of ownership is the upkeep of the bridge which we have reinstated.

Picture Post Cards

In previous years the Trust have issued series of picture post cards for sale among visitors, especially of bird subjects, many

being from negatives by Mr. R. Gaze. With a view to bringing these up-to-date, a further dozen was issued this year, including six studies of Sandwich Terns generously put at our disposal by Mr. George Marples of Liverpool. These have proved a great success, as well they might, being pictures of great beauty.

Gifts

The following donations of money, made since the issue of the last Report in 1926, are gratefully acknowledged. They have been credited to the Fund for the upkeep of the Laboratory, purchase of apparatus, and the like :—

Dr. Violet Anderson, £1 1s. 0d. ; Mr. Francis Druce, £2 2s. ; Dr. J. L. Gayner, £5 3s. 0d. ; Mr. A. H. Macdonald (for Library in O.L.B.H.), £3.

Such profits as accrue from the sale of Blakeney Point Publications and of picture post cards are credited to the same Fund.

Personnel of Committee

Owing to his migration from Norfolk to Oxford in 1928, Dr. Robert Gurney felt that he was compelled to relinquish the Chairmanship of the Committee, which he had accepted a few years previously. Dr. Gurney was an original member of the Committee and was always faithful to the interests of the Point, and we lose him with the greatest regret. His successor as Chairman is Mr. J. W. Castle.

Owing to my own absence in Egypt for some time, Dr. S. H. Long has kindly consented to act as Hon. Sec. to the Committee.

Committee for 1930.—Mr. J. W. Allen, Mr. S. E. Barker, Mr. T. W. Bourne, Mr. J. W. Castle, Mr. Walter Derham, Dr. G. Claridge Druce, Mr. W. A. Forsyth, Mr. R. M. Garnett, Mr. Quintin E. Gurney, Capt. L. W. Lloyd, Dr. Sydney H. Long (Acting Hon. Sec), Prof. F. W. Oliver, Mr. Sam Peel, Dr. E. J. Salisbury, and Miss M. A. Sewell.

V.

OOLOGY AS AN AID TO SCIENCE

BY E. C. STUART BAKER, O.B.E., F.Z.S., F.L.S.,
M.B.O.U.

I THINK I told you when I had the honour of addressing you last year that egg collecting is looked upon by most people as a silly vice, generally shown either in the very young or the very old. Protectionists look upon it as the acme of all that is cruel, whilst I am afraid even among scientists there are a great many, at the present day, who look upon oology as useless. I tried last year to show you that scientific collecting and the scientific study of eggs may be really of some value. I then briefly referred to many ways, some obvious and some not so easy to follow, in which oology may be of value to ornithology if properly pursued. To-day, I intend to try to show how eggs may help in the study of evolution, which is, of course, a far grander and far bigger thing than any one special branch of Zoology. For this purpose I have brought with me some exhibits which are probably more convincing than slides. It is rather a habit nowadays to decry Darwinism and to assert that modern scientists have shown that Darwin's crude ideas of environmental evolution are exploded. The more, however, I read the works of modern scientists, the more it seems to me that their theories are controlled by Darwin's "survival of the fittest." The great discoveries of Mendel, Bateson and others, important as they are and true as they are, still appear to me to be merely individual factors in the determination of living individuals. A very simple instance of this is Mendel's mathematical progression in the number of forms evolved by crossing. Uncontrolled by other forces his discoveries would merely result that at the end of a given number of years we should have a given number of individuals of each of the variations caused by hybridisation. This, we know, is not the case and we are aware that while certain forms continue and flourish, other forms dwindle away and finally cease to exist, whilst the cause of their variation in continuity in numbers can only be due to their environment. Except, however, in the case of man-controlled hybridisation it is difficult to see Evolution proceed-

ing before our eyes. Compared with the process of environmental selection, man's life is so brief that it is practically impossible to appreciate the changes which are slowly but surely taking place. It does, however, seem to me that Birds' eggs do show us in a very plain manner how the gradual process of evolution is taking place by the destruction or elimination of that which is unsuited to its surroundings. In the form, colour, size and texture of eggs we are constantly meeting facts the reasons for which seem to be fairly simple and obviously due to adaptation to their surroundings, but amongst Cuckoos' eggs we have examples of what, to me at all events, appears to be the most easily read example of the progress of evolution by selection.

The Cuckoo, as we all know, is a bird which is parasitic on others, either laying or depositing its eggs in other birds' nests and taking no part in their incubation or in the bringing up of the young when hatched. It would seem manifest, therefore, that the foster parent upon whom this duty devolves should not be able to distinguish between her own eggs and those of the Cuckoo, otherwise the eggs would not be hatched, the young Cuckoo would not be reared and the Cuckoos which are parasitic would soon become extinct. If the parent bird is to be deceived, then the deception must be carried out by evolution of the Cuckoo's egg, until it becomes sufficiently like that of its foster parent to ensure its being hatched.

Admittedly during most birds' normal breeding life there are three dominant passions or, as I should call them "furores." First, the desire to lay the egg; secondly, the furore of incubation and thirdly that of feeding the young, and we know that during these three stages birds react to very curious stimuli and perform very curious actions, though these actions are those of individuals and not of the species. It is quite true that one gets an occasional bird which will sit continually on a marble or a lump of clay, or even on a tennis ball, but such birds are the exception and, if our cuckoo relied on these abnormal birds for bringing up its young, it would meet with many bitter disappointments.

Let us see then if we can show whether the Cuckoo's egg does in any fashion agree with that of its fosterer and, if so, how this assimilation is carried out.

Before proceeding further with my attempt to prove the existence of environmental evolution I should perhaps refer to one other point. I have often been told, when giving my views on the Evolution of Cuckoos' eggs, that I have never proved that there was any necessity for such evolution and that consequently my deductions were groundless. I have therefore to-day brought down a box containing a small series of the eggs of the Indian form of the Common Cuckoo. The largest of this series numbers eleven and they range down to that of two only. In the first series five eggs are shown together with the Pipit's eggs with which they were placed. Of these, two nests were deserted, in one case the Cuckoo's egg having been pecked before desertion. In the next series of seven eggs, six were found in the nests of the Verditer Fly-Catcher and one in that of the Plumbeous Redstart; two eggs were deserted. In the next little series of two eggs only, rather remarkable eggs in colour and size, both were deserted. In the next series of eleven, three were deserted. In the fifth series of seven clutches of eggs the nest containing three Cuckoos was deserted, whilst in the final series of five eggs one was deserted.

In giving the number of nests deserted I have only counted those which were obviously left for good and all, but it is quite possible that some of the others had already been deserted or would have been deserted later, although with the exception of the little series of two, these eggs were all deposited in the nests of normal fosterers having eggs with which the Cuckoos' eggs agreed well. It must be remembered that in many cases it is impossible to say whether eggs have been deserted or not. If one finds the Cuckoo's egg very shortly after it has been placed in the nest, the foster parent has had no time to decide whether it shall desert or not, for it is already known from observation that some birds will sit for a short time on the Cuckoo's egg before they desert. Still I think these series prove that desertion does take place very frequently, whilst it is probable that it is even more frequent than has been actually proved. The *sequitur* is that there is a definite reason for the evolution of the Cuckoo's egg.

Again in many instances, especially in the tropics, eggs do not get cold when unbrooded so that it is no use feeling them to see if they have been recently sat on.

As the result of more than forty-five years' study of Cuckoos' eggs it seems to me that we have certain stages of adaption. First, we have the incipient ; second, we have the advanced ; and, third, the perfected. I should explain that I use the term "perfected" for those eggs which have arrived at a stage of adaptation which is so advanced that no further progress is necessary, although this stage differs greatly in different species and genera of *Cuculidæ*. As examples of what I have been saying I will commence with our British Cuckoo. I must, however, preface my remarks by saying that I have had to cut down my exhibit to something which should be portable and I therefore confine myself to commenting on what I can actually show you. The English Cuckoo may be said to have five dominant fosterers in England ; the Pied Wagtail, the Pipit, the Reed-Warbler, the Robin and the Hedge-Sparrow. Now if we examine the four boxes which I have brought down containing series of eggs of the Cuckoo together with those of the foster parents, but omitting the Robin from the above five, you will see that in all four the type of egg which the Cuckoo lays does not vary very greatly and that it is, on the whole, an egg which does not contrast at all violently with those of the first three, the Wagtail, Pipit, and Warbler but, which does contrast very violently with those of the Hedge-Sparrow. If again we examine the eggs more closely we find that though there is a rough general *likeness* there is also a rough general *difference* between the eggs of the Cuckoos in these boxes. Those eggs which have been deposited in the Wagtails' nests are undoubtedly paler on the whole than those which have been placed in the nests of the Pipits and Warblers, whilst those placed in the Pipits' nests are somewhat darker and often redder than those which have been found in the Warblers' nests. So then it seems that whilst there has been a general adaptation of the Cuckoo's egg which renders it inconspicuous when laid in any one of these birds' nests, there has yet been a further adaptation specially to suit each one of the three genera concerned. This we may call a stage of slightly advanced adaptation. When we come, however, to the Hedge-Sparrow's eggs, we find the difference between Cuckoos' and fosterers' eggs is so great that it seems impossible the foster parent could ever be deceived and it

certainly looks as if evolution was non-existent. Even here, again, a closer examination of the Hedge-Sparrow series of eggs will show that the five eggs in the bottom row of the box do show that some evolution is apparently in progress, for the Cuckoo's eggs are almost uniform pale bluish grey, the markings being infinitely less conspicuous than they are in most Cuckoo's eggs. Perhaps here we have a case of incipient adaptation. My audience will of course ask me why there should be a difference in evolution in eggs of the same bird in the same country. To me there appears to be a fairly simple answer. It is probable that when the Cuckoo first arrived in England the fosterers she imposed upon were the Wagtails, Pipits and Warblers and, in the course of many thousands of years, evolution reached its present stage; on the other hand the birds increased in numbers so greatly that the supply of original foster parents was insufficient and so she had to seek others. The Hedge-Sparrow, being a very common bird, was one of those selected, but the selection took place at a comparatively recent date and so there has been no time for great developments. In support of this the exhibit in the next two boxes seems to have great weight. In Finland three of the most common types of fosterers are birds of the genera *Phænicurus*, *Saxicola* and *Oenanthe*, all of which lay blue eggs. You will see from the exhibit that the Cuckoo's egg deposited in these birds' nests is also blue and in one clutch of eggs exhibited you will see two Cuckoos' eggs, one very pale and one dark blue. This shews that Cuckoos' eggs have been evolved of exactly the same range and types of colouring as the eggs of the foster parents, resulting in a certain proportion being anually deposited in the nests of birds which could not possibly distinguish between their own and the Cuckoo's egg. In the next box we have eggs of the Brambling type, such as are normally deposited in the nest of that bird, and you will see by the exhibit that the adaptation here also is almost perfect.

A very beautiful example of environmental evolution is I think shown in the box containing eggs of the little Rufous-bellied Cuckoo. (*Cacomantes merulinus et sub sp.*) Here I show thirty-six eggs deposited in the nests of small Warblers of the genera *Suya*, *Orthotomus* and *Franklinia*. Now these little

birds lay eggs which I may describe as polymorphic in colouration. The ground colour varies from white to pale blue or, less often, very pale pink, whilst they are generally spotted in various degrees with light and dark red in greatly varying manner. The Cuckoos' eggs, as you will see, are also polymorphic in colour so that a certain percentage, sufficient for the continuation of the species, agrees with those of the fosterer, whilst others contrast slightly or decidedly. Now this little Cuckoo has an immense range of breeding area, practically over the whole of the Southern Oriental region and, over the whole of this region, with one exception, it lays eggs of the kind described. The one small exception, however, is an area of some twenty miles in length and breadth round about Hyderabad in the Deccan Province of Southern India. Here for some reason the Cuckoo *invariably* deposits its eggs in the nests of the Little Warbler, *Prinia socialis*, a bird which lays brick red eggs. You will see that a Cuckoo's egg has been produced which agrees well with that of the foster parent. Now it seems to me that this red egg could only have been evolved in one way. The area referred to is on the whole very barren and very dry, whereas this Cuckoo certainly prefers damp, well-wooded country. As however, it became more numerous, competition forced it gradually to spread into a dryer area, in which the Little Warbler, *Prinia*, with the red eggs, is much the most common of the small birds, indeed, it is so common that there are few gardens in the towns which do not have two or three nesting pairs. Perhaps when the Cuckoos first arrived, there were among them some which laid eggs coloured with a very faint tinge of red and, among these eggs, there must have been some which escaped detection and were hatched and the young reared. Among these some grew to maturity and of course laid eggs similar to those of their parents. Of these some again probably laid eggs of yet a slightly stronger red tint and so the process continued until all those birds had been eliminated which laid the original normally coloured egg, only those persisting which laid eggs sufficiently red to escape detection.

An extraordinary proof of this occurred in 1928. Two men, both keen field observers, who were not ornithologists in the scientific sense of the word, wrote two letters to a certain

journal. The first of these wrote and asked if anybody could explain how it was that the little *Prinias* which laid red eggs, seemed to have been wiped out all round about the Hyderabad Deccan. The second wrote to say that he had found numerous small Cuckoos' eggs in the nests of Warblers of the *Orthotomus* and *Prinia inornata* groups, the Cuckoo's egg being in each case bright red and nothing like those of the fosterer and, he added "in every single case the nest had been deserted." Here then we have cause and effect shown in a rather startling manner. No doubt our grandchildren will find no red eggs of this Cuckoo ever laid unless *Prinia socialis* recovers its status in the Hyderabad Deccan, for the Cuckoos to cucold.

Passing now from incipient and advanced stages of evolution, I will turn to that condition I term "perfected adaption," though even in this, as I have already remarked, you will see the degree of perfection varies to some extent. The first eggs I show you are those of the Large Hawk Cuckoo (*Hierococcyx sparveoides*), a bird which is much larger than the English Cuckoo although the difference in size in the eggs of the two birds is not very great. This bird lays two kinds of eggs, the first olive-brown, the second blue. The first is deposited in the nests of the Great Spider Hunter (*Arachnothera magna*) or in that of one of the little Short-winged Thrushes (*Drymochares nipalerisis*), and the second type is placed in the nests of the *Garrulax* group of Laughing Thrushes. There is no inter-gradation of any kind between the two forms and each agrees beautifully with the eggs of the birds in the nests of which it is placed, whilst in this instance you also have, what is most exceptional in Cuckoos' eggs, a variation in size as well as in colour. This is what I consider a good example of perfect dimorphic adaptation.

An equally beautiful example of dimorphic, yet perfect, evolution is shown in the eggs of the Small Himalayan Cuckoo (*Cuculus poliocephalus*). This little bird, without undergoing any geographical variation, has the widest range of any of the many species of Cuckoo. It extends from the extreme Western Himalayas to Japan and throughout this vast extent of country shows no subspecific change. This Cuckoo lays two very different types of eggs. In the extreme East, that is to say, in Eastern China and Japan, it lays eggs of a brilliant terra-

cotta red, whereas in the extreme West, that is to say, in the Western Himalayas, it lays pure white eggs. In both these particular areas the eggs are absolutely constant and they are laid—the first, in the nests of *Cettia*, and the second, in the nests of different species of *Phylloscopus*, both of which lay eggs in colour exactly like those of the Cuckoo. As the Eastern form approaches India, *Cettia* is no longer to be found and we find the eggs are deposited in the nests of birds of the *Horornis* group. So far the eggs of the Cuckoos and of the fosterers agree absolutely in colour, only varying in size, shape and texture. When, however, we come to the middle Himalayas, say from Assam to Garhwal, we find that, though the two types of eggs still remain unchanged, there is a great deal of wrong deposition, so that frequently we find red eggs placed in the nests of birds which lay eggs nothing like those of the Cuckoo. This seems to be a case where the Cuckoo has probably extended from one of the extreme ends of its present habitat and that, whilst the intermediate portion is not so suitable to the bird, the two extremities are much more so. In consequence you have a Cuckoo which is very common in both the East and the West, in each of which areas it produces an egg completely adapted to its environment. On the other hand, in the centre portion of its range the bird is much less common and is probably only kept going by a constant irruption from the East and West areas of birds which are of a strain laying a finally adapted egg. Quite possibly in course of time we may have the bird in the central portion completely eliminated and, eventually, geographical and other conditions may cause changes in the birds, thus sufficing to distinguish them as subspecies or even species.

Another form of perfect adaptation is that in which evolution has eliminated all but one type of egg, excellent examples of which are the Crested Hawk Cuckoo (*Clamator corromandus*) and the Koel (*Euclynamis scolopacea*). Of these two the former is undoubtedly the more perfect. It invariably lays a very spherical pale blue egg, varying very little indeed in depth of colour or in other respects. It is equally invariably laid in the nests of either *Garrulax moniliger* or *G. pectoralis*, both of which lay eggs of the same colour, though different in shape. The evolution of an egg to a state of perfection such as this

depends on a good many factors. In the first place the bird itself must have a definite breeding area. In the second place the selected fosterers must be extremely common within that area, so that their nests are easy to find. Thirdly, the fosterers must be such as are suitable in every way to rear the young Cuckoo when hatched. All these factors obtain in regard to this Cuckoo and the selected foster parents. It may be said that under circumstances such as these the Cuckoo would soon become so common that all the nests of the foster parents would be made use of and so, by degrees, the foster parents would thus be wiped out of existence, having had to spend the whole of their time and energy in incubating and rearing young Cuckoos to the exclusion of their own. The very perfection of the adaptation in this Cuckoo's egg does away with this result, for the eggs are so extremely like those of the fosterer that not only is the foster parent deceived but the Cuckoo herself and, in consequence, one or several Cuckoos often place two or several eggs in the same nest instead of hunting for another in which no Cuckoo's egg has been previously deposited. In the series shown you to-night, you may see two clutches of eggs containing 6 Cuckoos' eggs in addition to those of the fosterer. Now in both these cases the final result will be the bringing up of one young Cuckoo by one pair of Laughing Thrushes instead of six pairs of Laughing Thrushes having to look after six young Cuckoos, so the remaining five of the former may have a chance of looking after their own young.

