

TRANSACTIONS

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NATURALISTS' SOCIETY;

Presented to the Members for

1882-83.

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1883.

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To Balance from last year 52 2 4		39 7 6
„ Subscriptions:—			
5 for 1881—82 1 5 0	By Fletcher and Son for Printing Transactions, 1881—82 3 13 6
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 491 1 3	„ Balance in hand 491 1 3

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*List of the publications received by the Society as Donations
or Exchanges from March, 1882, to March, 1883.*



AGASSIZ (LOUIS, Prof. of Zoology and Geology).

The Structure of Animal Life. Six Lectures delivered at the
Brooklyn Academy of Music in January and February,
1862. 8vo. Lond. 1866

From Mr. John Henry Gurney, jun., F.Z.S.

BAKER (T.B.L.).

An Ornithological Index, arranged according to the Synopsis
Avium of Mr. Vigors. 8vo. Lond. 1835

From Mr. John Henry Gurney, jun., F.Z.S.

BINGLEY (REV. W., A.M., F.L.S.).

Animal Biography, or Popular Zoology; illustrated by
Authentic Anecdotes of the Economy, Habits of Life,
Instincts, and Sagacity of the Animal Creation. Fifth
Edition. 4 Vols. 12mo. Lond. 1820

From Mr. John Henry Gurney, jun., F.Z.S.

BIRDS.

Report [of the Committee appointed by the British Association]
on the Migration of Birds in the Spring and Autumn of
1881. By Mr. John A. Harvie Brown, Mr. John Cordeaux,
Mr. Philip M. C. Kermode, Mr. R. M. Barrington, and
Mr. A. G. More. Third Report, 1881. 8vo. pp. 101.

Lond. 1882

From Mr. John Cordeaux.

BREE (C.R., M.D., F.Z.S.).

An Exposition of Fallacies in the Hypothesis of Mr. Darwin.
8vo. Lond. 1872

From Mr. John Henry Gurney, jun., F.Z.S.

BRIDGMAN (JOHN B., F.L.S.).

Further additions to Mr. Marshall's Catalogue of British
Ichneumonidae. [From the Transactions of the Entomo-
logical Society, 1882. pp. 141—164.] 8vo.

From the Author.

BROWN (J. A. HARVIE, F.Z.S.).

The History of the Squirrel in Great Britain. [From Proceedings of the Royal Phys. Soc. Edinb. Vols. v. and vi.] 8vo. *Edinb.* 1881

From Mr. John Henry Gurney, jun., F.Z.S.

CHENU (DR.).

Encyclopédie d'Histoire Naturelle. Oiseaux, avec la collaboration de M. Des Murs. 6 Vols. 4to. *Paris, n.d.*

From Mr. John Henry Gurney, jun., F.Z.S.

CLARKE (WILLIAM EAGLE).

Bird-Life at the Farne Islands. [Reprinted from the 'Naturalist,' Jan., 1881.] pp. 7. 8vo.

From the Author.

CROWE (HENRY, M.A., Vicar of Buckingham).

Zoophilos; or, Considerations on the Moral Treatment of Inferior Animals. Second Edition, enlarged. 12mo. *Lond.* 1820

From Mr. John Henry Gurney, jun., F.Z.S.

DEBY (JULIEN) and KITTON (F.).

A Bibliography of the Microscope and Micrographic Studies. Being a Catalogue of Books and Papers in the Library of Julien Deby, Fellow of the Royal Microscopical Society, &c. Part 3. The Diatomacea, compiled with the co-operation of Frederick Kitton, Hon. F.R.M.S. Roy. 8vo. *Lond.* 1882

From the Compilers.

ENGLISH (JAMES LAKE).

A Manual for the Preservation of the Larger Fungi (Hymenomyces) in their Natural Condition, by a New and Approved Method; also a New Process for the Preservation of Wild Flowers. 12mo. *Epping,* 1882

From Mr. T. J. Mann.

GLOYNE (C. P.).

Remarks on the Geographical Distribution of the Terrestrial Mollusca. [Extracted from the Quarterly Journal of Conchology.] 8vo. *Leeds,* 1878

From Mr. W. D. Hoebuck.

GOULD (JOHN, F.R.S.).

An Introduction to the Trochilidae, or Family of Humming-Birds. 8vo. *Lond.* 1861

From Mr. John Henry Gurney, jun., F.Z.S.

GRAHAME (JAMES).

The Birds of Scotland, with other Poems. 12mo. *Edinb.* 1806
From Mr. John Henry Gurney, jun., F.Z.S.

HUDLESTON (W. H., M.A., F.G.S., F.C.S.).

On Deep-Sea Investigation: being the Presidential Address delivered at the Opening of the Session 1881—82. [Re-printed from the Proceedings of the Geologists' Association. Vol. vii. no. 4.] 8vo. pp. 36.
From Mr. H. B. Woodward, F.G.S.

MCCLELLAND (JOHN, Assist.-Surgeon).

Some Inquiries in the Province of Kemaon, relative to Geology and other branches of Natural Science. 8vo. *Calcutta*, 1835
From Mr. John Henry Gurney, jun., F.Z.S.

MERRIFIELD (MRS.).

A Sketch of the Natural History of Brighton and its Vicinity. Edited by Mrs. Merrifield. 8vo. *Brighton*, 1864
From Mr. John Henry Gurney, Jun., F.Z.S.

MOXON (JAMES H. H., LL.D.).

The Birds of the Fens. 8vo. *Camb.* 1882
From Mr. Henry Stevenson, F.L.S.

NEWTON (E. T., F.G.S.).

Notes on the Vertebrata of the Pre-Glacial Forest Bed Series of the East of England. Parts vi. and vii. [Extracted from the 'Geological Magazine,' Decade ii. Vol. ix. Jan. and March, 1882.] 8vo. pp. 3 and 3.

On the Occurrence of *Spermophilus* beneath the Glacial Till of Norfolk. [Extracted from the 'Geological Magazine,' Decade ii. Vol. ix. February, 1882.] 8vo. pp. 4.
From the Author.

NORTH (THE HON. ROGER).