The other series I show you is very similar in results, although the eggs are so different. The Koel, as you are aware, is parasitic almost entirely on birds of the genus *Corvus* and wherever a Koel is to be found, Crows of some kind are common. There are only two exceptions that I know of and in these two cases the Koels have adopted as fosterers Magpies in Western China and the Shan States and certain large Starlings (*Gracula nipica nivicollis*) in parts of South-Western China. In both these cases the area is of a comparatively small extent. In India and in many parts of Burma, the Koel is undoubtedly the most common of all Cuckoos but its selected fosterer, the House Crow, is even more common. In this series you will see the same set of conditions obtaining as in that of the Crested Cuckoo whilst there are also examples of large numbers

of Cuckoos' eggs being deposited in the same nest. In the series itself there is one set of nine eggs and I have heard of sixteen Cuckoos' eggs being found in one Crow's nest.

My final exhibit is a box containing a few eggs of the Pied Cuckoo (*Clamator jacobinus*). This bird places its dark blue eggs in the nests of birds of the genera *Argya* and *Turdoides* and I think you will agree with me that it is very difficult even for human beings to say which are the Cuckoos' eggs and which are those of the foster parent, for here we have not only an exact adaptation in colour but also in size, shape and superficial texture. Indeed, so close is the resemblance that I have myself taken eggs which I did not distinguish to be Cuckoos' until I had taken them home and begun to blow them. The thick shell, pale yellow yolk and great comparative weight of the egg then showed of course, that they were unmistakably those of a Cuckoo.

I have already said how I think the process of evolution goes on but, to sum up, we may describe it as follows. Among the eggs of parasitic Cuckoos of every kind there is a certain degree of variation, coming under Darwin's definition of "individual variation." Among the fosterers, on the other hand, there is a certain percentage of birds who have sufficient intelligence to distinguish between their own eggs and other eggs which contrast very strongly with them. In consequence those eggs which agree least well with those of the fosterers are rejected in greater proportion than those which are more like the eggs of the birds which are asked to adopt them. In this way we get a constant elimination of the most unfit, until in the process of time an egg is evolved which, even if it is not exactly like that of the foster parent, is sufficiently so to ensure its being accepted, hatched and the young reared. This seems to me to be an excellent proof of Darwin's theory of the "Survival of the Fittest."

VI.

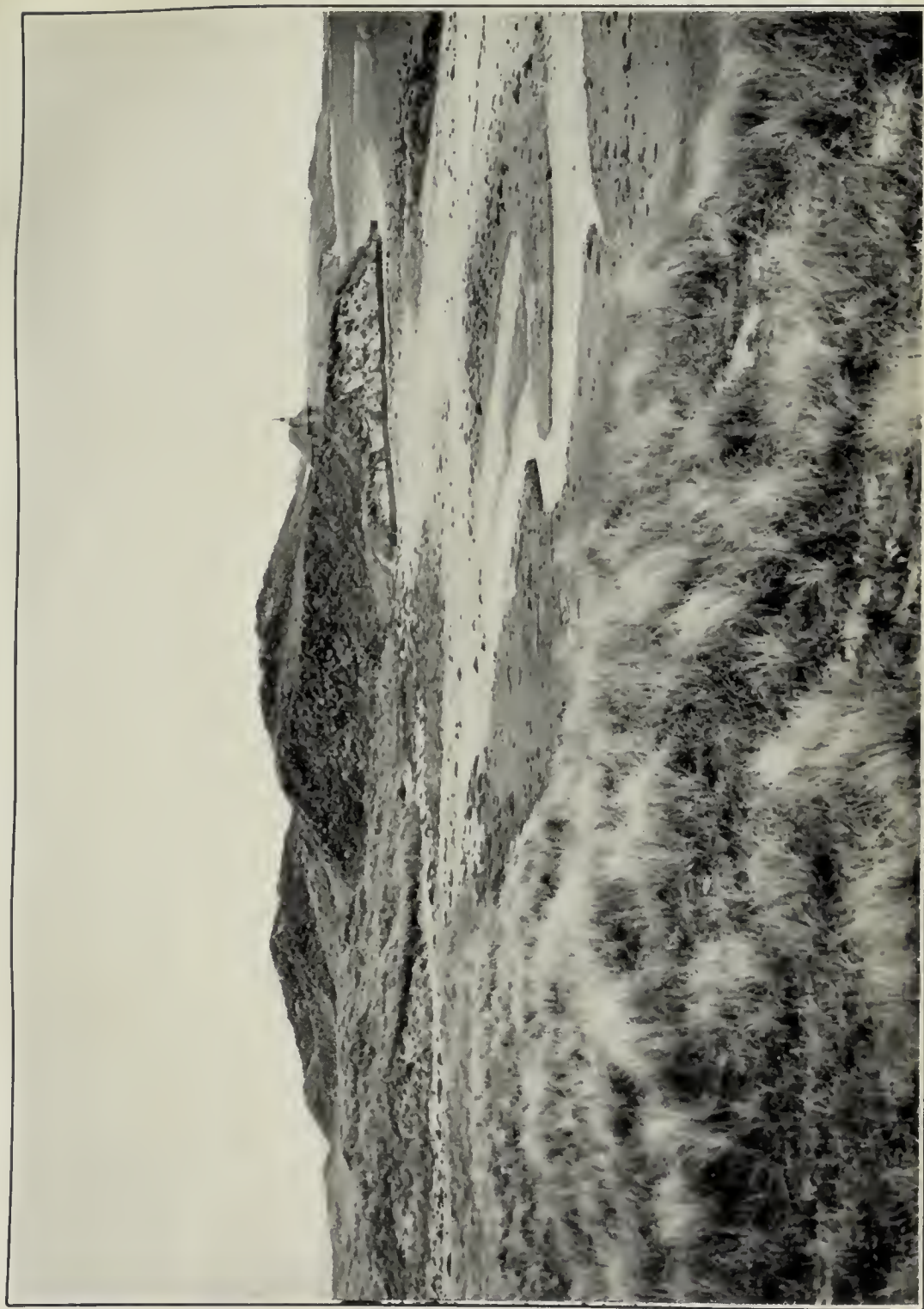
GEOGRAPHICAL WORK ON SCOLT HEAD ISLAND
AND ADJACENT AREAS

BY J. A. STEERS, M.A.

DURING the past few years a certain number of papers on Geographical aspects of Scolt Head Island have appeared in these Transactions. These papers have been of a general nature and serve as a basis for future work. In order to accomplish such work it seems advisable that the island problems should be approached from a wider point of view, and that more trained people should be encouraged to take an interest in them. Hence steps were taken to bring the Cambridge University School of Geography into touch with the Committee of the Norfolk and Norwich Naturalists' Society with a view to affording students easy access to Scolt Head Island to carry out practical work which will be at once valuable in certain aspects of the training of Geographers, and also in the gradual accumulation of data for a memoir on the island.

To accomplished this end one of the first necessities was the foundation of a laboratory near at hand and suitable for use in connection with field-work. This has been made possible in two ways. First, the Norfolk Naturalists Trust has purchased "Dial House" in Brancaster Staithe for the watcher, Mr. Charles Chestney. This house contains ample accommodation for visitors interested in the island, and also extensive out-buildings. Second, the University of Cambridge placed a certain sum of money at the disposal of the Cambridge Geography School which enabled the latter to make various structural alterations in one of the outhouses, the old Brew House, so as to adapt it as a field-laboratory in which its students can work.

The full equipment of this laboratory cannot be found for some time; the limitation of finances and the development of a suitable technique for dealing with island problems both render a gradual increase in scientific apparatus necessary. Nevertheless, a beginning has been made and in time a field station, similar to Dr. F. W. Oliver's at Blakeney Point, should be available.



Photo]

THE HUT HILLS, SCOLT HEAD ISLAND

[J. A. Steers



It may be of interest to readers of these Transactions to indicate a few of the Geographical problems to which attention may be devoted. Necessarily they will overlap a good deal on to other sciences ; hence the co-operation of workers in the biological sciences will be welcomed.

The erection of a self-recording tide-gauge is important. The establishment of a mean sea level to which all surveying work can be referred is an essential. Unfortunately the cost of such an instrument is rather high, and so its erection will have to be postponed for a time. The whole matter of tidal currents off the main beach and in Norton Creek needs careful investigation. The general set of such currents is known, but their details are not. Further, the velocities and transporting powers of these currents require investigation with particular reference to their constructive and other effects on sand and shingle bars, and also with regard to the amount of silt carried through the harbour mouths at Overy Staithe and at Brancaster.

Silt deposition on the marshes is another big problem. So far very little has been done in this way. The problem is intimately bound up with the spread of marsh vegetation and a full analysis of the conditions of sedimentation implies a knowledge of physical-chemistry. A careful collection of the sediments must also be made and analysed. Whilst this is being done, it would be useful to make a " geological " survey of the island. The surface distribution of sand, shingle and mud is obvious, but vertical sections of bores would help much in making clear the whole structure of the island. A systematic series of bores put down to a depth of five or six feet—more in places—would probably give the data sufficient for such a survey. Careful analyses of the bore sections should also be made.

A large and more difficult problem is that of making a contoured map of the island, especially of the marshes. The differences of level are very small and, except for lines of levels, the usual surveying methods are of small use. Probably the best way of meeting the difficulty is by photographic-survey. In any particular marsh, such as that in front of the Hut, plates taken with a photo-theodolite at regular time intervals during the rise of a high spring tide would afford data from which a contoured map could be made. This



7. Determination of the Water Table.
8. Meteorological Measurements.
9. Rates of Dune growth and related problems.

If carried out carefully such work will give not only very interesting general results of scientific value, but will also make possible the production of a geographical memoir of considerable interest on Scolt Head Island.

As the Geographical Laboratory will be on the mainland, the Hut will not be affected, and Ornithologists and others who visit the island will not find their work impeded in any way. It cannot be emphasized too much that all scientific work relating to the island must be developed. The schemes outlined above in no way interfere with the present interests in Scolt Head, and bird-lovers and others will not find their work interrupted.

VII.

MUSEUM BOULTERIANUM

BY CHARLES DAVIES SHERBORN

IN the Transactions of this Society (VI. [1] 1895, p. 81) appeared a brief note by Mr. F. D. Palmer on Daniel Boulter of Yarmouth who died in 1802. Little is there said but that he was a Quaker, dealt in general goods, and had a Museum. It may be therefore of interest to note that I have lately come into the possession of a copy of his Museum Catalogue, and it will be useful to put the following notes on record.

The book has no printed wrapper but on the half-title is a sort of Trade-card which reads ;—

DANIEL BOULTER, / No. 19, Market-Place, Yarmouth, /
Sells, wholesale and retail, great choice of the best London made,
Birming- / ham, Wolverhampton, Sheffield, and Pontipool
Goods, in the newest taste, se- / lected from the principal
manufactories, in the Silversmith, Jewellery, Cutlery / and
Toy Line. Also a great variety of Books of all kinds, new
and second-hand, / Stationary Wares, Haberdashery, Gloves,
Perfumery, & Patent Medecines. / N.B. The full value
given for light gold, foreign coin, silver, jewells, watches, &c. /

whether purchased or taken in exchange.—Mourning, motto, and hair-device / rings, locketts, &c. with every other article in the jewellery branch, executed / with elegance and expedition.—All kinds of jewellery, watches, and silver / goods, neatly repaired or engraved. / *.*His museum, which has been upwards of twenty years in collecting, is / daily open for the inspection of the curious.—Admittance by ticket / or one shilling each person. / Natural Curiosities, Antiquities, Coins. Medals, / CURIOUS BOOKS, &c. / Bought, sold, or exchanged. /

The Title-page reads ;—

MUSEUM BOULTERIANUM [in Gothic type] / A / CATALOGUE / of the / curious and valuable collection / of / natural and artificial curiosities / in the / extensive Museum / of / Daniel Boulter, Yarmouth : / consisting of / English and Foreign Birds and Beasts in high Preservation. Reptiles, / Fish, and Insects, dried and in Spirits. Elegant Shells, Corals, / Corallines, and other Marine Productions. Seeds, Fruits, and / other parts of rare plants. Fine Specimens of different Ores, / Petrefactions, Spars, Fluors, and Crystals. Agates, Calcedonies / Jaspers, Carnelians, &c. polished and unpolished. Roman, Egyp- / tian, and British Antiquities in Earthen Ware and Bronze. Carvings / in Wood, Stone, Ivory, and Alabaster. Curious ancient Enamel- / lings, China and Delft. Shell-Work, Needle-Work, &c. Cruci- / fixes and Rosaries. Ancient Stained Glass. Parts of Dresses, / Utensils, &c. Ancient Weapons of War. Old Monastic and / other Seals. Watches, Rings, and Amulets. Greek, Roman, / Egyptian, British, and English Coins and Medals, in Gold, Silver, / and Copper. Dresses, Ornaments, Weapons of War, Fishing- / Tackle, and other singular Inventions of the Natives of the lately / discovered Islands in the South-Seas.* Some capital Paintings by / the first Masters. Rare old Prints, including a large Collection / of Engraved Portraits, with a select Library of curious and / valuable Books in Natural History, Antiquities, &c. &c. Some / curious Missals, and a great Number of other singular Articles both / Ancient and Modern. [two rules] Price One Shilling. / To be had of

* Query James Cook's Voyages 1768-1780.

Henry Gardner, No. 200, Strand ; B. & J. White, / Fleet-Street ; Darton and Harvey, No. 55, Gracechurch-Street ; John / Simcoe, No. 11, Great Queen-street ; London. Yarrington and / Bacon, and R. Beatniffe, Norwich. And other Booksellers in / Town or Country. / N.B. Purchasers to the Amount of Ten Shillings will have the Price / of the Catalogue returned. /

Then follow (p.iii) Advertisement, (iv) Abbreviations explained [all of Titles of Books] (v, vi) Index (vii) errata, (viii) blank, (1-165) the Catalogue, (166) blank, (167) List of Donors [among which occur 6 Boulters, Sir Ashton Lever, 3 Sparshalls, Lilly Wigg, and other interesting people].

The Catalogue is remarkable for having printed prices affixed to each item and this seems to point to a late date when Boulter possibly wished to realize on his Collection. He is careful to note in his Advertisement that "Donations" are "excepted" from these prices. The only date found is "1794" pencilled on the Title-page, altered to "1793."

Of the articles catalogued the Prints number over 800 and the Books 984, a remarkable collection, the prices of which makes one's mouth water.

This rare little volume will be preserved in the British Museum (Natural History) where it can be seen by anyone interested.

VIII.

THE GREAT YARMOUTH AUTUMN HERRING FISHERY

1928

BY THE EDITOR

THE success of the Yarmouth herring fishing depends, in the last analysis, upon the capacity of the European peasant to consume salted herrings during the winter. It is not a question of organising a fleet and equipping it to catch herrings, but entirely a matter of marketing the catch, for 95 per cent. of the fish landed has to find a foreign destination. It may be quite true that herrings represent the cheapest food product available in north-west and central Europe, but the demand is rigidly limited, and the big concerns on the other side of the North Sea, who handle the business on its distributing side,

know to a barrel how many the various countries can absorb in a season. One great outlet is closed through private trading with Russia being rendered an impossibility, though countries whose frontiers march with the Soviet borders may be able to carry on business to some extent with the Republic. It is probable that the war wastage has not yet been made good among the consuming populations, while their financial resources have been greatly reduced, and even their tastes may have changed.

A comparatively new feature, too, is the export of fresh herrings to Germany, and it would seem only natural that, as this business develops, export of the cured herring may suffer some decline. It has also to be remembered that fierce competition goes on with Norway and Holland, which seek the same markets as we are after, and Germany is doing everything possible to increase its own catching power. The ordinary inhabitant probably has no conception of the competition which the Yarmouth herring has to face abroad. To the same foreign ports to which our shipments go are also sent cargoes from Ireland, Scotland, North-Eastern England, and Iceland, to say nothing of Norway and Holland. At Riga, for example, Yarmouth herrings have to be sold side by side with cargoes from Lerwick, Wick, Stornoway, North Shields, Fraserburgh, Peterhead and Ardglass, so that the merits of our fish must be convincing. Apart from these inevitable handicaps, the fishing this season has suffered from its own success, paradoxical as that may sound, for too many herrings were caught in too short a time. Sometimes a crop is so big as to be almost profitless to the farmer, and the herring crop was harvested in such plenty that for the first time in living recollection the curers met and decided they must stop, or they would flood the markets, send down prices, incur losses and throw the trade into confusion if not chaos. This drastic step was brought about through continuous fine fishing weather, large daily hauls and herrings being of the best quality. So the bulk of the Scotch fleet went home earlier than usual, but some lingered on and, with the smaller landings, higher prices ruled, so that most of the boats made a good finish.

The best Yarmouth drifter is reputed to have grossed over £3,000, and a few reached £2,000, but the general run would

be between £1,500 and £1,800. Taking it in all its aspects this herring fishing from Yarmouth is a business of no little magnitude, for the season's catch, which was an immense advance on that of last year, represents a value at first hand of anything between £750,000 and £1,000,000. The landings to December 8th were 520,177 crans compared with 405,490 crans in 1927, and 393,068 crans in 1926. The better to understand these figures it may be stated that a cran of herrings is approximately 1,000 fish, so that the total number of herrings landed at Yarmouth during the four months—August to November—of 1928, was about 480 millions. We set out below the deliveries during the busy part of the season :—

Week ending	1928. Crans.	1927. Crans.	1926. Crans.
Oct. 6	53,554	34,242	11,920
„ 13	31,867	97,321	44,872
„ 20	89,518	40,578	143,784
„ 27	107,773	63,076	52,727
Nov. 3	124,694	52,367	45,999
„ 10	52,850	66,863	43,829
„ 17	18,855	18,771	19,688
„ 24	5,966	1,329	8,007
Dec. 1	5,765	6,337	3,766
„ 8	4,531	3,715	2,196

The density of the shoals and the abundance of herrings has been proved by some remarkable hauls. On September 15th the Lowestoft drifter Two Boys brought in 195 crans and handed over the balance of her nets to three other drifters, which took out 97 crans, 90, and 55 crans respectively, giving the total of 437 crans for one “strike.”

October saw the peak point of the fishing, and the catch of the season was made on October 26th, when 569 boats landed 44,831 crans, showing the high average of 78 crans. Shots of from 180 to 100 crans were frequent, and despite the rush of boats there was no congestion in the Harbour, no confusion, and no undue delay.

The fleet comprised 623 Scotch boats, 112 Yarmouth boats, and 13 boats from other ports, a total of 748, compared with 784 last year and 833 in 1926.

Scotch curers numbered 103, compared with 112 last year

and 117 in 1926. Fish workers from the North totalled 3,357 against 3,456 last year and 3,420 in 1926. Scotch coopers, carters and labourers were employed to the number of 804, as against 810 last year and 780 in 1926. The first fish workers' special train arrived from Aberdeen on September 25th, and on October 5th and 6th fourteen specials brought an invasion of nearly 3,000 Highland lassies to work over the herring troughs.

It is of interest to note where Yarmouth herrings go, for they cover an almost world wide territory. So far to Danzig, the corridor port for North Western Europe, have been sent this season 109,738 barrels, nearly twelve thousand more than last year, 37,618 barrels to Stettin, 37,618 barrels against 39,045 to Libau, 31,698 against 29,614 to Konisberg, 28,091 against 18,667 to Riga, 16,308 against 14,471, Duisberg 6426 against 5651, Hamburg 5179 against 3976, Memel 3075 against 4027, Wyburg 2661 against 902. These are the usual centres, but there are some others. The Holy Land has taken 782 barrels through Haifa, and 282 through Jaffa. Montreal has received 150 barrels, and the United States took 1036 barrels divided between New York, Boston, Philadelphia and Baltimore, and to all these points none had been shipped last year. Australia also has a sample, 12 barrels being shipped to Melbourne. Belgium took 250 barrels at Bruges, and Holland received 100 barrels at Vlaardingen and 1637 at Ymuiden. Even London took 176 barrels. The Yarmouth cure this year totalled 457,310 barrels, of which so far 250,250 have been shipped.

By way of record, it is perhaps interesting to recall that the highest price paid for herrings was £5 10s. per cran on November 17th, obtained by a Berwick boat, in contrast with only 10s. a cran, paid for some inferior salted fish. Of coal for bunkers a large proportion came by sea, and the general rate was around 32s. per ton. Paraffin oil for motor drifters, at 7d. per gallon, was one halfpenny cheaper. The number of boats fitted with wireless receivers showed a considerable increase this season, and when the crews are able to listen-in this must have been a source of great pleasure to them.

The above information has been extracted from the columns of the "Eastern Daily Press," to the Editor of which we tender thanks.

IX.

AFFORESTATION IN BRECKLAND

BY BRIGADIER-GENERAL H. G. JOLY DE LOTBINIÈRE, D.S.O.

MY early days were spent in Canada, where my family still possess one of the original French Seigniory's, a considerable portion of which is still a primeval forest. For this reason, possibly, I have the same love for trees that you have for your wild birds, and I can understand your anxiety to maintain a portion, at least, of your beautiful Breckland, and that you do not wish to see the whole converted into pine forest.

In my opinion the only tree, if we except the birch, that is at home on the major part of your breck lands is the pine. This species is the lover of dry and sandy soils, as opposed to the firs and spruces which prefer damper conditions both above and below ; and to the hard-woods, which prefer stronger and more fertile soils.

It is unfortunate that in this country the birch does not grow into a larger and more valuable tree, as it does in Canada ; because with its picturesque white stems it would make an attractive wood, which, with its thin canopy of leaves, would be much more suited to bird life than is the denser, canopied pine. I am assured that, although it will not be planted by the Commission, it will find its own way into the plantations, and I am hopeful that in the future we may, in certain parts, find birch glades amongst the pine woods. None of the spruces or firs, excepting possibly the Douglas, will I think be included in these plantations, but oak, beech, larch and, in places, poplar will be planted.

The present plan is to lay out these forests in blocks of about thirty acres—roughly, in areas of 400 yards each way. These blocks will be bounded by rides as a precautionary measure to localise fires, and also as a convenience when the timber is being moved. The rides or fire lines will be planted on either side with hard-woods, mostly oak and beech, for the width of a chain (twenty-two yards), which will act as an additional protection against fires and help to break the monotony of the dark masses of pine. Also every public road will have its belt of hard-woods. It is estimated that these rides and

belts will comprise about ten per cent. of the forest area. They will also perform another and technical duty which I will touch upon presently. One fifth of the blocks will, I am informed, be composed of beech and larch, a very attractive mixture as the beech is our most beautiful tree, and the larch in spring especially striking. We shall have therefore a variety in the planting, which should go a long way to kill the monotony of an endless, ever-green pine vista. We cannot, however, get away from the fact that the main crop will be pine and will consist of two varieties, the Scotch and Corsican, and I should like to say a few words about these two pines.

The Scotch, as you know, is a tree indigenous to this country, but the Corsican is an exotic from southern Europe. I believe a few Maritime pines have been planted at Rendelsham, but the experiment is not being repeated.

The Scotch pine has the widest distribution of any pine and extends right across the northern part of Europe and Siberia, growing best where the winters are cold and the summers hot. Where grown under forest conditions the timber is excellent and is known commercially as Riga, Dantzic, or Yellow Deal. It is said that the remains of primeval forests still exist in a few places in the Highlands of Scotland. In their early life these exclusive Scotch pine areas will, I fear, be less attractive to look upon than your open breck lands and will give little enjoyment to this generation; but if they are permitted to grow to middle age, say forty years, the next generation will admire their lengthening red boles. However, it will be the following generation, when the trees have reached maturity at about eighty years, which will be able to appreciate their full beauty and enjoy the mystery and solemnity such as one finds in a cathedral of magnificent columns and arched domes.

Wild life will, I am afraid, suffer from lack of food and sun, and I doubt if these forests of the future will hold as much wild life as your breck lands do to-day.

We now come to the Corsican pine, an exotic from the Mediterranean littoral. It is doing extraordinarily well in this country and is being extensively planted in New Zealand and in South Africa, with the object of producing timber as rapidly as possible. In England it is becoming a rival to our Scotch pine, but it is still doubtful if the quality of the timber

will be as good as that of the Scotch, and it is not in such favour for pit-props. Its chief merit is its rapid growth, so that it produces a very heavy crop of timber in a comparatively short time, besides] accommodating itself to our soils and climate. From a beauty point of view it cannot compare with the Scotch pine, but an old wood of these trees with their dark grey stems of great height should be a very impressive sight.

I stated that the hard-wood belts would perform a technical duty, besides being ornamental and a safety against the spread of fire. For all practical purposes we may look upon these belts of oak and beech as being permanent, for we know that they can live for hundreds of years. The blocks of pine, on the contrary, will in some cases be cut at an early age for pit-props or pulp-wood, but in others will be allowed to grow to mature timber suitable for building purposes. This course will be necessary in order to sub-divide the forest into different age classes. As an example, in a 25,000-acre area, such as Thetford Chase, the planting is being done at the rate of 2,500 acres a year, so that the whole will be planted in ten years' time. If all the trees were left to grow to the same age before felling, the whole area would be cut down in a period of ten years and there would be no further crop for many years afterwards. Such a system would not be economical in practice, as it is desirable to have a crop every year. Hence the necessity of cutting some of the blocks when only of pit-prop size in order to establish a uniform yearly supply of timber. The ornamental hard-wood belts will remain as wind shelters to the subsequent plantations.

In addition to the drives and roadways there will be a considerable number of fields with cottages in the forest. For every 200 acres there will be a small holding of at least ten acres, with a cottage for a forest worker, or a total of about 130 for the Thetford Chase area. Each forest worker is guaranteed at least 150 days' work in the year. I believe these holdings are much sought after, and they should in time be the homes of a hardy type of worker.

Rabbits are being effectually dealt with and when exterminated the interior wire-netting will be moved, and only that bordering the public roads and boundaries maintained. The Roe Deer, which are in considerable numbers near Brandon,

will probably increase and spread throughout the forest ; as it is, they do a certain amount of damage, especially to the larch, which they are particularly fond of.

The public will, no doubt, be admitted into the forest in time, but certain places of interest, such as the Punch Bowl and Fowlmere, will be left unplanted and remain accessible.

In addition to Thetford Chase the Commissioners have acquired and are planting in East Anglia 5000 acres at Rendelsham, 5000 acres at Swaffham, 1000 acres at Melton Constable and 1000 acres at Dunwich. Up to the present 14,000 acres have been planted in the Thetford area.

Having described the work of the Forestry Commissioners in East Anglia I must refer briefly to the necessity for planting in England. During the War a very serious situation arose over the difficulty of maintaining supplies of pit-props to the coal mines. For every hundred tons of coal brought to the surface at least one ton of pit-props is required ; and as we raise about 250 million tons of coal annually, we require two and a half million tons of pit-props. These, if laid out end to end, would circle the equator four times.

Our yearly importation of wood of all kinds amounts to sixty million pounds sterling. Further, in proportion to our land surface we have less commercial timber growing in this country than in any other European country, except Portugal.

The arguments in favour of afforestation are strong and may be stated very briefly, as follows.

A reserve of timber both for economic and for industrial reasons, and in case of war, is essential.

There are large areas unsuited for any other crop (rabbits excepted) and, unless planted with timber, will remain derelict. If we are to find work for our ever-increasing population every source of employment must be fully developed.

When I returned from the War I was much impressed by what one of our leading foresters told me. He said that in order to bring the American troops to France it was found necessary to set free four million tons of shipping. This was achieved largely by cutting down our young plantations to supply pit-props to the mines, but it left the country denuded of timber. Broadly speaking the present programme aims at replacing the three millions of acres then felled and, in ad-

BRITISH
MUSEUM
25 FEB 60
NATURAL
HISTORY.



Photo]

[J. S. Thomson

Male and Female Montagu's Harriers at nest at Hickling, 1929

dition, to afforest a further two million acres, and thus to raise our proportion of woodland from about four per cent, to nearly seven per cent. of the total land area. I hope you all agree with me that we ought not as a nation to be blind to the necessity for afforestation.

I now come to what I think is uppermost in your minds. Where is this afforestation going to end in East Anglia, and are you going to lose all your Breckland as a breeding ground for rare and interesting species? These questions appear to me to point to the necessity for a Society such as yours, and I am sure you can save some, at least, of this unique part of England.

I am not aware of any case where a Government has taken up afforestation and subsequently abandoned it. Afforestation has come to stay and the only brake that will be applied is that of cost. The Forestry Commissioners will not, I think, acquire isolated areas of less than 1000 acres; the cost of planting and administering smaller areas would be prohibitive. Your opportunity, therefore, lies in the preservation of the small and isolated areas of Breckland. You could make a survey by voluntary workers and mark on the 6-inch Ordnance maps all the areas that are important from your point of view, and who are the owners; you would then have the necessary data from which you could draw up a programme.

X.

WILD BIRD PROTECTION IN NORFOLK IN 1929

REPORT OF THE COMMITTEE

By issuing, annually, a report on the measures taken to assist in the protection of wild birds in Norfolk, especially during the nesting season, and of placing on record events of ornithological interest, the committee feels that it is not only paying back a debt to its subscribers, but it is also encouraging the spirit of Protection, which its supporters would wish to see extended.

During the year under review the Home Office has issued a new Wild Birds Protection Order for the county, which repeals all previous Orders, and which, unless rescinded or altered

by a Supplementary Order, will remain in force for the next five years. That this Order may receive added publicity we reproduce it at the end of this report.

With the exception of the watcher on Breydon, those in the service of the Committee remain as last year. A house-boat, purchased last year, has been moored on the ternery on Blakeney Point, and in this Pinchen passed the night throughout the nesting season. The birds very soon learned to disregard it, and from it they could be watched at close quarters. As mentioned on p. 685, a permanent residence, Dial House, has been purchased for the watcher of Scolt Head Island.

One additional note. If subscribers could remember to send their subscriptions on the 1st of January, or, better still, would sign and return the banker's order enclosed with this report they would save our honorary secretary's outward correspondence by from 400 to 500 letters a year.

BREYDON

The committee continues to maintain a watcher on Breydon during the summer and, as a successor to William Betts, who resigned, appointed William Bull Death, who was on duty from April 1st to August 31st. It is not an altogether enviable post, as the house-boat which he occupies is moored in the middle of the estuary and is exposed to very stormy weather, and such was experienced during April and May of the past season.

The presence of a watcher on these extensive mud-flats is undoubtedly a deterrent to illicit shooting, especially at the beginning and end of the season, though in these days when the demand for British-killed "specimens" has almost died out, there is no longer the same temptation to shoot every rare bird that puts in an appearance. As usual, Spoonbills paid periodical visits to Breydon this summer, and on June 4th seven arrived, to be joined by another on the 10th. We went over to see these birds, which remained until the 13th.

As bearing on the question of the return route taken by the terns that nest on our foreshores it has been noted for many years that about the middle of July Little Terns begin to appear on Breydon, to be followed in a few days by Common Terns, and on July 23rd of the past season the watcher esti-

BRITISH
MUSEUM
25 FEB 30
NATURAL
HISTORY.



Photo]

[R. M. Garnett

ROBERT BISHOP
Watcher of the Cley Marshes

mated that there were between one and two thousand Common Terns on the estuary. Sandwich Terns are seen only in small numbers, but on the coast, for example, at Horsey, there is a steady movement of these birds to the south during August and September. The fact that three young Sandwich Terns ringed on Blakeney Point by Mr. A. W. Boyd in 1928 were recovered about six weeks later north of their birth place—one seven miles north of Aberdeen—(“British Birds,” Vol. XXII, p. 187) suggests that the return route taken by some of the birds is *via* the north and west coasts of Scotland, but the evidence for this is inconclusive.

CLEY AND SALTHOUSE

As will be known to most of our subscribers, the Cley Marshes, 400 acres, are the property of the Norfolk Naturalists Trust, whereas the marshes on the other side of the East Bank, commonly known as Salthouse Broad, are held by various owners. It is fortunate that these latter are eager to co-operate with the Trust in the protection of the birds during the nesting season, for that is the most important period in the life of a bird when it needs most protection from its enemies. The Broad is really the complement of the marshes, because for certain species, especially waders, the shallow watered flats on the Broad are a rich feeding ground for this class of birds. The marshes, on the other hand, with their extensive reed beds and coarse herbage and numerous shallow lagoons afford more attractive resting places and breeding ground. It thus happens that at any season of the year, but more especially during the spring and autumn migration, the East Bank, at Cley, is one of the best observation posts for the bird watcher. The marshes were acquired and conveyed to the Trust in the hope that, if carefully looked after during the breeding season, certain of our lost species might be induced to return to nest; and although that is but three years ago there are already indications that this hope may some day be fulfilled.

The following notes are compiled from the journal of Mr. Ronald M. Garnett, of Kelling, who visited the marshes almost daily from May to November, and from observations by the writer and by Bishop, the watcher. The dates all refer to the year 1929.

STARLING (*Sturnus vulgaris vulgaris*).—An enormous number of Starlings have recently resorted to reeds on the Cley marshes for roosting. It is impracticable to drive them away.

GOLDFINCH (*Carduelis carduelis britannica*).—Is becoming more common in the district. A flock of about sixty were feeding on thistle seeds on Blakeney Eye on September 21st.

SNOW-BUNTING (*Plectrophenax nivalis*).—During the past winter were unusually numerous, in flocks of 200—300. First arrivals October 15th.

YELLOW WAGTAIL (*Motacilla flava rayi*).—For the past year or so has decreased in numbers. One seen on the East Bank on April 18th, and one nest found, the young of which were ringed on June 23rd.

RED-BACKED SHRIKE (*Lanius collurio collurio*).—For several years past a pair has nested near the Watcher's hut. This year six young were hatched, which were ringed.

PIED FLYCATCHER (*Muscicapa hypoleuca hypoleuca*).—Not so numerous this year as in most autumns. First seen on September 5th.

BARRED WARBLER (*Sylvia nisoria nisoria*).—One seen near the Watch-house on September 5th by R. M. G., A. Holte Macpherson and others.

FIELDFARE (*Turdus pilaris*).—An early arrival flushed from the bushes on September 17th. Small parties coming in from the sea on October 10th.

COMMON BUZZARD (*Buteo buteo buteo*).—One seen crossing the Cley marshes on an inland course on April 19th.

PEREGRINE FALCON (*Falco peregrinus peregrinus*).—One over Salthouse Broad on September 8th and 9th, another on the 27th and one on October 16th, during a rush of migrants.

MERLIN (*Falco columbarius æsalon*).—One was seen on Blakeney Point on September 17th.

MARSH-HARRIER (*Circus æruginosus*).—On May 16th one was seen circling over Kelling Hangs and, turning its head, gave a good view of the buff crown and nape.

SPOONBILL (*Platalea leucorodia leucorodia*).—The visits of this bird are becoming more frequent, and during the past summer many had the pleasure of watching it feeding on one or other side of the East Bank. On March 22nd one was seen flying high to the south by E. Ramm, and five days later one

was feeding on the Salthouse marshes (Bishop). On June 4th there were four on the Cley marshes. The last bird left on September 14th.

BARNACLE GOOSE (*Branta leucopsis*).—Wild geese of any species are rarely to be found on either the Cley or Salthouse marshes, though passing skeins are frequently to be seen. The Barnacle is an uncommon visitor to Norfolk, so that it is worth recording that two were found resting near the East Bank on October 31st (S. H. L.) After a short time they flew out to sea.

COMMON POCHARD (*Nyroca ferina ferina*).—Has occasionally nested on the Cley marshes (Pashley). A pair was seen on the marshes on June 9th, and a male on the other side of the bank on the 16th, but there is no evidence of nesting.

RED-NECKED PHALAROPE (*Phalaropus lobatus*).—An adult in winter plumage, a very confiding bird, was seen daily feeding on a pool on the Cley marshes from October 19th to the 21st.

WOOD SANDPIPER (*Tringa glareola*).—Among the many Green Sandpipers that are to be found in the pools amongst the thick herbage on the Cley marshes in autumn it is not easy to identify a closely-allied species, but on August 31st the writer and R. M. G. had a good view of two of these birds, which eventually took to wing, uttering their characteristic call.