A Treatise on Fish and Fish-Ponds. Illustrated with Eighteen Beautifully-coloured Specimens, by Ebenezer Albin. Imp. 4to. *Lond. n.d.*
From Mr. John Henry Gurney, jun., F.Z.S.

PLOWRIGHT (CHARLES B.).

On Wheat Mildew (*Puccinia graminis*, Pers.) and its connection with the Barberry *Æcidium* (*Æ. berberidis*, Gmel.). Reprinted from the 'Gardeners' Chronicle.' Roy. 8vo. pp. 16. *Lond. 1882*
From the Author.

RAMSAY (ALEXANDER, F.G.S.).

The Scientific Roll and Magazine of Systematized Notes.
Conducted by Alexander Ramsay, F.G.S. Vol. i. nos.
7 and 8. Climate. 8vo. Lond. 1882

From Mr. Alexander Ramsay, F.G.S.

RAY (JOHN, F.R.S.).

The Wisdom of God Manifested in the Works of the Creation.
Twelfth Edition, corrected. 8vo. Lond. 1759

From Mr. John Henry Gurney, jun., F.Z.S.

ROWBOTHAM (FRANK J.).

Natural History Notes. Edited by Frank J. Rowbotham.
Second Series. Vols. i. and ii. 8vo. Lond. 1881—82

From Mr. H. E. Woodward, F.G.S.

TAYLOR (JOHN W.).

Life Histories of British Helices. No. 1. Helix arbustorum.
[Reprinted from the Journal of Conchology, Vol. iii. no. 8,
1882.] 8vo. Leeds, 1882

From Mr. W. D. Robuck.

WILSON (ALEXANDER) and BONAPARTE (CHARLES LUCIAN).

American Ornithology; or the Natural History of the Birds of
the United States. Edited by Robert Jameson, Esq.,
F.R.S.E., &c. 4 Vols. 18mo. Edinb. 1831

From Mr. John Henry Gurney, jun., F.Z.S.

BATH.

Proceedings of the Bath Natural History and Antiquarian Field
Club. Vol. iii. no. 3, Vol. iv. no. 4, Vol. v. no. 1. 8vo.

Bath, 1876—82

From the Bath Field Club.

BELFAST.

Annual Reports and Proceedings of the Belfast Naturalists'
Field Club, for the years ending 31st March, 1880 and 1881.

Series ii. Vol. i. part 7, and Vol. ii. part 1. 8vo.

Belfast, 1881—82

From the Belfast Naturalists' Field Club.

BELGIUM.

Annales de la Société Malacologique de Belgique. Tomes
13, 14, 16. 8vo. Bruxelles, 1878—82

From la Société Malacologique de Belgique.

BELGIUM.

- Annales de la Société Belge de Microscopie. Tome vi. Année
1880. 8vo. *Bruxelles, 1882*
From la Société Belge de Microscopie.

BRISTOL.

- Proceedings of the Bristol Naturalists' Society. New Series.
Vol. iii. part 3. 8vo. *Bristol, 1882*
From the Bristol Naturalists' Society.

CARDIFF.

- Cardiff Naturalists' Society. Report and Transactions. Vol. xiii.
1881. 8vo. *Lond. 1882*
From the Cardiff Naturalists' Society.

DRESDEN.

- Description du Cabinet Roial de Dresde touchant l'Histoire
Naturelle. [In French and German.] 4to.
Dresde et Leipsic, 1755
From Mr. John Henry Gurney, jun., F.Z.S.

EASTBOURNE.

- Transactions of the Eastbourne Natural History Society. New
Series. Vol. i. part 2. 8vo. *Eastbourne, 1882*
From the Eastbourne Natural History Society.

ESSEX.

- Transactions of the Epping Forest and County of Essex
Naturalists' Field Club. Vol. ii. part 6. 8vo.
Buckhurst Hill, 1882
From the Essex Naturalists' Field Club.

FRANCE.

- Feuille des Jeunes Naturalistes. No. 133—147. Nov. 1881—
Jan. 1883. Roy. 8vo. *Paris, 1881—83*
From la Feuille des Jeunes Naturalistes.

HERTFORDSHIRE.

- Transactions of the Hertfordshire Natural History Society and
Field Club. Vol. i. parts 8 and 9. 8vo. *Lond. 1882*
From the Hertfordshire Natural History Society.

LIVERPOOL.

- Proceedings of the Liverpool Naturalists' Field Club for the
year 1881—82. 8vo. *Liverpool, 1882*
From the Liverpool Naturalists' Field Club.

LONDON.

Journal of the Royal Microscopical Society. Series ii. Vol. ii.
parts 2—6. 8vo. *Lond. 1882—83*

From the Royal Microscopical Society.

Proceedings of the Royal Geographical Society and Monthly
Record of Geography. New Monthly Series. Vol. iv.
nos. 4—12, and Vol. v. no. 1. 8vo. *Lond. 1882—83*

Royal Geographical Society. Supplementary Papers, published
under the Authority of the Council and Edited by the
Assistant-Secretary. Vol. i. part I, containing Travels and
Researches in Western China; by E. Colborne Baber.
Roy. 8vo. *Lond. 1882*

From Mr. H. G. Barclay, F.R.G.S.

Proceedings of the Royal Institution of Great Britain. Vol. ix.
parts 4 and 5. July 1881 and July 1882. 8vo.

From the Royal Institution.

Proceedings of the Linnean Society of London, 1866. Contain-
ing the Address of the President, George Bentham; and
Obituary Notices by the Secretary, George Busk, including
notices of Sir W. J. Hooker, John Lindley, and S. P.
Woodward. 8vo. *1866*

From Mr. H. B. Woodward, F.G.S.

The Gardens and Menagerie of the Zoological Society Delineated.
2 Vols. 8vo. *Lond. 1835*

The Zoological Gardens, Regent's Park. A Hand-Book for
Visitors. 12mo. *Lond. n.d.*

Guide to the Gardens of the Zoological Society of London.
Twenty-third Edition, corrected by Philip Lutley Selater,
M.A., Ph.D., &c. 12mo. *Lond. 1870*

From Mr. John Henry Gurney, jun., F.Z.S.