GREENSHANK (*Tringa nebularia*).—During the past season was more numerous than usual. The first was seen on July 21st, and there were two on the marshes as late as October 16th.

BLACK-TAILED GODWIT (*Limosa limosa limosa*).—Two were seen on Salthouse Broad on August 20th, and there were three on the Cley marshes on October 5th. Another was seen and heard on November 12th.

AVOCET (*Recurvirostra avocetta*).—From June 9th to July 1st an avocet was to be seen daily feeding on Salthouse Broad. This fact soon became known amongst bird lovers, and a large numbers of visitors went to see it. Another appeared on September 11th and was joined by a second two days later. One of these disappeared and the other remained until October 12th, when it was seen to rise to a considerable height and go off to the westward with seven Sheld-ducks.

BLACK TERN (*Chlidonias niger niger*).—About the usual number of this species was passing through during the spring and autumn.

COMMON TERN (*Sterna hirundo hirundo*).—This species is being gradually displaced by the Sandwich Tern on Salthouse Broad. There were from 50—100 nests this year.

SANDWICH TERN (*Sterna sandvicensis sandvicensis*).—On two small islands on Salthouse Broad, within good view of the East Bank, there was again this year a very closely-packed colony of these birds. During the last week in May the keeper (Holman) counted 271 nests. On July 1st R. M. G. ringed 189, and there were then about sixty too active to be caught.

Mr. Robert Bishop, of Cley, continues to act as the watcher of the Cley marshes, and has now the added pleasure of watching his birds through a pair of prismatic field-glasses kindly presented to the Norfolk Naturalists Trust by Lt.-Col. R. M. Byne.

BLAKENEY POINT

The chief interest of Blakeney Point during the breeding season is the very large colony of Terns that now nest here. During the past season the number of birds was quite up to that of last year, at any rate as regards the Sandwich Terns. On June 4th 1,008 eggs of these birds were counted ; 302 twos, 2 threes, the rest being singles. Many eggs were laid after this date so that 1,000 pairs of Sandwich Terns nesting in this colony during 1929 would be a conservative estimate. In addition, there were several hundred nests of the Common Tern. These latter now nest on the Far Point in the company of the Sandwich Tern, and there were very few nests this year on the dunes to the north of the old Life-boat House. It is commonly supposed that the Roseate Tern arrives about a month later than the other Terns, but this is not the experience at Blakeney. This year the first Common Tern was seen on April 30th and on May 16th the first Roseate was seen. On May 25th a Roseate's nest was found containing one egg, very near to the site of last year's nest, the second egg being laid on the 27th. The first of these eggs hatched on June 16th, the second the next day. A second pair of Roseates arrived and successfully hatched off, but in both cases only one young one reached adult life. There were a few pairs of Arctic Terns identified in the Colony. During the last week in June the weather was very cold and hundreds of young Terns, mostly Common, died as soon as hatched, apparently

from exposure. On the whole, however, the birds did well. During July the Ternery was over-run by hundreds of young birds. On July 16th Captain A. W. Boyd ringed 160 young Sandwich Terns. The last Sandwich Tern's egg to be hatched out was on July 16th, and by this date there were still left a few Common Terns' nests with eggs. A pair of Oystercatchers nested on the Far Point in the middle of the Ternery, and hatched off on July 17th.

SCOLT HEAD ISLAND

On an island like Scolt Head, which lies on the migration route and is little disturbed, there is considerable variation in its bird population, and during the past year this has been marked. The island not only provides nesting sites for several species, but it also affords resting places and extensive feeding-grounds for large numbers of visitors. January and February were exceptionally cold months and, as usually happens under such conditions, most of the surface-feeding ducks, except wigeon, eventually moved further south. On the other hand the north Norfolk estuaries were invaded by an unprecedented number of Brent Geese, and by the middle of February there were from 500-1,000 of these birds to be seen and heard daily feeding in the creeks along the mud-flats of the island. From a distance the noise made by them resembled the baying of a pack of hounds. The first Brents were seen on January 14th and the last had not left the island until April 13th. They ate up every blade of Wigeon Grass (*Zostera*) on the island. A few were shot by local gunners, but they were so thin that they were not considered eatable and were left unmolested. Gray Geese visit us every year in very large numbers but Brents and Bernicles are rarely to be seen on the Norfolk Coast. At Blakeney a similar invasion occurred, and here 101 were shot by a gunner in five days during the last week of the month. On January 21st 10 Short-eared Owls were found in the dunes near the hut. These birds remained about the island until the end of April and a pair were frequently found in the neighbourhood of their nest of last year, but eventually they left and no owls nested on the island this year.

During the middle of February the cold was extreme. There were thousands of Snow Buntings and many Shore-

larks on the island, and on the 18th the watcher estimated that there were some 500 Sheld-ducks, the largest number he had ever seen. Waders of all kinds were numerous and were dying from starvation, the frost being so severe that their feeding-grounds froze as soon as they became uncovered by the receding tide; the Hooded Crows took advantage of these conditions and in many cases dealt the final blow. Several Mergansers were to be found in the creeks, and a large number of Common Scoters came into the harbour, while swans were seen passing on several days. In spite of this unusually cold weather the Spring migrants were not delayed in their arrival. The first Wheatear was seen on March 27th, and on April 9th the first Sandwich Tern was seen at sea by a local fisherman, H. Loose. By this date Sheld-ducks were getting to the dunes, prospecting for nesting sites; and by the 15th a pair of Oyster-catchers were scraping out their nest of last year. By April 17th a Ringed Plover's nest with egg was found. On April 18th the first Sandwich and Common Terns were seen, and on the 20th many Swallows and Martins were observed going west. The first Oyster-Catcher's egg was found on April 26th. There were 16 nests of these birds on the island this year, and two on the Nod; all these hatched off. By the first week in May there were many Ringed Plovers' nests. On the 9th a pair of Swallows returned to the coalhouse at the back of the hut and again nested in exactly the same spot as last year—on the bottom of an up-turned box.

The first Common Tern's egg was found on May 19th and two days later the first egg of the Little Tern. On this same day, the 21st, there were 21 eggs of the Sandwich Tern. For some unexplained reason these Sandwich Terns all forsook their eggs and moved off to the eastward—presumably to Blakeney Point—and this year there were no Sandwich Terns hatched on the island, although the birds from Blakeney Point frequently paid visits—often as many as 200 at a time. The first-discovered egg of the Common Tern hatched out on June 4th (incubation 17 days). On June 7th and 8th exceptionally high tides came and washed out many Common Terns' eggs. These were moved higher up by the watcher and the birds resumed sitting. On June 14th the island was covered by blowing sand and many young chicks were choked as they were hatching.

BRITISH
MUSEUM
25 FEB 30
NATURAL
HISTORY.



Photo]

[D. Carruthers

DIAL HOUSE, BRANCASTER STAITHE

Recently bought by the Norfolk Naturalists Trust for the Watcher of Scolt Head Island. The two rooms on the left of the porch are reserved for visitors. The barn, used as a garage, is seen behind the house.



JIM LINKHORN

Well known to many ornithologists as one of the keepers on the Hickling Reserve. He caught the bittern by stalking it in the reed-bed. When released it flew to an adjacent reed-bed and within five minutes was again booming.

On the 25th there was a strong gale from the north-west with a very high tide which washed out many nests and most of the chicks of the Common and Little Terns were either drowned or choked by blown sand. Second clutches were laid, and these hatched off successfully. During the latter half of June and most of July a pair of Harriers were to be seen almost daily on the island, but there was no evidence that they nested. One of these birds was seen to pick up a young tern on the breeding ground, quite regardless of the mobbing it received from the parent birds. On July 23rd and 24th the watcher identified two Roseate Terns at the Ternery; these were almost certainly the birds which nested on Blakeney Point. The number of Little Terns nesting on Scolt Head has been increasing from year to year and during the past season the watcher counted 204 nests, distributed all along the shingle beaches. Of Common Terns' nests 382 were counted, but it is impossible to say how many of these successfully hatched off. Several Mallards nested on the island, and Redshanks' nests were numerous.

During the year a house, known as "Dial House," has been purchased in Brancaster Staithe by the Norfolk Naturalists Trust as a permanent residence for the watcher. It was formerly the "Victory" Public House, and as part of the property there are a large Brew House, barn (built of hard chalk) and a commodious yard. The Trust has reserved and furnished a bedroom and a sitting room in the house, which are let to visitors by arrangement with the watcher's wife, Mrs. Chestney. The brewhouse has been adapted for a museum and laboratory, and the barn provides garage accommodation. These various improvements, painting, furnishing, etc., have added to the original purchase price of the property, namely £540, by about £150, towards which the sum of £513 16 0 has already been subscribed. This "Dial House Fund" remains open in the hope that some of our supporters will help us to wipe out this deficit. The property is situated on the edge of the saltings at the head of the harbour and commands an uninterrupted view of the island.

BROADLAND

We are indebted to Mr. Jim Vincent, head keeper to Lord Desborough, for the following notes in connexion with the bird life in the Hickling area during the past season:—

Many birds suffered from the severe and prolonged winter's frost, and no less than nine dead or moribund Bitterns were picked up. We heard of two more starved Bitterns being found on an adjacent broad. Three found their way to the Cley marshes, but these, too, became frozen up, and the fate of these birds is unknown. It is estimated that about four pairs of Bitterns nested at Hickling this year, but, wisely, there was no search for their nests. The cold also depleted the numbers of Water Rails, Waterhens and Coots, as was reflected by their decrease in the breeding season. Among Bearded Tits there was a heavy death toll during the winter. About a dozen pairs survived and, judging by the numbers seen in the autumn, several of these had two, and perhaps three, broods. On November 13th Vincent {saw ten on Starch Grass, the recently-acquired marsh of the Norfolk Naturalists Trust, so that the outlook is encouraging.

On March 12th the broad began to open up once more and there were then large flocks of Tufted ducks, Pochards, Mallard and Teal, forty Goldeneyes, two Goosanders, a few Great Crested Grebes and thirty Bewick swans all revelling in the thaw. These swans left at 8 p.m. on March 28th.

A Little Bittern was seen flying across the broad by one of the reed cutters on March {27th. On the next day three pairs of Garganeys arrived and it is computed that from six to eight pairs nested. It was not until March 30th that Bitterns were heard grunting ; in ordinary years they would have been booming a month earlier than this.

HARRIERS.—The Broads district of Norfolk may be considered to be the home of the Harriers in England at the present time, and it is satisfactory to be able to report that both the Marsh and the Montagu continue to nest with us. On April 5th a male Marsh-Harrier arrived, which later was joined by a female. But it was not until May 30th that the first egg was laid, though in 1928 there were full clutches by May 7th. Four eggs were laid this year and two young reached maturity. The male parent and one of the young remained in the district until the last day of October.

The first Montagu Harriers were seen on April 22nd, and seven pairs stayed to breed, one bird laying the abnormal clutch of eight eggs. This year, for the first time, a male

Montagu Harrier has been observed to visit the nest. Once it was flushed from the nest by Vincent, and by the courtesy of Mr. Ian Thomson we are able to reproduce a photograph of both birds at the nest.

It is impossible to record all the birds that visited the Broads during the year, but mention must be made of two Black-winged Stilts that came to Hickling on May 24th. Grasshopper warblers were plentiful, and there were more pairs of nesting Yellow Wagtails than have been seen for some years. A pair of Common Pochards nested, but there is no evidence that Tufted ducks nested this year.

Of other visitors to Hickling may be mentioned several Ruffs and Reeves, which were about the marshes from the middle of April to the end of May; a Red-necked Grebe on April 5th and a pair of Black-necked Grebes on the 19th.

The Osprey is a bird that almost regularly visits the county during its northward migration, and we have seen it on the Broads and also on more inland waters. This year one arrived at Hickling on April 28th, where it stayed for several days and was seen by a number of ornithologists. This bird, unfortunately, came to an untimely end and was picked up at Catfield, mortally wounded by shot, on May 16th.

Of the many interesting birds that have now visited us for many years the Spoonbill is, perhaps, the most tantalising. It comes to Breydon Water, within a stone's throw of its former historical nesting place—Reedham church wood; to the Broads—there were four on Hickling on May 7th—and to the Cley Marshes. It is never molested nor even disturbed. Why, then, does it not nest here, when such suitable nesting sites and feeding grounds are provided? Only the bird itself can supply an answer.

Signed (on behalf of the Norfolk W. B. P. Committee).

SYDNEY H. LONG. *Hon. Sec.*

THE WILD BIRDS PROTECTION (ADMINISTRATIVE COUNTY OF NORFOLK) ORDER, 1929. DATED MAY 1, 1929

BIRDS

Close Time extended

II.—(a) Throughout the Administrative County of Norfolk, except the range of hills and foreshore known as Blakeney Point,

the period during which the killing or taking of Wild Birds is prohibited by the Wild Birds Protection Act, 1880, shall be extended.

- (1) so far as regards snipe, teal, wigeon and all other species of wild duck so as to be between the 10th day of February and the 1st day of August in each year with the exception of the foreshore and sandhills and marshes adjoining, as defined in paragraph VI (c) of this Order, the close time for which shall be between the 1st day of March and the 1st day of August in each year.
- (2) so far as regards woodcock so as to be between the 1st day of February and the 13th day of August in each year.
- (3) so far as regards all other Wild Birds mentioned in the Schedule to that Act, as amended by the Act of 1881, or added thereto by Clause III of this Order, so as to be between the 1st day of March and the 1st day of September in each year.

(b) Throughout the Blakeney Point District above referred to the close time shall be extended (1) so far as regards snipe, teal, wigeon and all other species of wild duck so as to be between the 10th day of February and the 1st day of September in each year and (2) so far as regards all other Wild Birds so as to be between the 1st day of March and the 1st day of September in each year.

Additions to the Schedule of the Act of 1880

III. The Wild Birds Protection Act, 1880, shall apply within the Administrative County of Norfolk to the following species of Wild Birds in the same manner as if those species were included in the Schedule to the Act :—

Great Bustard,	Sand Martin,
Corncrake,	Swallow,
Crossbill,	Swift,
Fly-catcher,	Bearded Tit (Reedling or Reed
House-Martin,	Pheasant),
Quail,	Warbler (all species).

Certain Birds protected during the whole of the Year

IV. During that period of the year to which the protection afforded by the Act of 1880, as varied by Clause II. of this Order, does not extend, the killing or taking of the following

species of Wild Birds is prohibited throughout the Administrative County of Norfolk :—

Avocet,	Owl (all species except Little Owl),
Bittern (all species),	Phalarope (all species),
Great Bustard,	Red Poll,
Buzzard (all species),	Ruff and Reeve,
Crossbill,	Sandgrouse,
Dartford Warbler,	Siskin,
Diver (all species),	Spoonbill,
Eagle (all species),	Black-winged Stilt,
Black-tailed Godwit,	Stork,
Fly-catcher (all species)	Swallow,
Goldfinch,	Swift,
Grebe (all species),	Blue-Throat and all species of Warblers,
Harrier (all species),	Bearded Tit (Reedling or Reed Pheasant),
Hobby,	Woodlark,
Hoopoe,	Woodpecker (all species).
Kingfisher,	
House-Martin,	
Golden Oriole,	
Osprey,	

All Birds protected on Sundays in certain Areas

V. During that period of the year to which the protection afforded by the Act of 1880, as varied by Clause II. of this Order, does not extend, the killing or taking of Wild Birds on Sundays is prohibited within the areas described in Article VI. paragraphs (a), (b), (c), (d), (e) and (f) of this Order.

EGGS

All Eggs protected in certain Areas

VI. The taking or destroying of the eggs of any species of Wild Birds is prohibited during the period of five years from the date of this Order, within the following areas :—

(a) Hickling Broad, Whitesley and Heigham Sounds, Black-fleet Broad, Horsey Mere, Martham and Somerton Broads, and the rands, skirts, and walls thereof, and fens and reed grounds appertaining thereto respectively, and the islands therein, and the dykes communicating therewith, including the Hundred Stream or Thurne River and ancient bed, and the rands and walls thereof from Heigham Bridge to the sea at Winterton, and all the marshes and low-lying uncultivated lands, fens, reed grounds, warrens, marram or sand hills and sea shore, to the line of high-water mark, in the several parishes of Waxham, Horsey, Potter Heigham, and Hickling, and such part of the parish of Catfield as lies to the east of the Midland and Great Northern Joint Railway.

(b) The warrens, marram or sand hills and sea shore, to the line of high-water mark, in the parish of Winterton.

(c) Such parts of the Rivers Yare and Wensum as are within the Administrative County of Norfolk, and the streams communicating therewith ; the River Bure and the streams communicating therewith ; and Rockland and Surlingham Broads and the rands, skirts, and walls of each such river and broad, and fens and reed grounds appertaining thereto respectively, and the islands therein, and the dykes communicating therewith.

(d) The series of Broads known as Ormesby, Rollesby, Hemsby, Filby, and Burgh Broads, and the rands, skirts, and walls thereof, and the dykes communicating therewith, and the fens, reed grounds, and low-lying lands, marshes and pastures adjacent thereto, including Lady Broad or Hard Fen Water, in the parish of Filby, Brandyke Broad, in the parish of Burgh St. Margaret, and Muckfleet Dyke, and the marshes and low-lying lands and pastures near or adjacent thereto respectively.

(e) The whole of the foreshore of the County of Norfolk, including the shingle, sand hills, salt marshes, creeks, and other unenclosed lands extending from high-water mark to the first boundary of enclosed or cultivated land separating the foreshore from them.

The approximate position of the rivers, open broads, and foreshores referred to above is shown in blue on a map deposited with the Clerk of the County Council, sealed with the Home Office Seal and dated the 1st May, 1929.

(f) The range of hills and foreshore known as Blakeney Point, which area is coloured red on a map, similarly sealed and dated, and deposited with the Clerk of the County Council.

Certain Eggs protected throughout the County

VII. The taking or destroying of the eggs of the following species of Wild Birds is prohibited throughout the Administrative County of Norfolk :—

Avocet,
Bittern (all species),
Great Bustard,
Buzzard (all species),
Crossbill,
Stone Curlew (Norfolk Plover or
Thick-Knee),
Fly-catcher (all species),
Black-tailed Godwit,

Oyster-Catcher (Sea Pic),
Ringed Plover (Ringed Dotterel
or Stone Runner),
Quail,
Land Rail or Corncrake,
Water Rail,
Redstart,
Ruff or Reeve,
Common Sandpiper,

Goldfinch,
Grebe (all species),
Harrier (all species),
Hawfinch,
Hobby,
Kingfisher,
Wood Lark,
Lapwing (Peewit or Green
Plover),
Magpie,
House Martin,
Sand Martin,
Nightingale,
Golden Oriole,
Owl (all species except Little
Owl),

Red-backed Shrike (Butcher
Bird),
Spoonbill,
Swallow,
Tern or Sea Swallow (all species),
Swift,
Bearded Tit (Reedling or Reed
Pheasant),
Grey Wagtail
Yellow Wagtail,
Dartford Warbler,
Warblers (all species),
Wild Duck and Teal (all species),
Woodcock,
Woodpecker (all species),
Wryneck.

Repeal of former Order

VII. The Order of the 6th August, 1925, is hereby repealed.

Given under my hand at Whitehall, this 1st day of May,
1929.

W. Joynton-Hicks,

One of His Majesty's Principal
Secretaries of State.

LIST OF SUBSCRIPTIONS AND DONATIONS TO THE
NORFOLK WILD BIRDS PROTECTION FUND FOR 1929

	£	s.	d.
H.M. THE KING	3	3	0
H.R.H. THE PRINCE OF WALES, K.G. ...	2	2	0
Adam Miss H. ...	1	1	0
Agnew C. G. ...	1	1	0
Allars R. W. E. ...	3	3	0
Allen J. W. ...	2	2	0
Anderson Edward ...	10	0	
Arnold E. W. ...	10	6	
Back H. W. ...	10	0	
Baker E. S. Stuart ...	3	3	0
Barclay F. H. ...	1	0	0
Barclay H. G. ...	2	2	0
Barclay Miss M. ...	10	0	
Barclay-Smith Miss P. ...	10	6	
Barlow J. Allen, C.B. ...	1	1	0
Barnard Mrs. ...	1	1	0
Barrow Miss ...	10	6	
Barry W. J. ...	1	1	0
Barton S. J., M.D. ...	1	1	0
Bedford, Her Grace the Duchess of ...	2	2	0
Beever Sir Hugh, Bart. ...	1	0	0
Carried forward ...	£29	4	6

	£	s.	d.
Brought forward ...	29	4	6
Benn Sir Ion Hamilton ...	1	1	0
Bewly Miss N. ...	5	0	
Blackburn C. J. ...	2	0	0
Blakeney Point Collect- ing Box ...	1	5	0
Boardman E. T. ...	1	0	0
Boileau Sir M., Bart. ...	1	1	0
Brash T. ...	2	2	0
Briscoe Lieut. F. M. Eliot-Drake ...	10	0	
Brittain H. ...	1	0	0
Brooks J. R....	1	1	0
Brown E. ...	1	1	0
Brown H. ...	1	1	0
Buckle Lt.-Col. D. W. ...	1	1	0
Bullard Ernest ...	1	1	0
Bulwer Col. E. A. ...	1	0	0
Burrowes R. B. ...	1	0	0
Burrows Mrs. ...	2	0	0
Butcher R. W. ...	1	1	0
Buxton E. G. (the late) ...	2	2	0
Buxton G. F. (the late) ...	3	3	0
Carried forward ...	£54	19	6

	£	s.	d.
Brought forward ...	54	19	6
Buxton W. L. ...	1	1	0
Byne Lt.-Col. R. M. ...	1	1	0
Byers J. ...	10	0	
Calley Miss J. M. ...	3	3	0
Candler Charles ...	10	6	
Capron J. T. ...	1	1	0
Carr Mrs. Laurence ...	10	0	
Carruthers D. ...	2	2	0
Cassie R. L. ...	10	0	
Castle J. W. ...	3	3	0
Cave Walter F. ...	2	2	0
Chadwick Dr. Morley	2	2	0
Chapman E. H., His			
Honour Judge ...	3	3	0
Christie J. A., M.P. ...	1	0	0
Churchill Mrs. Arnold	10	0	
Cleave H. P. O. ...	1	1	0
Cleminson H. M. ...	1	0	0
Clutton Bryan ...	3	3	0
Coe Mrs. A. E. ...	10	0	
Colman Miss E. ...	1	1	0
Colman Miss H. C. ...	1	1	0
Colman R. J. ...	1	1	0
Colomb Admiral P. H.,			
C.B. ...	1	0	0
Cooke A., F.R.C.S. ...	10	0	
Cowper Johnson K. ...	1	0	0
Cozens-Hardy A. ...	1	1	0
Cresswell Mrs. George	1	1	0
Davy G. ...	10	0	
Deacon Dr. G. E. ...	10	0	
De La Warr, Lady ...	1	0	0
Dewar T. F., C.B.,			
D.Sc., M.D. ...	10	0	
Dewrance Sir John,			
G.B.E. ...	2	2	0
De Worms C. ...	1	1	0
Doughty C. G. ...	1	1	0
Drury G. L. ...	10	6	
Duncanson T. J. G. ...	3	3	0
Eccles James R. ...	1	1	0
Ennion E. F. R. ...	10	6	
Ferrier Miss Judith ...	10	0	
ffolkes Sir W., Bart. ...	1	1	0
Finch F. R. ...	1	1	0
Flowers John, K.C. ...	1	1	0
Forbes H. ...	1	1	0
Friedlein W. ...	10	6	
A Friend ...	10	0	
Garrod F. W. ...	1	1	0
Gay Miss C. E. ...	1	1	0
Gayner Dr. J. S. ...	1	1	0
Giles C. C. T. ...	5	0	
Glanville J. P. ...	1	1	0
Glegg W. E. ...	1	0	0
Goddard W. N. ...	10	6	

Carried forward ... £114 10 0

	£	s.	d.
Brought forward ...	114	10	0
Gowen H. P. ...	1	1	0
Graves Mrs. ...	1	1	0
Green Major E. A.			
Lycett ...	10	0	
Gresham School Nat.			
Hist. Soc. ...	1	1	0
Gurdon E. T. (the late)	1	1	0
Gurney Q. E. ...	1	1	0
Gurney G. H. ...	2	2	0
Gurney R., D.Sc. ...	2	2	0
Gurney W. S. ...	1	1	0
Hannaford G. ...	2	2	0
Harding J. Rudge ...	10	0	
Harker W. ...	1	1	0
Harmer T. Bertrand ...	1	0	0
Harrison J. H. ...	15	0	
Haydon W. ...	5	0	
Herbert E. G. ...	10	0	
Heywood R. ...	1	1	0
Higham W. ...	10	0	
Hill T. A. M. ...	1	1	0
Holland C. B. ...	10	6	
Hollom P. A. D. ...	10	0	
Hopwood Miss M. ...	1	0	0
Horsfall R. E. ...	10	0	
Howlett Dr. J. K. ...	10	0	
Hudson Lt.-Col. Percy			
C.M.G., D.S.O. ...	1	0	0
Hughes W. ...	1	1	0
Hyslop A. B. ...	2	2	0
Hyslop Brig. - Gen.			
H. G., D.S.O. ...	1	1	0
Jago Cyril ...	10	0	
Jenkins Rev. T. L. ...	1	0	0
Jessop A. L. ...	2	2	0
Jones Sir L., Bart. ...	1	1	0
Jones Lawrence E. ...	3	3	0
Ketton-Cremer W. C.	1	1	0
Keith E. C. ...	1	10	0
Kennaway Dr. E. L.	10	0	
Kerr Mrs. M. Rait ...	1	1	0
Kinder Rev. E. H. ...	1	1	0
Knight E. ...	1	0	0
Kolle H. W. ...	2	2	0
Lang Gordon L. ...	2	2	0
Lee-Elliott Rev. D. L.	1	1	0
Littlewood Miss ...	10	0	
Lister S. R., M.D. ...	11	0	
Lewis J. Spedan ...	4	4	0
Lloyd Capt. L. ...	1	0	0
Long Miss ...	5	0	
Long S. H., M.D. ...	2	2	0
MacAlister Donald A.	1	0	0
MacAlister Mrs. ...	6	1	0
McHardy Maj. - Gen.			
A. A., D.S.O. ...	10	6	

Carried forward ... £177 17 0

	£	s.	d.
Brought forward ...	177	17	0
Macpherson A. Holte	1	1	0
McKenzie Miss G. ...	10	0	
McKittrick T. H., Jun.	2	2	0
McLean C. ...	1	1	0
Marshall J. M., J.P....	1	1	0
Masters Miss M. G. ...	10	0	
Matthews T. G. ...	1	1	0
Maynard Miss J. ...	1	1	0
Meade-Waldo E. G. B.	1	1	0
Meadows Mrs. A. H....	10	0	
Mennell E. ...	5	0	
Micholl Mrs. ...	1	1	0
Milne Mrs. Findlay ...	1	1	0
Mitchell Arthur ...	1	1	0
Moxey Mrs. ..	1	0	0
Murton Mrs. ...	1	0	0
Nash John E. ...	5	0	
Nash W. ...	1	0	0
National Trust, The...	10	0	0
Naylor W. S. ...	1	1	0
Newman Miss F. B. ...	10	0	
Pain P. ...	1	1	0
Parker George ...	1	1	0
Pearson S. V., M.D. ...	10	0	
Penrose F., M.D. ...	1	1	0
Perrin Percy ...	1	1	0
Plowright Dr. C. T. ...	2	2	0
Poole Miss D. Lane ...	7	6	
Powell A. M....	5	0	
Preston Sir E., Bart., D.S.O. ...	1	1	0
Purdy T. W....	1	1	0
Ransome Mrs. ...	1	1	0
Raikes Miss D. T. ...	5	0	
Reeves H. ...	1	1	0
Reid Dr. E. S. ...	10	0	
Report, Sale of ...	3	10	4
Riley W. ...	1	1	0
Ringrose B. J. ...	1	1	0
Riviere B. B., F.R.C.S.	2	2	0
Rogers Rev. H. ...	1	0	0
Royal Society for the Protection of Birds	2	2	0
St. Quintin W. H. ...	1	1	0
Sanders Rev. A. H. W.	5	0	
Savill Harry ...	2	2	0
Savin A. C. ...	5	0	

Carried forward ... £232 15 10

	£	s.	d.
Brought forward ...	232	15	10
Savory Mrs. ...	10	0	
Scolt Head Collecting Box ...	4	2	6
Schreiber P. G. ...	1	0	0
Sheldon W. G. ...	10	6	
Simmonds C. E. ...	5	0	
Simpson F. T. ...	2	2	0
Smith Col. H. F. ...	1	1	0
Soman A. E. & Co., Ltd. ...	1	1	0
Spalding G. ...	10	0	
Sparrow Col. R. ...	10	0	
Southwell E. B. ...	1	1	0
Steward Rev. Canon Edward ...	1	1	0
Stimpson E. ...	1	0	0
Sumpter Dr. B. G. ...	2	2	0
Tancock Canon O. W.	5	0	
Taylor Dr. Mark ...	1	0	0
Thompson C. R. W.	10	0	
Thorpe W. H. ...	1	1	0
Thouless H. J. ...	10	0	
Tuke Anthony W. ...	1	1	0
Turner Edgar ...	1	2	0
Turner E. G. ...	1	1	0
Upcher H. E. S. ...	1	0	0
Upcher Miss L. ...	2	2	0
Vincent T. ...	5	0	
Walmisley Miss V. ...	10	0	
Walter C. H. ...	1	1	0
Watson J. B. ...	10	0	
Watson-Kennedy Mrs.	1	1	0
Webb-Ware Mrs. ...	10	0	
Wells C. H. ...	1	1	0
Wemyss Major G. ...	1	0	0
Whittaker W. I. ...	1	1	0
Winch Major S. B. ...	2	2	0
Wishart E. E. ...	5	0	0
Whymper S. L. ...	1	1	0
Wormald H. ...	1	1	0
Wright B. D. Z. ...	10	0	
Wright T. J. ...	10	6	
Wylllys H. J. M. ...	10	0	
Wylllys W. E. ...	10	0	
Yeo H. ...	10	6	
Yeo Mrs. ...	10	6	

Total ... £278 8 4

NORFOLK WILD BIRDS PROTECTION FUND

Year ending December 31st, 1929

RECEIPTS			EXPENDITURE		
	£	s. d.		£	s. d.
Balance brought forward from 1928	86	18 7	Breydon Watcher's Wages and Insurance	42	13 6
Subs. for 1929 paid in 1928	8	7 6	Oil, Coal, etc., for Breydon House Boat	1	0 6
	95	6 1	Scolt Head Watcher's Wages and Insurance to Nov. 7th, 1929	119	6 5
Subscriptions and Donations, 1929	261	3 0	Axe for Watcher	7	0
Blakeney Point Collecting Box	1	5 0	Blakeney Point—Contribution to Watcher's Wages	30	0 0
Scolt Head Collecting Box ...	4	2 6	Honorarium to Edith Pinchen ...	2	2 0
Sales of Report	3	10 4	2 doz. Rat Traps	1	18 0
Donations for Field-glasses for Watchers	14	0	Mattresses for Watcher's House Boat	5	17 0
			Oil Stove for do.	1	6 8
			Printing of Annual Report ...	8	13 6
			Printing and Receipt Books ...	1	3 0
			Postage and Watchers' Diaries	8	5 0
			2 Zeiss Field-glasses for Watchers	5	5 0
			Guernsey and Oil-skin for Watcher	1	18 6
			Cheque Books	6	0
			To Deposit a/c	50	0 0
			To the Norfolk Naturalists' Trust, towards purchase of "Dial House"	80	0 0
			Balance	5	18 10
	£366	0 11		£366	0 11

DEPOSIT

	£	s. d.
Balance, 31st December, 1928 ...	82	10 2
Interest to June 30th, 1929 ...	2	12 6
Transfer from Current a/c ...	50	0 0
	£135	2 8

XI.

METEOROLOGICAL NOTES, 1928

(From observations taken at Norwich)

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

JANUARY

NEW Year's Day saw a break up of the severe frost which had prevailed during the last week of December, and was followed by mild, stormy weather, with much rain and bright intervals and an occasional morning frost. The rainfall of the month (3.77 in.) was the greatest amount registered here in any January since 1922. The heaviest rain occurred

on the 2nd (.90 in.), and this downpour accompanying the melting of the heavy snows of the previous month occasioned disastrous floods in many places. A heavy gale occurred on the 6th with a velocity of 54 miles an hour. Mean temperature (40.2 deg.) was 2.6 deg. above normal, and the month was the sixth successive January with an excess of temperature.

FEBRUARY

Frequent storm centres from the Atlantic caused a continuance of the mild stormy weather which had characterised January, up to the 17th, when a dry time set in and continued to the end of the month. During the first fortnight there were no less than six days on which the wind rose to gale force, the heaviest gale being on the 10th, when the wind rose to 50 miles an hour. Thunderstorms, unusual in February, occurred on the 1st, 10th, and 11th. On the latter day at about 5.30 p.m. a brilliant flash of lightning struck the electric light plant of Norwich putting nearly the whole of the city into darkness. Mean temperature of the month (42.1 deg.) was 3.4 deg. above the average, and the rainfall (1.49 in.) 0.15 in. below. There was no snow.

MARCH

In the first week there were some warm days, the thermometer reaching 63.4 deg. on the 4th. On the 6th a cold spell set in, the maximum on the 11th being only 33 deg. Much wintery weather occurred at this time with snowstorms on the 9th, 10th, 11th, and 12th, the snow lying 5 in. deep on the morning of the 12th. From the 17th the weather was generally mild. The month's rainfall (1.68 in.) was 0.28 in. deficient. A rather sharp thunderstorm passed over the city on the afternoon of the 30th. Mean temperature (43.3 deg.) was 1.8 deg. in excess of the normal. Sunshine was 15 hours deficient.

APRIL

After commencing with four cold days, a fine, warm period coinciding with the Easter holidays followed. An abrupt change to wintery conditions ensued, and from the 13th to the 22nd the temperature did not once touch 50 deg. On the 18th it fell by night to 28.5 deg. in the screen and to 24 deg. on the

grass. Slight snow and sleet fell almost daily between the 15th and 20th. The last week was warm, the thermometer reaching 71 deg. on the 26th. Mean temperature (47.4 deg.) was 1.1 deg. above and the rainfall (1.50 in.) 0.21 in. below their respective averages.

MAY

From the 3rd to the 7th there was a short period of fine, bright weather, but from the 8th to the 24th there was hardly a warm day and a great prevalence of cold, bleak weather, with much north wind and cold showers. From the 24th an improvement took place and continued over the Whitsun holidays. On Bank Holiday the thermometer rose to 76.8 deg., a temperature which was not again reached until July 10th, and which was the warmest day since the 6th of the previous August. The total sunshine of the month was 30 hours deficient. The total rain (none of which fell after the 23rd) was 1.97 in., and approximately the normal. Mean temperature 51.4 deg.

JUNE

There were but few warm days during this month, the thermometer rising above 70 deg. on six days only, and the maximum for the month was only 74.2 deg., the same as in the previous June. The month was, however, much drier than the last-named month, the total rainfall having been 2.30 in. against 4.80 in. in 1927. The heaviest rain (.60 in.) occurred during a thunderstorm on the afternoon of the 26th. There were many windy days, the predominant direction of the wind having been between south and north-west.

JULY

This month was notable for the great outburst of heat which prevailed from the 8th to the 26th, and for the remarkable drought which accompanied it. Maximum temperatures of 85.1, 86.3, 85.9, 88.0 and 85.6 deg. were recorded on the 11th, 12th, 14th, 15th, and 22nd respectively, and on many other days during the month 80 deg. was nearly attained. The mean temperature of the entire month (64.2 deg.) was higher than in any previous July since 1923, and it was the sunniest July since 1921. Down to the 26th day only .13

in. of rain had been measured, but the last six days yielded 1.80 in., bringing up the month's total to 1.96 in. The period 9th to 24th was absolutely rainless. With the exception of some distant rumblings on the morning of the 27th, no thunder was observed throughout the month. Winds were mainly from the south-west, west, and north-west.