NEW ZEALAND.

Transactions and Proceedings of the New Zealand Institute,
1881. Edited by James Hector, C.M.G., M.D. Vol. i.
1868, Second Edition; and Vol. xiv. Roy. 8vo.

Wellington, 1875—82

From the New Zealand Institute.

NORTHAMPTON.

Journal of the Northamptonshire Natural History Society and
Field Club. Nos. 1 and 9—12. 8vo. *Northampton*, 1880—82
From the Northamptonshire Natural History Society.

NORWAY.

Om Stratifikationens Spor, af Dr. Theodor Kjerulf. 4to.
Christiania, 1877
From L'Université Royale de Norvège à Christiania.

PENZANCE.

Penzance Natural History and Antiquarian Society. Reports
and Transactions, 1880—82. 8vo. *Plymouth*, 1881—82
From Mrs. Luscombe.

PLYMOUTH.

Annual Report and Transactions of the Plymouth Institution
and Devon and Cornwall Natural History Society. Vol. viii.
part 1, 1881—82. 8vo. *Plymouth*, 1882
From the Plymouth Institution.

RUSSIA.

Bulletin de la Société Impériale des Naturalistes de Moscou.
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Moscou, 1881—82

Table Générale et Systematique des Matières contenues dans
les premiers 56 Volumes (Années 1829—1881) du Bulletin
de la Société Impériale des Naturalistes de Moscou. Dressée
par E. Ballion. 8vo. *Moscou*, 1882
From the Société Impériale des Naturalistes de Moscou.

UNITED STATES OF AMERICA.

Annual Report of the Board of Regents of the Smithsonian
Institution, showing the operations, expenditures, and
condition of the Institution for the year 1880. 8vo.
Washington, 1881

List of Foreign Correspondents of the Smithsonian Institution,
corrected to January, 1882. 8vo. pp. 165. *Washington*, 1882
From the Smithsonian Institution.

YORKSHIRE.

Transactions of the Yorkshire Naturalists' Union. Part 4. 8vo.
Lond. 1882
From the Yorkshire Naturalists' Union.

ADDRESS.

Read by the President, MR. H. D. GELDART, to the Members of the Norfolk and Norwich Naturalists' Society, at their Fourteenth Annual Meeting, held at the Norfolk and Norwich Museum, March 27th, 1883.

LADIES AND GENTLEMEN—When a boy reaches the age of fourteen, he ceases to be a child, and his parents and friends look sharply at him, to see what chance of life and work there is in him, and what he is likely to be fit for. So with our Society: it is fourteen years old to day; it has passed the risks of early childhood, and is now a youth, with a fair chance of survival to a strong and healthy manhood. When we met here for the first time fourteen years ago, some of our friends thought that our Society would soon grow faint and fail. We were but weak then; we had published nothing; now we exchange 'Transactions' with thirty other Societies. We started in life with one hundred and twelve members; we have now two hundred and thirty-seven; our funds are flourishing, our library grows apace, and almost the only regret which mixes with our good hopes of life to come is, that our kindly genial friend who first filled this chair, and "rocked the cradle" for us,* is no longer here, that he might see to-night the adolescence of the babe in whom he took such great and lively interest.

The past year has been uneventful and prosperous. We have elected eight new members, and lost five, three of them by death; and we have now a total of two hundred and thirty-seven, of whom thirteen are life, and thirteen honorary members. Those whom

* The Rev. J. Crompton.

we have lost by death are, the Rev. George Weare Braikenridge, Mr. F. J. Cresswell, and Mr. W. F. Footitt. Of the first we have received the following brief biographical notice:—

“The Rev. George Weare Braikenridge, M.A., F.L.S., and F.A.S. of Scotland, was born in Bristol on the 19th May, 1815, the elder son of one of the West India merchants of that city. He was early imbued with a strong taste for natural history, which had been his father’s chief recreation in intervals of business. Entomology and ornithology had the greater charms for him, but later on he added to these pursuits that of botany, and he was a ‘whole man’ to them all, though nothing of the Creator’s works in nature ever came amiss to him. A clergyman of the Church of England, he devoted himself for many years to his sacred profession, natural history then becoming the recreation more of his few leisure hours. Whenever there was an opportunity, he delighted to awaken or cherish in his younger friends the tastes which were so dear to himself, often with success. When ill health at last obliged him to resign his benefice of Christ Church, Clevedon, Somerset, he spent several winters in the South of France, induced by its attractive flora to resume his botanical pursuits only too eagerly. During the last four years of his life he was occupied in the attempt to form a complete list of the birds, native or visitors to Clevedon and its surroundings, but died before his pleasant task was accomplished, on the 19th February, 1882. His collection of the eggs of British birds is of some repute. Though personally a stranger to the officers and members of the Norfolk and Norwich Naturalists’ Society, he warmly sympathized with it, and esteemed it an honour to have his name on its list.”

Of Mr. F. J. Cresswell, one of our members who knew him well writes:—

“We have also to regret the death of Mr. F. J. Cresswell, which took place at Lynn on the 19th September, who, although he never directly contributed to our Society, has been the indirect means of bringing several interesting facts under our notice, the last of which was the occurrence of the Grey Seal off the Norfolk coast, a record of which will be found at p. 415 of the present volume of our

'Transactions.' Mr. Cresswell was a born Naturalist and sportsman; and although unfortunately he could never be induced to commit to paper the results of his many years' experience in sea fishing and wild-fowl shooting, he was always most ready to impart information to those who sought it. For many years, in conjunction with the late Harry Hornigold, who had long been his faithful and attached servant in all matters relating to yachting and gunning, Mr. Cresswell had very successfully pursued a very curious method of taking fowl by means of stake nets set along the shore just above high-water mark; and those who have seen the charming cage of waders in the fish-house at the Zoological Gardens, probably owe to Mr. Cresswell the opportunity of studying such birds as Knots and Dunlins in confinement, for birds taken alive in his nets were frequently sent to that institution. In Mr. Dawson Rowley's 'Ornithological Miscellany' for July, 1877 (pp. 354—373) will be found an account of Mr. Cresswell's system of netting, with some excellent illustrations. Mr. Cresswell's genial manners and kindly disposition had endeared him to all who knew him; but amongst the fishing population, whose interests and welfare had always been his peculiar care, it will be long before the genuine regret at the loss of so kind a friend, so forcibly expressed by their numerous attendance at his funeral, will pass away."

At our first meeting, in April, Mr. G. Christopher Davies exhibited a series of photographs of Decoys, which were explained by Mr. Southwell: this was only the first of a series of exhibitions of photographic views taken by Mr. Davies which he has shown this year, and to which we shall have to allude again. At the second meeting, in May, Mr. C. B. Plowright delivered a lecture on "Fermentation, Putrefaction, and Zymotic Disease," illustrated by diagrams. After pointing out the relationship which exists between these phenomena, he described particularly the researches of Koch on blood poisoning, and his discovery of the Bacillus which accompanies consumption. Mr. Plowright also described the Bacillus of anthrax and the experiments of Pasteur, by which were demonstrated the possibility of cultivating an attenuated state of the anthrax microbe, which could be used as an inoculating medium for

the protection of sheep and oxen against this virulent disease. Unfortunately this lecture was delivered without notes, and we have no means of publishing in our 'Transactions' what would have been one of the best papers of our year. Mr. Plowright delivered an address to the Norfolk Agricultural Society in February last on "Mildew in Wheat," to which the members of our Society were kindly invited: this address being given on a Saturday, many of our members interested in the subject were unable to attend.

At the September meeting Mr. Preston read "Notes of a Walking Tour in the West Riding of Yorkshire," and described the plants which he had found there; and Mr. Harmer exhibited a set of photographs of the scenery of the Riviera, and described the flowers which he had found during his residence there last spring, with the help of the illustrations to Mr. Moggridge's beautiful 'Flora of Mentone.'

At the October meeting, Mr. Southwell described the animals and birds he had met with in a visit to the valley of the Upper Engadine; and Mr. Edward Bidwell sent for exhibition a fine set of photographs of the Bass Rock, showing the breeding places of the Gannets.

In November a letter was read from Mr. Marsham, calling attention to the extraordinary rainfall of last October, as compared with that of the same month of former years. The greatest rainfall in twenty-four hours ever registered by Mr. Marsham was on the 22nd October, 1882, viz. 1.45 inch. Mr. Davies showed some photographs of the Swan-pit at the Great Hospital. Mr. Stevenson read a paper on the Dusky Shearwater; and exhibited a specimen which was picked up dead at Earsham in 1858, and which was the first specimen of this species ever found in Great Britain. Mr. Southwell exhibited and described a specimen of the Sooty Shearwater, which he obtained alive at Lynn in 1851, and which he recorded at that time as an immature specimen of the Great Shearwater: the renaming of this specimen causes an alteration in the list of Norfolk birds by the substitution of *Puffinus griseus* for *Puffinus major*. Mr. Horace Woodward read a paper on "The

Scenery of Norfolk," in which he traced the geological causes which have taken part in the formation of the present aspect of our county, and the changes of its inhabitants which have taken place since prehistoric times. Both Mr. Stevenson's and Mr. Woodward's papers will be printed in our 'Transactions.'

At the December meeting Mr. Southwell contributed two papers—one containing very valuable notes on the Seal Fishery; and the other on a Whale of the genus *Hyperoodon*, commonly known as the Bottle-nose Whale, illustrated by drawings and photographs of skulls. Both these papers Mr. Southwell kindly allows us to print. Some interesting notes were read, contributed by General Norgate, on "The Mongoose, the Indian Crow and Cuckoo." These notes contained a graphic account of a fight between a Mongoose and a Cobra, at which the General was present, and satisfied himself that the victory of the former was entirely due to his quickness in evading the Snake's attack, and, in fact, that the Cobra was killed without ever having been able to strike the Mongoose; "for the poison fangs were there plain enough, but did not appear to have been used, inasmuch as the poison glands were full." I venture to quote the General's account of the Crows' parliaments. "These Crows have meetings or assemblies every now and then. They all settle in a ring on a piece of grass, several make a peculiar kind of caw, and every Crow within earshot comes. There generally is one in the centre, who does not attempt to fly away. After a great deal of hopping about, suddenly several Crows attack the prisoner, sometimes kill him, break his wing, or otherwise most severely punish him. A native very often puts them to flight, or a dog runs in at the assembly, when they all fly away, prisoner also. I have not observed if another court is quickly assembled again. I have seen three hundred Crows attend one of these courts, which the natives call 'Punchaits,' the name of one of their courts of justice or injustice. Of course I have never been able to find out the object of these courts, or what Crow commandment has been broken; but rest assured the criminal has done something against Crow laws. Once I saw the prisoner punished with death on the spot. Once another

had his wing broken, and was allowed to go away : it frequented my garden afterwards for ten years, and was always alone. Four or more Crows come from a distance, having one in charge, who, as I have stated, does not attempt to fly away. A certain sound is made by the Crows all putting their beaks to the ground, and every Crow, whatever he may be about, seems obliged to attend the summons. Some remain a short time, and then fly away. Some remaining till the end. I have often seen nothing done at these meetings, and no prisoner at all. During this time the Crows strut and hop about in a most ludicrous manner, with the head put down in a most knowing way. Sometimes two have a small row between themselves ; but this is stopped by the others with severe jobs of their beaks. We, with our fancied superior knowledge, hesitate to admit that Crows have courts and laws, punishments, &c. The native does not mince the matter, but tells you he has seen their customs all his life, and would consider one a fool who disbelieves what he sees so often with his own eyes."