AUGUST

August was characterised by an unusually large number of fine, warm days, without any excessive heat as in July, and was consequently an exceedingly pleasant month. The highest temperatures observed were 77.8 deg. on the 11th and 77.1 deg. on the 24th, but it reached or exceeded 70 deg. on 15 other days. Mean temperature was in close agreement with the average, and the rainfall 0.57 in. below. The most frequent rain fell between the 19th and 27th, but none of the falls were very heavy. Thunder occurred on the 12th, 20th, and 27th, and lightning was seen on the evening of the 24th. Sunshine was 24 hours in excess of the normal, and it was the sunniest August since 1923. The Bank Holiday was very fine, and the harvest progressed under most favourable conditions.

SEPTEMBER

This month was noted for the great abundance of sunshine, causing a protraction of the splendid summer weather which had preceded it. The total sunshine was 64 hours above the normal amount, and it was the sunniest September since 1911. Rainfall was only 50 per cent. of the average, and down to the 28th only half an inch of rain had been measured. Temperature rose to 81 deg. on the 5th, and to 80.7 deg. on the 8th, and the mean temperature of the first ten days was higher than the normal for July. Easterly winds prevailed on several days, and the mean pressure for the month exceeded 30 inches.

OCTOBER

The first week was fine and warm with high pressure, the shade temperature exceeding 60 deg. on most days. From the 9th to the month's end a succession of cyclonic storms passed over the country from the Atlantic, rendering the

weather extremely unsettled, but with warm days intervening. The mean temperature of the month was 2 deg. above the average, and there was hardly any frost. With one exception (1921) it was the warmest October since 1910. Rainfall was slightly under normal, although rain fell on 19 days. Sunshine was 11 hours in excess.

NOVEMBER

November was an exceptionally mild and stormy month. Mean temperature (46.9) was the highest of any November since 1899. There were only three nights with frost in the screen, and these frosts were very slight. The total amount of rain (which fell on 24 days) was 2.94 in., and fell far short of the amounts recorded in many parts of the south-east of England. Cyclonic disturbances came in from the Atlantic with great frequency, and caused, particularly between the 13th and 26th, a constant succession of high winds and heavy gales, the latter being of unusual intensity on some days, particularly on the 16th, 23rd and 25th, when much damage was done both at sea and on land. On the 16th 66 miles per hour were registered at Gorleston, on the 23rd 53 miles per hour, and on the 25th 55 miles per hour. Thunder occurred on the 5th and 25th. Sunshine 66 hours. The mildness caused roses and other garden flowers to remain in bloom until the end of the month.

DECEMBER

Mean temperature was slightly under normal, but there was a mild spell at Christmas, on the evening on which day 55.2 deg. was registered, which was the highest reading in this neighbourhood on that day since 1854. There were 11 nights with frost in the screen and 24 on the grass. Cold drenching rains fell on the 29th and 30th, amounting to 1.49 in., bringing up the month's total, which promised to be below the average to .60 in. above. Sunshine was 14 hours in excess, and while there was not much fog there were many days of gloom and drizzle.

THE SEASONS

Tables of mean temperature and rainfall of the four seasons of 1928 (including December, 1927, but excluding December,

1928), and compared with those of the five previous years and with the average.

TEMPERATURE

Seasons	1923	1924	1925	1926	1927	1928	Average for 30 years.	Departure of 1928 from average
	degrees	degrees	degrees	degrees	degrees	degrees	degrees	degrees
Winter -	41'3	37'3	41'6	39'7	39'4	39'3	38'4	+ 0'9
Spring -	47'3	46'7	47'6	48'5	48'6	47'4	46'7	+ 0'7
Summer -	60'3	60'2	61'5	60'6	59'7	61'8	60'2	+ 1'6
Autumn -	47'8	51'2	48'2	50'3	49'9	51'9	50'1	+ 1'8
Year -	48'7	49'4	49'2	50'0	49'1	50'1	48'8	+ 1'3
Jan. to Dec.								

RAINFALL.

Seasons	1923	1924	1925	1926	1927	1928	Average for 35 years.	Departure of 1928 from average.
	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.
Winter -	8'07	7'40	6'06	7'26	5'64	8'05	6'21	+1'84
Spring -	3'95	6'58	6'31	4'70	4'23	5'15	5'55	- 0'40
Summer -	6'45	6'08	4'65	6'92	10'62	6'06	6'89	- 0'83
Autumn -	8'84	10'86	8'51	7'01	14'92	6'73	7'83	-1'10
Year -	27'74	30'77	25'10	24'66	36'90	26'41	26'48	-0'07
Jan. to Dec.								

The winter was the fourth in succession warmer than the average, and the wettest (owing to snow) since 1923. The spring was also the fourth in succession warmer than the normal; the rainfall was 0.40 ins. deficient. The summer was the warmest since 1921, and, with 0.83 ins. deficiency of rain, was $4\frac{1}{2}$ inches drier than the preceding summer. The autumn was the warmest since 1913. It yielded 8.19 ins. less rain than the autumn of 1927, and was the driest autumn since 1922.

THE YEAR.

The mean temperature of the year was 1.3 deg. above the average, and it was the warmest year since 1921. The warmest

month was July with a mean temperature of 64.2 deg. and the coldest month was December whose mean temperature was 39.0 deg. The warmest months in relation to the normal were February and November (3.4 deg. and 3.1 deg. respectively above) and the coldest was June (1.1 deg. below). The warmest day was July 15th (88 deg.) and the coldest night January 1st (17.6 deg.) The total rainfall of the year (26.41 ins.) was very near the exact average and 10 inches less than in 1927. The wettest month was January (3.77 ins.) and the driest was September (1.05 ins.). The total sunshine for the year (the returns for which were again kindly supplied by Mr. J. H. Willis) was 1,748 hours—the greatest amount in any year since the sunny year 1921, and 286 hours more than in 1927. Each month, June to December, inclusive, yielded an excess of sunshine. There were but few thunderstorms during the summer, but there were three in February and two in November, two months usually noted for their absence. Although the late spring and early summer were cool and disappointing, abundant compensation followed in the splendid weather which prevailed from the beginning of July until well into October.

APPENDIX.

Annexed is a summary of the results obtained from meteorological and phenological observations, during the ten years 1918-1927, being a continuation of the tables given in Vol. VI of the "Transactions," pp. 342-347, Vol. VIII., pp. 739-746, and Vol. X., pp. 462-472.

TABLE I.

Absolute highest monthly and annual shade temperature during the ten years 1918-1927.

Year.	Jan.	Feb.	Mar.	Apl.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
	°	°	°	°	°	°	°	°	°	°	°	°	°
1918	55.0	58.0	69.5	59.2	81.0	77.2	80.0	90.8	72.2	62.0	59.0	57.8	90.8
1919	52.8	51.0	56.0	67.0	80.7	82.4	77.0	84.0	86.5	64.0	56.0	54.2	86.5
1920	55.0	57.2	66.0	63.8	77.8	78.0	77.0	72.3	71.5	72.0	59.4	55.4	78.0
1921	56.0	57.5	66.0	68.2	77.7	82.3	90.2	84.0	83.8	77.0	53.2	58.0	90.2
1922	56.4	59.0	59.0	65.4	88.7	82.0	75.5	73.0	70.0	64.0	53.0	52.6	88.7
1923	53.5	57.0	68.8	69.4	81.5	74.7	92.9	85.0	72.0	66.0	58.4	48.2	92.9
1924	50.2	49.4	58.4	64.1	77.6	80.7	85.6	75.4	71.0	68.8	58.0	54.0	85.6
1925	54.8	54.1	53.9	62.0	80.0	83.2	87.2	77.0	69.2	68.0	60.2	57.2	87.2
1926	52.7	56.5	59.0	74.5	73.0	77.0	83.0	78.7	86.0	70.2	55.0	50.0	86.0
1927	52.0	53.0	65.5	69.0	73.4	74.2	79.0	79.0	72.8	66.8	65.0	51.0	79.0
Extremes 1918-27	56.4	59.0	69.5	74.5	88.7	83.2	92.9	90.8	86.5	77.0	65.0	58.0	92.9
Extremes 1888-1927	56.4	64.0	70.0	75.4	88.7	90.4	92.9	93.5	93.0	78.4	65.0	58.0	93.5

TABLE II.

Absolute lowest monthly and annual shade temperature during the ten years 1918-1927.

Year.	Jan.	Feb.	Mar.	Apl.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1918	° 16.3	° 23.2	° 24.0	° 30.9	° 40.6	° 38.4	° 45.7	° 47.0	° 36.4	° 33.8	° 26.0	° 30.0	° 16.3
1919	27.0	12.0	24.0	28.0	36.5	38.0	42.5	39.2	31.7	31.2	25.0	24.2	12.0
1920	24.4	26.4	29.0	33.7	34.0	35.4	43.9	42.3	38.5	27.6	23.0	20.5	20.5
1921	28.6	26.2	28.5	31.5	32.7	39.2	42.3	41.0	38.6	38.3	23.0	25.0	23.0
1922	17.2	24.3	25.6	27.4	33.2	41.7	44.0	42.2	37.8	31.2	27.0	28.4	17.2
1923	28.6	29.0	30.6	30.9	33.0	37.0	48.5	43.0	40.5	32.2	21.2	24.0	21.2
1924	25.7	20.8	23.0	27.5	36.2	37.0	45.2	42.2	37.0	32.5	26.8	28.5	20.8
1925	26.3	23.7	24.4	26.1	36.5	43.7	48.0	45.9	41.2	32.2	25.4	16.2	16.2
1926	12.2	29.4	28.5	33.3	33.7	42.0	45.1	43.5	38.0	26.7	28.9	28.4	12.2
1927	26.2	24.2	32.4	29.4	28.5	42.5	43.8	46.0	35.0	32.0	31.1	14.2	14.2
Extremes 1918-27	12.2	12.0	23.0	26.1	28.5	35.4	42.3	39.2	31.7	26.7	21.2	14.2	12.0
Extremes 1888-1927	7.2	4.0	12.0	17.0	28.5	34.8	36.6	38.5	31.7	25.0	14.0	13.0	4.0

TABLE III.

Mean monthly and annual temperature during the ten years 1918-1927.

Year.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
	°	°	°	°	°	°	°	°	°	°	°	°	°
1918	37.6	42.9	42.9	44.0	55.6	56.2	61.4	62.5	55.2	48.7	42.0	43.9	49.4
1919	37.1	35.2	39.3	45.5	55.8	58.3	57.0	61.5	56.5	45.6	38.3	40.8	47.6
1920	40.7	42.1	46.3	48.3	55.3	59.4	59.9	57.4	57.1	50.7	42.9	39.7	50.0
1921	45.1	40.4	46.1	47.8	54.8	57.8	65.8	62.7	59.1	55.8	39.2	43.2	51.5
1922	37.3	40.0	40.9	43.1	56.6	57.9	58.0	57.8	54.9	48.3	42.1	42.0	48.3
1923	40.4	41.6	44.2	46.8	50.9	54.0	66.0	61.1	55.4	50.1	38.0	36.4	48.7
1924	38.8	36.7	39.4	45.7	55.0	59.4	62.1	59.1	57.5	51.6	44.6	42.8	49.4
1925	41.0	41.1	40.9	46.3	55.6	58.6	64.0	61.8	53.2	50.9	40.5	36.6	49.2
1926	38.3	44.3	44.0	50.3	51.3	57.1	62.5	62.1	59.4	47.3	44.2	39.4	50.0
1927	39.3	39.5	45.8	47.7	52.3	56.1	61.0	61.9	55.9	50.9	42.8	35.5	49.1
Mean 1918-27	39.6	40.4	43.0	46.6	54.3	57.5	61.8	60.8	56.4	50.0	41.5	40.0	49.3
Mean 1888-1927	38.4	39.1	42.0	46.3	54.3	58.0	61.4	60.9	57.1	50.0	43.2	39.4	49.1

TABLE IV.

Monthly and annual rainfall during the ten years 1918-1927

Year.	Jan.	Feb.	Mar.	Apl.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.
1918	2.94	1.22	0.85	3.46	0.79	1.08	3.48	1.47	4.65	2.86	2.11	3.97	28.88
1919	2.94	3.38	2.30	1.82	0.86	1.27	2.62	2.26	0.88	3.53	3.08	5.05	29.99
1920	2.34	0.73	1.23	3.60	1.78	2.11	3.16	2.07	2.21	0.77	0.78	3.22	24.00
1921	2.03	0.33	1.19	1.71	1.27	0.55	0.50	1.52	1.31	1.50	1.84	1.96	15.71
1922	5.20	2.70	2.25	2.49	0.58	1.67	7.33	1.54	2.62	1.42	2.01	2.68	32.49
1923	1.85	3.54	1.58	1.09	1.28	0.83	3.30	2.32	1.95	3.62	3.27	3.11	27.74
1924	2.35	1.94	0.68	2.05	3.85	1.60	2.09	2.39	5.22	4.20	1.44	2.96	30.77
1925	1.07	2.03	1.76	2.50	2.05	0.61	1.68	2.36	3.09	1.70	3.72	2.53	25.10
1926	2.78	1.95	0.37	2.81	1.52	2.71	1.67	2.54	1.14	2.78	3.09	1.30	24.66
1927	2.23	2.11	2.05	1.55	0.63	4.80	2.47	3.35	7.15	2.60	5.17	2.79	36.90
Mean 1918-27	2.57	1.99	1.43	2.31	1.46	1.72	2.83	2.18	3.02	2.50	2.65	2.96	27.62
Mean 1888-1927	2.13	1.78	1.91	1.83	1.80	1.89	2.70	2.51	2.19	2.74	2.55	2.64	26.67

TABLE V.

Prevailing direction of wind each month during the ten years 1918-1927.

Year.	Jan.	Feb.	Mar.	Apl.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1918	S.	W.	E.	N.	N.	W.	S.W.	S.W.	S.	S.W.	S.	W.
1919	S.E.	S.E.	E.	W.	E.	N.W.	N.W.	W.	N.W.	W.	E.	S.W.
1920	S.W.	S.W.	W.	S.	S.W.	W.	S.	N.W.	S.W.	E.	S.W.	E.
1921	S.W.	N.E.	S.W.	N.E.	S.E.	N.E.	E.	W.	E.	E.	S.E.	W.
1922	S.	S.	N.E.	N.E.	S.	W.	S.W.	S.W.	N.	E.	N.W.	S.
1923	W.	S.E.	E.	E.	W.	N.W.	W.	W.	W.	S.W.	N.W.	S.
1924	S.	N.W.	S.E.	N.	S.W.	W.	W.	S.W.	S.W.	S.W.	N.W.	S.
1925	S.W.	S.W.	N.E.	S.E.	S.W.	N.	S.W.	N.W.	N.W.	S.	S.E.	S.
1926	S.	S.W.	W.	S.W.	N.E.	N.	N.	W.	N.W.	W.	S.	N.W.
1927	S.W.	S.W.	S.W.	N.W.	N.	N.W.	N.E.	S.W.	W.	N.W.	W.	E.
Prevailing monthly direction.	S.W.	S.W.	E.	N.E.	S.W.	W.	S.W.	S.W.	N.W.	S.W.	N.W.	S.

TABLE VI.

Number of days on which the wind blew from the eight points each month
from 1918-1927.

Month.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.
January	13	8	18	32	73	63	61	42
February	17	27	32	45	38	46	50	28
March	25	36	41	20	34	57	53	44
April	44	52	42	22	23	31	42	44
May	38	37	45	31	40	52	42	24
June	48	35	24	19	18	27	55	74
July	34	28	36	20	39	53	55	45
August	35	11	19	12	37	63	65	68
September	21	29	19	25	35	56	61	54
October	33	23	53	23	47	44	41	46
November	26	22	38	47	39	34	39	53
December	18	24	28	15	62	62	55	46

TABLE VII.

Number of days on which the wind blew from the eight points from 1918-1927.

Year.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.
1918	43	28	26	33	60	69	65	41
1919	38	41	37	34	46	50	53	66
1920	25	29	52	35	54	76	56	39
1921	45	36	52	28	40	45	59	60
1922	37	42	45	21	51	56	60	53
1923	31	24	42	19	43	60	89	57
1924	21	26	33	42	67	64	59	54
1925	33	32	28	36	48	59	53	76
1926	44	42	32	37	39	56	63	52
1927	35	32	47	26	40	53	62	70
Average days 1918-27	35	33	39	31	49	59	62	57
Average days 1888-1927	35	37	37	30	46	59	66	55

TABLE VIII.

Dates of first leafing of Deciduous Trees, etc., during the ten years 1918-1927.

Trees, etc., Leafing.	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	Averages. 1918-27 1888-1927
Hawthorn	Feb. 26	Mch. 30	Feb. 10	Feb. 17	Mch. 18	Feb. 28	Apl. 1	Mch. 17	Feb. 27	Mch. 8	Mch. 7 Mch. 12
Sycamore	Apl. 3	Apl. 18	Mch. 24	Mch. 26	Apl. 25	Apl. 11	Apl. 2	Apl. 12	Mch. 11	Apl. 11	Apl. 5 Apl. 7
Horse Chestnut	Mch. 25	Apl. 14	Mch. 21	Mch. 17	Apl. 15	Mch. 25	Apl. 20	Apl. 10	Mch. 12	Mch. 21	Mch. 29 Apl. 4
Lime	Mch. 25	May 1	Mch. 27	Mch. 18	Apl. 18	Mch. 29	Apl. 23	Apl. 16	Mch. 18	Apl. 6	Apl. 6 Apl. 14
Birch	Apl. 1	Apl. 20	Mch. 28	Mch. 19	May 4	Apl. 3	Apl. 21	Apl. 16	Mch. 30	Apl. 11	Apl. 9 Apl. 18
Beech	Apl. 21	Apl. 28	Apl. 4	Apl. 1	May 1	Apl. 11	Apl. 27	Apl. 19	Apl. 9	Apl. 18	Apl. 17 Apl. 22
Elm	Mch. 29	Apl. 18	Mch. 7	Feb. 27	Apl. 15	Mch. 25	Apl. 21	Apl. 13	Mch. 14	—	Mch. 29 Mch. 27
Maple	—	Apl. 28	Apl. 3	Apl. 14	May 7	—	May 2	Apl. 23	Apl. 11	Apl. 28	Apl. 22 Apl. 28
Oak	May 9	May 1	Apl. 14	Apl. 3	May 12	Apl. 26	May 10	May 10	Apl. 9	Apl. 24	Apl. 27 May 1
Ash	May 16	May 17	Apl. 30	Apl. 17	May 9	May 3	May 14	May 17	May 13	Apl. 28	May 7 May 12
Foliage generally complete	May 31	May 31	May 26	May 22	May 30	June 12	June 3	May 31	June 3	May 29	May 31 June 2

TABLE X.