At the January meeting a letter was read from the Rev. J. A. Lawrence, describing a Meteor which he saw on January 27th. Mr. J. H. Gurney, Jun., contributed some interesting notes on the "Golden Eagle," which he has had unusual opportunities for observing in Scotland. These, with some further notes on "Grouse and Grouse Moors," will be found in our 'Transactions.' Mr. Southwell read a paper by Mr. Clement Reid, of H.M. Geological Survey, which we print by the author's kind permission, on a species of *Lithoglyphus* discovered by him in the Weybourne Crag. This is a very curious discovery, as this freshwater shell, which at the time of the deposition of the Weybourne Crag was living in England, is now, so far as Europe is concerned, found living only in the Danube, and a closely allied species is also said to occur in South America. Mr. Southwell also exhibited a skull of the Grey Seal (*Halichoerus gryphus*) killed on Breydon in December last, and described its characteristic points. Mr. Southwell will be glad if any of our members who have the chance will send him the head of any Seal occurring on the Norfolk coast.

But the most remarkable feature of this our January meeting was the exhibition, by Mr. Christopher Davies, of a large series of most excellent photographs, taken by himself, and shown by the magic lantern. These views included sixteen of Fritton Decoy, most valuable, as, with Mr. Davies' description, they enabled us to understand how a decoy is worked. There were also views on the Yare from Thorpe to Breydon; of the Bure and its tributaries, the Ant and the Thurne,—the Waveney and Oulton Broad; several of the Norfolk Broads; and finally, a series of Walberswick and the River Orwell. It is much to be hoped that Mr. Davies will favour us now and then with an exhibition of views such as these; and I would venture to suggest how very valuable such series of views of the same places, taken by an agency which "cannot lie" at intervals of many years, would be in enabling an estimate to be formed of the extent of the gradual and minute change which is always going on around us, for the most part unrecorded. I think Mr. Davies' views of our own county, and Mr. Bidwell's set of the Bass Rock shown in October, are among the most interesting incidents of our past year.

At our last monthly meeting Mr. Cross exhibited a small specimen of *Loligo* from Mundesley; and Mr. Edwards showed a method of preserving spiders in spirit, set out on card in test-tubes, which allows better examination of the specimens than the ordinary method of indiscriminate bottling. Mr. A. W. Preston read "Meteorological Notes for 1882," which we print, and hope he will continue annually, as a valuable record for reference. Mr. H. Woodward sent some additional notes on "Norfolk Spas," in continuation of his paper published in the last number of our 'Transactions.' Mr. J. H. Gurney, Jun., sent some Ornithological Notes for North Norfolk during the past mild winter, the most striking of which was the record of a great migration of Golden-crested Wrens last October. Mr. John Young contributed a capital paper, which we print, on the "Bearded Tit in confinement;" he having kept and watched this species for twelve years. In addition to the papers which have been read at our meetings, it is proposed to print this year "Fauna and Flora of Norfolk,

Part X. Marine Algæ." Although this list will certainly be more copious and complete than any hitherto published, there is no doubt that any resident on the coast who could give attention all the year round to this subject, and especially would examine microscopically the *Chlorospermeæ*, and the smaller parasitic, or epiphytal Algæ, might add considerably to it, as most of the additions made are the result of casual and desultory visits to the seaside, rather than of continuous and systematic observation.

No less than six species of plants have been added to our Norfolk Flora this year. These, together with a considerable number of varieties, will be found treated of in "Botanical Notes," by Miss Barnard, Mr. Bennett, and the Rev. E. F. Linton.

Our finances are in a sound condition, for although we have reduced our balance on the general account this year by £4 4s. 9d., this arises entirely from extra expenditure on the last number of 'Transactions' of a kind not likely to occur again; and we have besides, nearly forty pounds to the credit of our Life Membership Fund. Our Library is, thanks to the gifts of many friends, steadily increasing in number and value; and our Journal Committee hope to issue a number of our 'Transactions' quite equal to the average of those of former years both in interest and quantity.

We have had three excursions this season;—one, in June, to Hoveton, where the original locality of *Carex paradoxa*, for which it was first recorded in Norfolk, was revisited and verified; a second to Ipswich and Felixstowe, under the guidance of Dr. J. E. Taylor, the events of which have already been fully described in the 'Eastern Daily Press' of the date; and a third to Claxton and Surlingham. All of these excursions were successful and pleasant, and the cordial thanks of our Society are due to all our kind friends who helped to make them so.

I am now going to ask you to consider for a few minutes some observations which have recently been published on what is called Symbiosis (or "Life in Common") of lower animals and plants. Of course we all understand what a true Parasite is;—an organism,

whether animal or vegetable, living within or upon another organism which serves as a host, at that host's expense—appropriating to its own uses the juices of the host, to the host's detriment; and giving back nothing in return towards the host's support. Of this mode of life we have among both plants and animals many examples; notably, the Fluke in Sheep, which, favoured by the late wet seasons, has wrought so much mischief among our flocks. Among vegetables the Broomrape (*Orobanche*), whose seed, incapable of its own support, germinates on the root of its host, then flourishes and flowers at its host's expense. Again, we know what Commensals (*Messmates*) are, which, living together to their mutual advantage, draw their sustenance from a common source, probably always helping one another in some way. Of these, among animals, there are many examples;—the Pea Crab for instance, which lives in the Mussel's shell; the Mussel provides the house, and the Crab helps in the housekeeping. Among vegetables Epiphytes seem to take the place of Commensals. Orchids, for example, grow on the boughs and trunks of living trees, subsisting with them on the atmosphere and moisture around, but drawing no sustenance from the life of their apparent host, for they will grow equally well on a bit of dead wood. But in that form of Symbiosis which we are considering, the plant lives within the animal;—morphologically, apparently an entozoic parasite; physiologically, an independent being;—both contributing to each other's support, yet either capable of independent life, but “living in common” to their great mutual advantage.

During the past year two very remarkable sets of observations on this subject have been published;—one by Herr Brandt, in communications to the Physiological Society at Berlin, summarized in the ‘Transactions’ of the Royal Microscopical Society; the other by Mr. Patriek Geddes, in communications to the Royal Society of Edinburgh, inserted in ‘Nature.’ It has long been known that many of the lower animals contain granules of chlorophyll, and it has been found that this chlorophyll, tested by the spectroscope, is chemically identical with the true chlorophyll of green leaves, and several theories have been advanced to account for the presence

of these green bodies in such animals as *Hydra viridis* and *Spongilla*. One theory is, that the green bodies are true ehlorophyll granules; another, that they are not produced by the animals themselves, but are parasites; and a third, that in the Protozoa, at all events, they are merely portions of vegetable organisms which have been absorbed.

Herr Brandt set himself to demonstrate their true character; and he found that these green bodies from *Hydra* and *Spongilla*, examined microscopically with high powers, were not of a uniform colour like the ordinary ehlorophyll bodies of plants, but contained also hyaline protoplasm, and on treatment with hæmatoxylin he always found a definite cell-nucleus. These characters, he considers, prove that the green bodies are really unicellular organisms, morphologically independent; and he describes them as two new genera of Algæ—one green, *Zoöchlorella*, found in Protozoa, Sponges, Hydrozoa, and Turbellaria; the other yellow, *Zoöxanthella*, found in some Radiolaria, Hydrozoa, and Actiniæ. Not only are these organisms morphologically independent, their physiological independence can be shown also; for if individuals of *Zoöchlorella* are isolated from their host, they will live for days, or even weeks, and “when exposed to light they are able to develop starch grains.”

Brandt demonstrated the mutual relation between the animal host and the vegetable lodger thus:—He kept animals in which the Algæ were well developed in carefully filtered water, and found that though the animals thrive well whilst thus deprived of any food received in a natural manner—being nourished by the Algæ—as soon as they were placed in a darkened situation, the Algæ, unable to live without the light of the sun, died, and the animal died too, of starvation; for the filtration of the water allowed no food to reach it. This proves that the Algæ contribute to the support of their host. “So long as the animal contains but few or no green or yellow cells it is nourished like a true animal, by the absorption of solid organic materials. As soon as it contains a sufficient amount of Algæ it is nourished like a true plant, by the assimilation of inorganic materials. It ought to resume its original

mode of nourishment when the Algae withhold their functions in the absence of light. It perishes if it does not then adapt itself to the mode of alimentation which properly belongs to it."

"The animal renounces its independent life, and allows itself to be supported entirely by its parasites, when once the green or yellow Algae have entered its tissues and have multiplied there sufficiently. It absorbs no more organic substances, although it is perfectly able to do so; but is entirely comparable, from the morphological point of view, to an animal devoid of chlorophyll. Morphologically, it is the Algae which are the parasites; but physiologically, the animal."

Thus far Herr Brandt; but Mr. Geddes was simultaneously and independently studying the "yellow cells" of Radiolarians and Coelenterates, of which in Radiolarians, Professor Huxley in his 'Manual' writes thus:—"In the layer of protoplasm from which the pseudopodia proceed, cellæform bodies of a bright yellow colour, which have been found to contain starch, are usually developed;" and he found that these cells survive the Radiolarian in which they are contained, that their mode of division is thoroughly algaoid, that starch is invariably present, that the cell wall is true plant cellulose, and the yellow colouring matter is identical with that of diatoms. Thus the chemical composition, as well as the structure and the mode of division, are those of unicellular Algae; and Mr. Geddes proposes for them the generic name of *Phylzoön*, dividing the genus into slightly differing species, according to the hosts in which they are found.

As to the physiological relationship of the plants and animals thus so curiously associated, "every one knows that the colourless cells of a plant share the starch formed by the green cells, and it seems impossible to doubt that the Radiolarian, which actually encloses the vegetable cell, must similarly profit by its labours." In fact, there is a reciprocal process of nutrition going on; for whilst the animal profits by the starch formed by the plants, the latter, in their turn, profit by the carbonic acid and nitrogenous waste made by the animal; and, removing these, "perform an intracellular renal function, reaping an abundant reward, as their

rapid rate of multiplication shows." Besides this, the plants evolve nascent oxygen directly into the surrounding animal protoplasm, and thus we have "foreign chlorophyll performing the respiratory function of native hæmoglobin."

Mr. Geddes sums up these relationships in the following remarkable and most graphic sentences:—"Thus then for a vegetable cell no more ideal existence can be imagined, than that within the body of an animal cell of sufficient active vitality to manure it with carbonic acid and nitrogen waste, yet of sufficient transparency to allow of the free entrance of the necessary light. And conversely for an animal cell, there can be no more ideal existence than to contain a vegetable cell, constantly removing its waste products, supplying it with oxygen and starch, and being digestible after death. . . . In short, we have here the relation of the animal and the vegetable world reduced to the simplest and closest conceivable form."

Mr. Geddes considers the "nearest analogue to this remarkable partnership" is to be found in Lichens, which according to Schwendener's theory, are composed of a Fungus feeding parasitically on Algæ. It may be worth while then to consider what Schwendener's theory really is.

The following are Schwendener's own words as quoted by Dr. M. C. Cooke in Grevillea:—"As the result of my researches, all these growths (Lichens) are not simple plants, not individuals in the ordinary sense of the word, they are rather colonies which consist of hundreds and thousands of individuals, of which, however, one alone plays the master whilst the rest in perpetual captivity prepare the nutriment for themselves and their master. This master is a Fungus of the class *Ascomycetes*, a parasite which is accustomed to live upon others' work, its slaves are green Algæ, which it has sought out, or indeed caught hold of, and compelled into its service. It surrounds them, as a Spider its prey, with a fibrous net of narrow meshes, which is gradually converted into an impenetrable covering, but whilst the Spider sucks its prey and leaves it dead, the Fungus incites the Algæ found in its net to more rapid activity, nay, to more vigorous increase."