Dates of first flowering of Garden Plants, Shrubs, etc., during the ten years 1918-1927.

Plants flowering.	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	Averages. 1918-27	1888-1927
Winter aconite ...	Jan. 19	Dec. 17	Dec. 31	Jan. 2	Jan. 22	Dec. 21	Jan. 20	Dec. 30	Jan. 23	Jan. 23	Jan. 8	Jan. 5
Snowdrop ...	Jan. 23	Jan. 20	Jan. 18	Jan. 2	Jan. 22	Jan. 14	Jan. 25	Jan. 14	Jan. 26	Jan. 24	Jan. 19	Jan. 18
Crocus ...	Jan. 27	Jan. 17	Jan. 25	Jan. 11	Feb. 14	Jan. 24	Feb. 18	Jan. 4	Feb. 2	Jan. 29	Jan. 26	Feb. 2
Daffodil ...	Feb. 27	Mch. 27	Feb. 29	Feb. 23	Mch. 11	Feb. 26	Mch. 26	Mch. 4	Feb. 23	Mch. 17	Mch. 7	Mch. 16
Ribes sanguineus ...	Mch. 1	Mch. 16	Feb. 24	Feb. 17	Mch. 6	Feb. 26	Mch. 23	Mch. 9	Mch. 9	Mch. 5	Mch. 5	Mch. 17
Lilac ...	May 9	May 15	Apl. 18	Apl. 4	May 14	May 2	May 15	May 14	Apl. 14	Apl. 26	May 1	May 8
Laburnum ...	May 16	May 16	Apl. 24	Apl. 21	May 30	May 3	May 20	May 14	Apl. 22	May 1	May 8	May 13
White pink ...	June 4	June 11	May 24	May 23	June 9	June 21	June 20	June 11	June 5	—	June 4	June 4
Lilium candidum...	June 26	June 30	June 18	June 17	June 26	—	June 28	June 24	—	—	June 25	July 4
Colchicum autumnale ...	Aug. 18	Aug. 24	Aug. 6	Aug. 4	Sept. 1	Aug. 22	Aug. 24	Aug. 14	Aug. 16	Aug. 24	Aug. 18	Aug. 24

XII.

FAUNA AND FLORA OF NORFOLK

ADDITIONS TO PART XI.—BIRDS (NINTH LIST)*

1924—1928

BY S. H. LONG, M.D., F.Z.S., M.B.O.U., AND

B. B. RIVIERE, F.R.C.S., F.Z.S., M.B.O.U.

IN the following we have attempted to bring together, to the end of 1928, such published, and other, information about some of the rarer birds that have visited Norfolk during the past five years, and the present status of certain others that breed in the county. In all cases we have given references, whenever possible. As in previous years, we have adopted the nomenclature of the last-published B.O.U. List of British Birds.

GREENLAND (Coues') REDPOLL (*Acanthis linaria rostrata*).—A male of this race, the first to be recorded in Norfolk, was shot at Martham on January 4th, 1926, and identified by Dr. C. B. Ticehurst (Trans. N. and N. Nat. Soc., Vol. XII., p. 263).

CROSSBILL (*Loxia curvirostra*).—Continues to hold its own as a nesting species. There was a considerable immigration to the Norfolk Coast noted in the summer and autumn of 1925 and 1927.

ORTOLAN BUNTING (*Emberiza hortulana*).—A male was killed at Cley on September 8th, 1927 "British Birds," Vol. XXI., p. 24).

WOOD-LARK (*Lullula arborea*).—Becoming common in south-west Norfolk, and extending its range elsewhere in the county. Found breeding at Drayton, four miles north-west of Norwich, in 1925.

GREY WAGTAIL (*Motacilla boarula*).—Since 1923 a pair have bred each year at Taverham. No other nesting pair has been located.

CONTINENTAL BLUE TITMOUSE (*Parus cæruleus*).—One identified as belonging to this race, was killed at Cley October, 1921. This is the first record for

* For previous Lists see Vols. IV., 259 and 397; V., 642; VI., 501; VII, 733; VIII., 847; IX., 784; X., 499; XI., 586.

England, but two have previously been recorded for Scotland ("British Birds," Vol. XIX, p. 241).

DARTFORD WARBLER (*Melizophilus undatus dartfordiensis*).—

One was seen on January 9th, 1928, by Col. W. A. Payne, on a golf course by the sea. Only three have previously been recorded in Norfolk: two on Yarmouth denes and one at Wells ("British Birds," Vol. XXII., p. 249).

AQUATIC WARBLER (*Acrocephalus aquaticus*).—One was killed

September 4th and another on September 5th, 1924, at Cley. On September 11th, 1925, one was killed at Blakeney ("British Birds," Vol. XVIII., p. 286, Vol. XIX., p. 241).

WOOD-WARBLER (*Phylloscopus sibilatrix*).—Still breeds each

year at South Wootton. In 1925 B.B.R. was shown a small colony of three to four pairs at Blickling by Mr. Graves, who believes they have nested there for the past ten years.

NORTHERN WILLOW-WARBLER (*Phylloscopus trochilus evermanni*).—One was killed at Cley, May 8th, 1924 ("British Birds," Vol. XVIII., p. 286).

In all, several have been identified on the Norfolk coast both in spring and autumn.

REDSTART (*Phœnicurus phœnicurus*).—Five to ten pairs still

nest annually in the South Wootton district (Tracy) and a few pairs near the Suffolk border; elsewhere still very scarce as a nesting species. A pair nested at Taverham in 1927, and four pairs were found nesting at Kelling in 1928 (A. P. Meiklejohn).

RED-SPOTTED BLUETHROAT (*Cyanosylvia suecica*).—One or

two are usually to be met with at Cley in September. In 1927 several were seen in this month.

BLACK-BELLIED DIPPER (*Cinclus cinclus*).—In the late autumn

of 1926 one or more Dippers were seen on the river Wensum, a mile or so above Norwich. These were probably of the Scandinavian form

as this is the usual race that occurs in Norfolk. Only two examples of the British race have been recorded for the county.

RED-BREASTED FLYCATCHER (*Muscicapa parva*).—One obtained on Blakeney Point, October 2nd, 1925 ("British Birds," Vol. XIX., p. 241). Two were obtained (September 15th and 30th) and two more seen between Salthouse and Blakeney in September, 1928. ("British Birds," Vol. XXI., p. 249.)

WRYNECK (*Lynx torquilla*).—A very rare bird in Norfolk now-a-days. On May 5th, 1927 S. H. L. watched one calling in a wood in the south-west of the county, but we have no knowledge of its nesting of late years.

SHORT-EARED OWL (*Asio accipitrinus*).—Five pairs nested in the Broads district in 1924, the largest number for many years. A pair nested on Scolt Head Island in 1925, 1926 and 1928.

LITTLE OWL (*Carine noctua*).—Is now abundant throughout the county.

MARSH-HARRIER (*Circus æruginosus*).—In 1927 a male and what appeared to be three females were present in the Broads district during the summer. A nest was made and three eggs laid, on which the female brooded for fourteen days, at the end of which time she deserted and the eggs found to be infertile. In 1928 three nests were successfully hatched—a record for the county.

MONTAGU'S HARRIER (*Circus pyargus*).—Eight nests in 1924 (record); six in 1926; one in 1927; two, and possibly three, in 1928.

RED-FOOTED FALCON (*Falco vespertinus*).—A male in first summer plumage was found by A. P. Meiklejohn in a keeper's "larder" at Bayfield, July 5th, 1927; it had probably been there about a month ("British Birds," Vol. XXI., p. 248).

OSPREY (*Pandion haliaetus*).—Continues to visit the Broads district in most years on its northward (spring) migration.

WHOOPEE SWAN (*Cygnus cygnus*).—Attempted to breed in 1928.

A pair of swans were seen by a keeper to be building a nest at the foot of a willow tree in a small mere on the Merton Estate in mid-March. They were recognized as being Whoopers by H. Wormald. One left early in April, and the remaining bird, which had an injured foot though with unimpaired flight, remained until the end of May. It was seen twice by S. H. L., and on May 17th the nest was examined by B. B. R. and found to be empty. Early in June A. W. Boyd saw a Whooper on a neighbouring mere, probably the same bird.

GARGANEY (*Querquedula querquedula*).—1928 was an exceptional year for this species in Norfolk. About eight pairs bred in the Hickling-Horsey district, four to five pairs at Ranworth and one pair, for the first time, on the Cley marshes.

WHITE-EYED POCHARD (*Nyroca nyroca*).—A female was killed in a duck shoot at Hickling, November 24th, 1927 ("British Birds," Vol. XXI., p. 249).

PAGET'S POCHARD.—A male was shot at Hickling, November 3rd, 1928. This is the sixth or seventh that has been recorded for the county, and all have been males ("British Birds," Vol. XXII., p. 250).

SURF-SCOTER (*Edemia perspicillata*).—A flock of seven were seen off Scolt Head Island by Miss E. L. Turner, October 2nd, 1925 ("British Birds," Vol. XIX., p. 243). First record for Norfolk. Three drakes were seen off Hemsby by Miss J. Ferrier, November 16th, 1927 ("British Birds," Vol. XXI., p. 249).

LITTLE BITTERN (*Ixobrychus minutus*).—On May 10th, 1928, Major S. W. Trafford had a close view of one, three times, on his marshes at Wroxham.

BITTERN (*Botaurus stellaris*).—Is now well established and gradually extending its range. In 1928 one was heard, for the first time, booming in the Yare valley.

WHITE STORK (*Ciconia ciconia*).—One appeared on Breydon June 14th, 1927, but left the same night.

BLACK STORK (*Ciconia nigra*).—One flying over Scolt Head and identified by S. H. L. and others, June 9th, 1924 ("British Birds," Vol. XVIII., p. 287).

GLOSSY IBIS (*Plegadis falcinellus*).—A small flock visited Norfolk in September, 1926; one shot at Holme, September 11th and one seen at Hickling, September 14th and 16th; one seen on Breydon September 16th and one shot October 7th. Both those killed were immature birds ("British Birds," Vol. XX., p. 264).

DEMOISELLE CRANE (*Anthropoides virgo*).—One, possibly an escape, but full-winged and wild, seen by B. B. R. to fly in from the sea and alight on Wiveton Marsh, where it remained all day on June 17th, 1924. It departed mid-day next day and was not seen again ("British Birds," Vol. XVIII., p. 292).

RED-NECKED PHALAROPE (*Phalaropus lobatus*).—On June 5th, 1927, a female in full nuptial plumage arrived on the Salthouse side of the East Bank, Cley. The bird was very tame and was seen by S. H. L. and several others. On the night of the 6th it was joined by a male, and both birds moved on the next day.

SIBERIAN PECTORAL SANDPIPER (*Tringa acuminata*).—The following two Norfolk-killed Pectoral Sandpipers, both formerly recorded as of the American form (*T. maculata*), have been recently examined by B. B. R. and found to be of the Siberian species. The one, now in the Norwich Museum and formerly in Stevenson's collection, was killed at Caistor, September 16th, 1865 ("Birds of Norfolk," Vol. II., p. 368), a note regarding which appeared in "British Birds," Vol. XXII., p. 328; the other, now in the King's Lynn Museum, was killed on Terrington Marsh on January 9th, 1868 ("Birds of Norfolk," Vol. II., p. 368). Both these specimens

have been shown to Mr. H. F. Witherby, who agrees with the identification in each case. These bring the number of this species that has been recorded for the British Isles to four, all of which have been obtained in Norfolk.

RUFF (*Machetus pugnax*).—Visits the Broads district regularly on migration ; occasionally seen at Cley.

KENTISH PLOVER (*Ægialitis alexandrina*).—One was shot at Blakeney on December 30th, 1927, and picked out from a number of other small waders in the bag by Mr. Edward Ramm ("British Birds," Vol. XXI., p. 263).

ROSEATE TERN (*Sterna dougalli*).—In 1924 one pair bred on Scolt Head Island. In 1925 one pair again nested on Scolt Head and two pairs on Blakeney Point. In 1926 there was one nest on Blakeney Point ; in 1927 two nests ; in 1928 one nest.

GULL-BILLED TERN (*Sterna anglica*).—On May 17th, 1925. S. H. L. watched one feeding from the surface of Langmere, and four were independently identified by A. H. Patterson on Breydon Water the same day ("British Birds," Vol. XIX., p. 245).

SANDWICH TERN (*Sterna sandvicensis*).—There are now three established colonies : at Salthouse Broad, Blakeney Point and Scolt Head Island. The largest number bred at Salthouse in 1924, at Scolt Head in 1925 and 1926 and at Blakeney Point in 1927 and 1928. In 1928 a conservative estimate put the number breeding at Blakeney at 1,000 pairs.

ROCK-DOVE (*Columba livia*).—One, the first specimen correctly identified in Norfolk was picked up dead, with a wound in the breast, at Ludham, December 9th, 1925 ("British Birds," Vol. XIX., p. 243).

XIII.

FLORA AND FAUNA OF NORFOLK

ADDITIONS TO PART IV.—FISHES (NINTH LIST)

BY ARTHUR H. PATTERSON

SINCE the publication of my last list in these Transactions (Vol. XI., p. 592) I have not had any new species to add to the Norfolk list.

CUCKOO WRASSE (*Labrus mixtus*).—Two examples from the Suffolk Coast came into my hands in January, 1925. It has not previously been reported from Suffolk. Lowe refers to it as the Green Wrasse.

SCAD OR HORSE-MACKEREL (*Caranx trachurus*).—A large example, which had been taken alive from a pool on Breydon, was brought to me on September 6th, 1929.

BONITO (*Auxis Rocheii*).—An example, 16 inches in length and weighing 4 pounds, was landed at Lowestoft in October, 1927.

RAY'S SEA-BREAM (*Brama raii*).—During the winter of 1927-28 several were recorded as visitors to our east coast. One, weighing 5 pounds 14 ounces and measuring $23\frac{1}{2}$ inches in length, was stranded in Wells harbour, November 12th, 1927.

POLLACK (*Gadus pollachius*).—During the summer of 1928 several young pollacks were drawn up from the river into the intake pipe of the Yarmouth Electric Works. They had assumed the normal colour of the adult fish.

BRILL (*Rhombus lævis*).—I have come across two examples of this fish having four black spots running parallel to the base of the surrounding fins.

TURBOT (*Rhombus maximus*).—In June, 1928, a turbot was observed swimming in the river Bure, and was captured. It weighed about 9 pounds.

FLOUNDER (*Pleuronectes flexus*).—Several examples of this fish have been taken as high up-river as Horning, Potter Heigham, and Barton Broad.

SUN-FISH (*Orthogoriscus mola*).—One was landed at Yarmouth by a herring drifter in November, 1925; and another, 4 feet 2 inches in length, was washed ashore at Blakeney, December 31st, 1928.

SALMON (*Salmo salar*).—The remains of a male salmon weighing 9 pounds was picked up on the banks of the Yare, near Hardley Cross, in October, 1925. A large piece had been eaten out of the back, probably by an otter.

PORBEAGLE SHARK (*Lamna cornubica*).—An example, $8\frac{1}{2}$ feet in length, was brought in in October, 1925. This fish is commonly landed by the herring drifters.

BLUE SHARK (*Carcharias glaucus*).—One was stranded on the coast a mile north of Caister, October 9th, 1928.

XIV.

MISCELLANEOUS NOTES AND OBSERVATIONS

SOME NEW PLANT RECORDS FROM NORTH AND WEST NORFOLK

Cardamine flexuosa With.—N. Wootton.

Nasturtium officinale R.B. var. *siifolium* (Reichb).—Cley.

Alyssum incanum Linn.—Whittington, by the roadside.

Hypericum dubium Leers.—N. Wootton, Congham, Bawsey.

Trifolium hybridum Linn.—N. Wootton, Leziate, Saxlingham, Holt.

Petasites fragrans Presl.—Well established in a wood near Weybourne ; also occurs at Holt.

Crepis taraxacifolia Thuill.—Weybourne.

Monotropa Hypopitys Linn.—Holt ; abundant in a large conifer plantation.

Myosotis sylvatica Hoffm.—Holt.

Lamium maculatum Linn.—Kelling, as an escape.

Tragopogon porrifolium Linn.—Weybourne.

Potentilla procumbens Sibth.—S. Wootton.

Salix purpurea Linn.—Hillington.

S. triandra Linn.—N. Wootton, Hillington, Castle Rising.

(Neither of these willows is recorded from division (4) in the Flora).

Aceras anthropophora Br.—Holt district.

Goodyera repens Br.—Holt ; abundant.

Carex curta Good.—Setch.

var. *tenuis* Lang.—N. Wootton ; this was sent to Mr. A. Bennett for identification and constitutes a new record for the county. There is one other station in England.

C. axillaris Good.—N. Wootton.

C. divisa Huds.—N. Wootton.

Apera interrupta Beauv.—N. Wootton.

Pilularia globulifera Linn.—E. Winch, Roydon ; abundant in the dry summer of 1929.—C. P. PETCH.

SUMMER ARRIVAL OF THE GREEN SANDPIPER.—Captain L. W. Lloyd has the following records of the dates of arrival of the Green Sandpiper (*Totanus ochropus*) at Taverham Mill, on the river Wensum, about five miles above Norwich.

1923, July 10th ; 1924, August 30th ; 1925, August 6th ; 1926, July 3rd ; 1927, July 17th ; 1928, July 10th ; 1929, July 18th.

Mr. H. E. S. Upcher has sent a specimen of *Amsinckia Lycopsoides* from Sheringham, which has been placed for reference in the herbarium of the University of Leeds. Writing under date of July 8th, 1928, he says :—“ I enclose a flower for you to chronicle as growing in Norfolk. There are quite a lot of them round one of my manure heaps. I had never seen a yellow Borage so sent it to Kew. They say it is *Amsinckia lycopsoides* (a native of California). I had some barley meal made of foreign barley and fed it to my pigs. Is this the way it got here ? ”

Thirteen seeds from the specimen were sown in pots to test their vitality ; ten germinated, and the seedlings are now in the open garden in Horsforth, looking a healthy colour in early December. It seems advisable to note the occurrence of these aliens as some will become established, and their early history is difficult to trace. *Amsinckia* is a North American annual with yellow flowers and hairy leaves belonging to the Borage family. It has been seen in Yorkshire and Lancashire since 1913 and probably earlier.—W. H. BURRELL.

XV.

WALTER RYE

1843—1929

By the death of Walter Rye, which took place in Norwich on February 24th, 1929, in his 86th year, the Norfolk and Norwich Naturalists' Society has lost a distinguished member, who joined the Society in 1901.

He was born in London in 1843, and was the seventh child of Edward Rye, a London solicitor. At the early age of fourteen he entered his father's office at 16, Golden Square, Westminster, where he served his articles, and became qualified as a solicitor in 1866. He retired in 1900, leaving the business in the hands of his two sons. From that date to his death he resided in Norfolk. He was buried at Lammas, in which village he lived for many years after his retirement.

In trying to describe Walter Rye we think we cannot do better than quote from an appreciation of him, written in 1919, by his friend the late W. G. Clarke, to whose pen the Transactions of this Society are indebted for many valuable papers.

"It is possible to deal with Mr. Walter Rye's athletic prowess by tabulating records, dates, and times; with his amazing industry as an antiquary and genealogist by a recapitulation of the titles of his books, and of the number of entries in his marvellous indices; and of his public work as Mayor of Norwich, and on the Museum and Public Library Committees by a summary of his activities. But all this would not picture him as a man, would not disclose his amazing vitality, grim humour, capacity for hatred and friendship, his absolute lack of snobbery, and his virile personality. When the announcement was made of his acceptance of the Mayoralty of Norwich one of his friends wrote 'that Mr. Rye's qualities are not altogether of the kind usually associated with Mayoralty.' He continued:—'Mr. Rye is a brilliant and scholarly controversialist, a born fighter, full of unconventional surprises; whose genial presence is a very personification of the robust zest of life; a hater of shams and pretentiousness, with always something of the Homeric about whatever he says or does.'

This 'robust zest of life' was, perhaps, his chief characteristic. This was partly owing to his great physical strength, which he attributed to inherited vitality as the average age of the last ten of his progenitors was seventy-six. When a boy in his father's solicitor's office in London he used to walk home the three and a third miles to Chelsea in half-an-hour, and his favourite Sunday evening walk was one of twenty-four miles. As a lad he walked thirty-seven miles into Surrey on a bitterly cold day, with six cold mutton sandwiches and a bottle of lemonade as his only refreshment. His longest walk in one day was eighty-six miles, and one Boxing Day he walked from Norwich to Swaffham and back. Almost every nook of the Norfolk Broads was known to him years before they became a popular playground.

His amazing energy found outlets in various directions. He started antiquarian work at seventeen, and continued it all his life. His output was enormous; no other man has ever written, or is likely to write, so much about Norfolk, and, like Bernard Shaw, his "prefaces" were often more piquant than his books. There was little of the wild life of the countryside about which he did not know something. In his youth he collected beetles, butterflies and mollusca. His brother, E. C. Rye, was the author of "British Beetles, an introduction to the Study of our Indigenous Coleoptera," published in 1886, and still a useful text book. Walter did not follow his brother's pursuit, but he had a good knowledge of entomology, and the report—unfounded as it proved—a few years ago, that the Large Copper had been seen near Horning aroused all his youthful enthusiasm. In his later years he made pilgrimages to Foxley Wood to see the Purple Emperor, and stayed out night after night with the late R. J. W. Purdy to see the luminous owl. Birds he knew and loved. His greatest ornithological treat he considered the presence of a hoopoe on his pasture at Lammas twice in 1907. Although he spent months on the Broads at all seasons of the year he had only twice seen a live otter, once on Wroxham Broad on a Christmas Day, when he saw two, and once on Beverley Brook. He was a capable gardener, with a wide knowledge of wild flowers, some of the rarer species of which he carefully tended in his gardens at St. Leonard's House and

Surrey Street, Norwich, and in his charming country residence at Lammas.

Rectory Cottage, Lammas, is probably the spot with which most of the friends he made after his retirement from the profession of a solicitor in London, will associate Walter Rye in memory. Here, almost every week-end he was the host for men of diverse temperaments and of different walks in life—teachers, tailors, auctioneers, farmers, librarians, journalists, and the like. He had transformed the Rectory Cottage and the village schoolroom into a commodious dwelling. The long schoolroom was the dining room, and with the partially-stained windows, peat fire, and furnishings which evidenced the taste of a cultured antiquary; a host who was a brilliant raconteur, with a keen sense of humour, a strong character, and an unequivocal method of expression, there is little wonder that the after-dinner talk often continued until the small hours. In matters of food Mr. Rye had epicurean tastes, sometimes verging on the bizarre. He believed that almost every animal, bird, fish or plant was edible, if sufficient imagination and industry were brought to bear on its cooking. With the help of an able coadjutor he was almost invariably successful in proving his thesis. Many a bird of the heath, the marsh, and the mudflats, usually considered uneatable, was made a delicacy. In his earlier days he once ate a whole emu's egg, given to him by Mr. Peek, of Peek, Frean & Co.

His epicurean tastes did not include clothes, or rather he believed that they should be included with old wine, old friends, and old books, as better than new. This disregard of the conveniences respecting dress is said to have been the reason that the Mayor of Norwich was Walter Rye when King Edward came to the city, and Walter Rye when he left. If there was any man to whom this was a matter of indifference it was probably the Mayor. I saw him put on the Mayoral robes on November 9th, 1908, and it was a very unhappy man who tried to squeeze his bulk into the robes removed by his predecessor. Civic life had no attractions for him, and during the first week-end of his Mayoralty which I spent with him at Lammas, he told me that but for the respite afforded by his country residence he would never have accepted the

honour. Yet no man worked harder to fulfil the duties of the office during his year of Mayoralty.

In politics he was a Tory, in religion a Churchman, but was of too independent a type of mind to be bound by the shibboleths of one creed or the other. What he considered strict Toryism would often have met with the approval of the most advanced Socialist. He objected to temperance reform, but would cheerfully have hanged all brewers. With many parts of England he had a most intimate acquaintance, particularly the Norfolk Broads and coast, and North Hampshire, but I believe the only time he was on the Continent was on a professional visit to Paris. On that occasion he went by train from London to Newcastle, thence straight to Paris, where he only stayed an hour or two, in which he secured the desired documents, returned to Newcastle and back to London, without any rest except such as he got in the trains. To all general workers on archæological and genealogical subjects he was a generous friend, giving freely of his vast stores of knowledge and of the benefit of his wonderful indices, but his language regarding the many rich people who wrote to him asking for full particulars of their family tree to be furnished gratis, was vigorous to the extreme. He was a nervous lecturer, even with the aid of lantern slides, but a good after-dinner speaker, in proof of which may be cited his speech at the annual dinner of the Scots Society at St. Andrew of Norwich in 1907.

His Christmas greeting for 1913 was characteristic of the man :—

To those he Liketh—The Inditer
A Merry Christmas sends.
A New Year happier and brighter
Than that which Wednesday ends.
To those he Hates—much Zoedone
And Scraggy Spinsters' kisses,
And Indigestion, weird and wild
(a Thing in which no Bliss is),
And after dinner (Slow and Cold)
Some good old Weary Bore
To drone Stale Stories in his ear
He oft hath heard Before.

Mr. Rye claimed to be the originator of the expressions, "Common or Garden" and "Obstacle race," as he indubitably was the "Father of paper-chasing," which he introduced as an open sport in 1867.

Walter Rye was a fine type of Englishman, with varied tastes, a remarkable combination of athlete, naturalist and antiquary."

CANON JOHN ALFRED LAURENCE

1836—1929

WITH the death of Canon Laurence, which took place on August 12th, 1929, in his ninety-fourth year, at Dilham Vicarage, Norfolk, our Society has lost one of its three remaining original members.

Born in 1836 John Alfred Laurence, after taking his degree at Cambridge as a *Junior Optime* in 1859, was ordained in 1860, and appointed to his first and only curacy, at Bergh Apton, Norfolk, which he held for twelve years, and was then appointed in 1872, vicar of Dilham and Honing, which incumbency he held up to the time of his death. In 1922, when he had completed fifty years at Dilham, an honorary canonry of Norwich cathedral was conferred upon him for his "unassuming, genuine and diligent work in a somewhat isolated spot."

To within a year or so of his death he was a fairly regular attendant at our monthly meetings, though he never contributed anything to our Transactions. Canon Laurence was never married. He was buried in Dilham churchyard.

GEOFFREY FOWELL BUXTON, C.B., F.Z.S.

1852—1929

It is with deep regret that we have to record the death of Geoffrey Fowell Buxton, which occurred at his residence, Hoveton Hall, Norfolk, on April 11th, 1929. Although not an original member, he joined the Society in 1874 and at the time of his death was the fourth oldest surviving member.

Born at Leytonstone in 1852 Geoffrey F. Buxton was the grandson of Sir Thomas Fowell Buxton, the first baronet, and second son of Thomas Fowell Buxton. He was educated at Uppingham and at Trinity College, Cambridge, where he took his degree in 1874. Soon afterwards he joined the old



GEOFFREY FOWELL BUXTON

1852—1929



Gurneys Bank in Norwich, and after the absorption of this bank by Barclays he became a director of the latter, which position he held up to the time of his death.

Always a public-spirited man he served as Sheriff of Norwich in 1890-1, and as Mayor in 1903-4. For many years he served with the 1st Volunteer Battalion of the Norfolk Regiment, from which he retired with the honorary rank of lieutenant-colonel. When the Norfolk Imperial Yeomanry were started he was made second in command. In all forms of sport he took great interest, and for many years was master of the Dunstan harriers. He was ever ready to assist in the work of this Society and our library is indebted to him for the gift of many volumes. He showed his interest in the formation of the Norfolk Naturalists Trust by becoming one of its first life-members. Quiet and unassuming of manner he was a splendid example of the English country gentleman and will be missed by a very large circle of friends.

He married in 1878 Mary, the eldest daughter of the Rev. the Hon. John Harbord, rector of Southrepps, who survives him, together with two sons and five daughters. He was buried in the churchyard of Hoveton St. Peter, Norfolk.

EDWARD GURNEY BUXTON

1865—1929

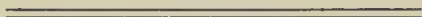
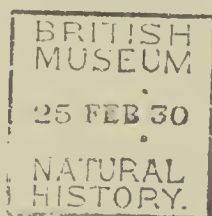
WITHIN ten days of the death of his second cousin, Geoffrey Buxton, there passed away, suddenly, at Barclays Bank, Norwich, on April 19th, 1929, Edward Gurney Buxton, of Catton Hall, Norfolk, and it is with much regret that we have to record his death in this same issue of our Transactions.

Born in 1865, Edward Gurney Buxton was the eldest son of Samuel Gurney Buxton, of Catton Hall, and a grandson of Sir Thomas Fowell Buxton, the first baronet. He was educated at Harrow and at Trinity College, Cambridge, and at the age of nineteen entered Gurney's Bank, Norwich, with which he was associated for the rest of his life, having been elected a director of Barclays Bank on the death of his father.

In 1907 he followed in the footsteps of his father by becoming Mayor of Norwich, and in the business life of the city occupied a prominent position as director of various companies. He was passionately fond of cricket and from 1890 to 1909 was honorary

secretary of the Norfolk County Club, for which he worked hard to raise it to the level of the second class counties. In 1926 he was elected president of the club. He was a good shot and a skilled fisherman, and for many years he went to Scotland for salmon fishing. He became a member of this Society in 1887, and although he never took any active part in its affairs he was interested in its work.

He married Laura, the daughter of John Gurney of Sprowston Hall, who survives him with five sons and six daughters. He was buried at Old Catton.



*Copies of the TRANSACTIONS OF THE NORFOLK AND NORWICH NATURALISTS' SOCIETY can be obtained from the Hon. Librarian, Mr. F. C. Hinde, Oaklands House, Cringleford, Norwich, at the following prices. Those marked by an * are damaged by fire.*

Vol. 1	Part 1	1869—1870	...	...	—	Out of Print.
"	" 2	1870—1871	...	...	—	Out of Print.
"	" 3	1871—1872	...	...	0 6	
"	" 4	1872—1873	...	...	1 0	
"	" 5	1873—1874	...	...	—	Out of Print.
	Supplement	...	...	...	—	
Vol. 2	Part 1	1874—1875	...	...	—	Out of Print.
"	" 2	1875—1876	...	...	—	Out of Print.
"	" 3	1876—1877	...	...	—	Out of Print.
"	" 4	1877—1878	...	...	—	Out of Print.
"	" 5	1878—1879	...	...	—	Out of Print.
Vol. 3	Part 1	1879—1880	...	...	—	Out of Print.
"	" 2	1880—1881	...	...	—	Out of Print.
"	" 3	*1881—1882	...	...	0 6	
"	" 4	1882—1883	...	...	1 0	
"	" 5	*1883—1884	...	...	1 0	
Vol. 4	Part 1	1884—1885	...	...	—	Out of Print.
"	" 2	*1885—1886	...	...	1 0	
"	" 3	1886—1887	...	...	—	Out of Print.
"	" 4	*1887—1888	...	...	1 0	
"	" 5	1888—1889	...	...	—	Out of Print.
Vol. 5	Part 1	1889—1890	...	...	—	Out of Print.
"	" 2	*1890—1891	...	...	1 0	
"	" 3	1891—1892	...	...	—	Out of Print.
"	" 4	*1892—1893	...	...	1 0	
"	" 5	*1893—1894	...	...	1 0	
Vol. 6	Part 1	1894—1895	...	...	—	Out of Print.
"	" 2	1895—1896	...	...	2 0	
"	" 3	1896—1897	...	...	2 0	
"	" 4	1897—1898	...	...	—	Out of Print.
"	" 5	1898—1899	...	...	3 6	
Vol. 7	Part 1	1899—1900	...	...	2 0	
"	" 2	1900—1901	...	...	3 6	
"	" 3	1901—1902	...	...	3 6	
"	" 4	1902—1903	...	...	3 6	
"	" 5	1903—1904	...	...	3 6	
Vol. 8	Part 1	1904—1905	...	...	—	Out of Print.
"	" 2	1905—1906	...	...	—	Out of Print.
"	" 3	1906—1907	...	...	—	Out of Print.
"	" 4	1907—1908	...	...	—	Out of Print.
"	" 5	1908—1909	...	...	5 0	
Vol. 9	Part 1	1909—1910	...	...	6 0	
"	" 2	1910—1911	...	...	6 0	
"	" 3	1911—1912	...	...	6 0	
"	" 4	1912—1913	...	...	6 0	
"	" 5	1913—1914	...	...	6 0	
Vol. 10	Part 1	1914—1915	...	...	7 6	
"	" 2	1915—1916	...	...	7 6	
	Supplement	...	...	...	—	
"	Part 3	1916—1917	...	...	7 6	
"	" 4	1917—1918	...	...	7 6	
"	" 5	1918—1919	...	...	7 6	
Vol. 11	Part 1	1919—1920	...	...	7 6	
"	" 2	1920—1921	...	...	10 0	
"	" 3	1921—1922	...	...	10 0	
"	" 4	1922—1923	...	...	10 0	
"	" 5	1923—1924	...	...	10 0	
Vol. 12	Part 1	1924—1925	...	...	10 0	
"	" 2	1925—1926	...	...	10 0	
"	" 3	1926—1927	...	...	10 0	
"	" 4	1927—1928	...	...	10 0	
"	" 5	1928—1929	...	...	10 0	

MEMBERSHIP

The Society consists of two classes of Members, viz., Ordinary and Honorary Members.

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.

CONTENTS

	<i>Page</i>
List of Officers	V
List of Members	VI
Statement of Accounts	XV
I. President's Address	
A Guide to some Ornithological Work. By H. F. Witherby, M.B.E., F.Z.S., M.B.O.U....	527
II. The Fresh-Water Crustacea of Norfolk. By Robert Gurney, D.Sc.	550
III. The Swan-Marks of West Norfolk. By N. F. Ticehurst, O.B.E., M.A., F.R.C.S.	581
IV. Report on the Blakeney Point Research Station, 1927-29. By F. W. Oliver, D.Sc., F.R.S.	630
V. Oology as an aid to Science. By E. C. Stuart Baker, O.B.E., F.Z.S., F.L.S., M.B.O.U. ...	654
VI. Geographical work on Scolt Head Island and adjacent Areas. By J. A. Steers, M.A. ...	664
VII. Museum Boulterianum. By C. D. Sherborn ...	667
VIII. The Great Yarmouth Autumn Herring Fishery. By the Editor	669
IX. Afforestation in Breckland. By Brigadier- General H. G. Joly de Lotbiniere, D.S.O. ...	673
X. Wild Bird Protection in Norfolk in 1929. Report of the Committee	677
XI. Meteorological Notes, 1928. By A. W. Preston, F.R.Met.Soc.	694
XII. Fauna and Flora of Norfolk—Birds. By S. H. Long, M.D., and B. B. Riviere, F.R.C.S. ...	713
XIII. Fauna and Flora of Norfolk—Fishes. By A. H. Patterson	719
XIV. Miscellaneous Notes and Observations ...	720
XV. Obituary Notices	722