Now this dual-Lichen hypothesis has been accepted as true by some very eminent botanists both at home and abroad, but it has also been opposed and denied by other botanists of equal standing, both foreign and British. As far as I can understand the theory, the Algæ referred to by Schwendener are the gonidia or green bodies which are ultimately embedded in the substance of the thallus of the Lichen, whilst the Fungus, the parasite, includes all the rest of the plant, and the hyphæ, or minute branched filaments surrounding the gonidia, are the means by which the Fungus draws its nourishment from the Algæ; but there seems a difference of opinion as to the facts, between the opponents and the defenders of the theory, for whilst Bornet, who accepts it, says, that the hyphæ never produce gonidia, J. Muller, who rejects it, says, that the hyphæ do produce micro-gonidia, which ultimately become the gonidia themselves; and according to some recent observations of his on a Brazilian species of the genus *Cœnogonium*, the large green tubes which contain the gonidia narrow suddenly into slender capillary tubes, without any discontinuation of the cavity between the large tube and the capillary portion: this narrow portion he considers perfectly conformable to the slender hyphal tubes of the theoretic Fungus. Examined microscopically by high powers, this slender portion of the tube showed clearly the micro-gonidia, or gonidia in their preliminary state, under their form, size, and normal arrangement, and in this respect there is a conformity between the narrow part and the hyphal enveloping tubes of the encased filaments. "It follows that one and the same cell—in the one case enlarged and bearing gonidia, should have been the theoretic Alga—while in the other case remaining narrow, and containing the micro-gonidia, it should have been the theoretic Fungus, thus proving in the most absolute manner the falsity of the theory, that one and the same cell may at the same time belong to two classes of vegetation."

Of course I am in no position either to confirm or to deny Muller's observations; I can only say, that if they should eventually be confirmed by other observers, they amount to something very like a simple *reductio ad absurdum* of the Schwendenerian hypothesis;

and we should then have to fall back on the previously accepted theory, that the gonidia are reproductive bodies, belonging to the Lichen proper; and that, as Dr. Cooke considers, there is "neither Alga nor Fungus, but only Lichen," and that Lichens form an independent class of plants, having some of the characteristics of the other two classes. Be this as it may, the observations of Herr Brandt and Mr. Geddes seem to me very clearly to prove the fact of the "life in common," or "consortism," of very low classes of animals and plants, and to open to us a new chapter in that book of Nature which we are all so anxious to study; and if I have been so fortunate as to interest you in this subject, or, better still, to have set you seriously thinking on the very curious mutual relations by which these organisms, one living within the other, are supported by each other's products, I must beg you to remember, that nothing of what I have said to-night is original, and that I have merely used "scissors and paste" on other men's work, to bring before you something comparatively new.

I.

THE SCENERY OF NORFOLK.

BY HORACE B. WOODWARD, F.G.S.

Read 28th November, 1882.

NORFOLK is not remarkable for its scenery. One may journey by rail from Thetford to Yarmouth, or from Diss to Cromer, and be impressed rather with the monotony of the views than with any very striking features. The county has been described as "a plain with a spike in the middle,"—not at all a complimentary character to give it,—though it is probably true that our grand old cathedral rises to a higher elevation than any portion of the soil. The summit of its spire is said to be three hundred and fifteen feet from the ground, and, therefore, nearly three hundred and forty feet above the sea-level; while the highest land I know in Norfolk is that marked two hundred and sixty-seven feet at Little Fransham by the Ordnance Survey.

Our county, however, is essentially a plain, through which its rivers meander somewhat sluggishly at the bottom of their gently sloping valleys. There are exceptions to these gentle features, as at Norwich, where, from the high grounds of Mousehold, or even from the Castle Hill, we have a really fine view of a river valley, whose bordering hills rise a hundred or a hundred and fifty feet, and rather abruptly too. Indeed, at Kett's Castle we have a grand panorama; and Sir Andrew Ramsay told me it reminded him of the view of Edinburgh from the Calton Hill.

If the scenery of Norfolk is tame when we compare it with the landscapes of the West of England, there are numerous spots possessing much beauty, whether among the wooded hills and commons near Holt and Cromer, along many country lanes and roads, or around the peaceful waters of our broads.

The enjoyment of scenery, it is true, depends a good deal upon the season, the weather, and the state of our digestive organs ; but, for our present purpose, we may regard these circumstances as favourable. And although scenery alone—meaning, literally, the aspect of the land—may be dull and lifeless, if not actually depressing, yet when the surroundings are pleasant, and what we call picturesque, it will readily be admitted that such scenery brings enjoyment to the least-cultivated mind.

Some questions then arise, which have been considered by Principal Shairp in his most interesting work ‘On Poetic Interpretation of Nature.’ Can scientific knowledge of the subject lend any additional charm to the landscape? Would it not, in fact, tend to its disenchantment? Of course no one would suppose that an artist could less appreciate a scene from his knowledge of form or colour, and all the elements that combine to make a picture ; but geologists, with their long names, tedious detail, and much-debated explanations, are, on first thoughts, eminently calculated to banish every trace of sentiment. Yet science need not take all the poetry out of Nature, for Mr. Shairp observes that, however much a man may know of any subject, he is but raised to take a better view of “the great beyond ;” and whether one feels a “spontaneous glow in the presence of the great spectacles of Nature or not, depends not on his scientific knowledge, but on his natural temperament, on the amount of soul there is in him, underlying his attainments.” For “there is a poetic glow of wonder and emotion before science begins its work ; there is a larger, deeper, more instructed wonder when it ends.”

Looked at in this light, some knowledge of the physical causes which have originated our scenery may well increase our enjoyment : in illustration of which, we may compare our thoughts on contemplating a ruined abbey or castle, knowing nothing of its past, with those that would arise were we acquainted with all or many of the events in its history.

For all that, the lecture on the old ruin may, with some exponents, prove dry and irksome ; so may be my attempt to picture the evolution of our present scenery ; and it must rest with each one individually to develop into poetry the following prosaic facts and inferences.

The subject may be divided into three parts :—(1) The Geology, in which we must trace the history of the rocks or sub-strata, and their influence on the form of the ground; (2) The Physical Geography, in which we must consider the modifying influence of rain, rivers, and sea on the land in recent times, and the introduction of the forms of life, without which our scenery would indeed be bare and uninteresting; and (3) The Archæology, under which heading we must briefly sketch the artificial features, or the great changes brought about by man.

I. GEOLOGICAL INFLUENCES.

Norfolk may be said to be one of the most youthful parts of England. Time, which (poetically speaking) has tended so much to harden and furrow the features of our older tracts of land in the North and West, has left but gentle traces of its hand in the East. The strata beneath us were among the last laid down; they have not been subjected to the great disturbances which have folded the rocks and upraised our land in other places two or three thousand feet, nor to the great heat and pressure which have turned the soft clays and sands and calcareous muds of the early epochs into slate and quartzite and marble.

Although in some degree hardened by the pressure of overlying deposits, or by local chemical agents, our rocks in Norfolk have suffered no great alteration since they were laid down. Slow and gradual depressions and upheavals of the area there have been in past times, for the strata were most of them formed under water, and some at a considerable depth below it.

Our oldest deposits have little influence on the present scenery. The earliest, known as the Kimmeridge Clay, is exposed on the western margin of the county, below the Greensand hills of Sandringham, forming a low-lying track that merges into the alluvial flat of the Fenland. This formation, which may underlie a considerable portion of Norfolk, consists chiefly of a marine clay. Much of it was probably brought into the sea by rivers, along whose banks many huge reptiles disported themselves, and some of these, borne into the deep for our ultimate benefit, have been immortalized under the names of *Omosaurus*, *Cetiosaurus*, and *Plesiosaurus*. The nearest land in those days may have been in

what is now the eastern portion of Norfolk, Suffolk, and Essex. The succeeding formation of Lower Greensand (Neocomian), which rises in the picturesque hills at Snettisham, Dersingham, and Wolferton, tells also of the dominion of the sea, and is of much later date than the Kimmeridge Clay. It comprises sandy and clayey sediments, enclosing here and there remains of Ammonites, Oysters, Trigonias, and other shell-fish. Occasionally hardened by ferruginous waters into what is called "Carstone," it gives a character to the houses and churches of the neighbourhood, and is even vulgarly spoken of as "Gingerbread-stone."

Leaving out any account of the Gault and Red Chalk, as they have no particular effect on the scenery, we now come to the great White Chalk formation, which really constitutes the foundation of the larger part of the county. So masked is it, however, by sands, gravels, and clays of later ages, that one familiar with the North and South Downs or the Wiltshire Plain, would hardly recognize in Norfolk what is generally understood to be Chalk scenery. I am, however, informed by Mr. F. J. Bennett, that there is a miniature Chalkcombe at Ringstead, near Hunstanton; while at Hillington and near Thetford, in West Norfolk, the scenery most nearly approaches a Down-like aspect. Indeed, it is on record that a "white horse" had at one time been cut out of the short turf that concealed the Chalk in the neighbourhood of the old episcopal town of Thetford.* No vestige of the animal now remains, nor can I obtain any clue to its former whereabouts. Further south and south-west, the middle and lower beds of Chalk rise in a bold escarpment, especially in Bedfordshire; but in Norfolk, although we read in geographies of the "East Anglian Heights," the more conspicuous escarpment is formed by the Greensand, the Chalk having been planed down to a surface of gentle undulations.

The Chalk itself is an organic deposit of the deep ocean, and we need not concern ourselves here any further about its method of formation, though its bands of flint—themselves mineral concretions or veins of impure silica, much of which originally entered into the framework of various organisms—have aided largely in the production of the later deposits in Norfolk.

* G. B. Greenough, in Conybeare and Phillips' 'Outlines of the Geology of England and Wales' (p. 84).

Far away from this area were the margins of the Chalk sea; but the succeeding strata, proved to us in the well dug for Sir Edmund Lacon's brewery at Yarmouth, tell again of shallower sea-deposits in Eocene times, when we reach the dawn of the present life on the earth. These deposits—mostly of a clayey nature—were brought down from a land clothed with a tropical vegetation, and whose banks and waters teemed with Serpents, Crocodiles, Turtles, and Tapir-like mammals, some of which perchance, together with the *Nautilus* and other Mollusca, now lie entombed two or three hundred feet beneath the sands of Yarmouth. Although the occurrence of these soft and yielding deposits may have had some influence on the formation of the low-lying tracts of East Norfolk, nowhere do they make their appearance at its surface.

The next period, called the Miocene, with which we may include the later stages of the Eocene, was by no means unimportant in the history of our scenery. Instead of the deposit of new material, we have the upheaval of the strata that had been formed;—land usurped the area previously occupied by the waters, and this took place over the greater part of the country.

The Chalk in Norfolk was slightly tilted, and brought above the sea-level, gradually perhaps, but in the end so much, that the Red Chalk of Hunstanton, originally more than a thousand feet beneath the ocean bottom, was lifted to several feet above its surface-level. At this time there may indeed have been land a thousand feet high in West Norfolk, and then no doubt the Chalk was continuous with that which now forms the wolds of Lincolnshire and Yorkshire. This much is known, that at least a thousand feet of Chalk has been worn away in West Norfolk; but whether the denudation took place by degrees as the land was being upraised, or chiefly after it had been upraised, we are not in a position to say.

What has become of the material? We know that in Buckinghamshire, Hertfordshire, and Berkshire, where the Chalk-with-flints has been for ages exposed at the surface, the influence of acidulated water—rain-water and springs holding carbonic acid gas in solution—has been potent in dissolving and eroding the Chalk, carrying away its calcareous matter, and leaving the flints and insoluble substances behind. In those counties, as Mr. Whitaker has pointed out, the Chalk hills are largely covered with

Clay-with-flints to a depth sometimes of fifteen feet, a formation which may have derived portions of its argillaceous material from wrecks of Tertiary beds that once overspread the area.

It is then highly probable, that whilst so much of Norfolk remained as a land-area in later Eocene and Miocene times, extensive sheets of loose flints, mixed with earthy matter, would be formed on the surface. And although there is no reason to suppose that any formations of this early and middle Tertiary age have been left for our contemplation in the county, yet the materials then accumulated may have been ready to hand for agents in later times to re-assort and deposit elsewhere, if not in the same neighbourhood.

Passing on to the Pliocene period, we come more closely to the border-line between things past and things present. The deposits of this age, which for the most part lie concealed beneath a covering of Drift Gravels and Boulder Clay, are exposed to our view at the foot of our cliffs and on the borders of the Bure and the Yare. They consist of pebbly gravel, sand, and "jaubs" of clay, with here and there beds full of fossil shells called "Crag," that delight the eye of the collector. Our Norwich Crag is truly a sort of raised bed of the German Ocean, having been deposited at a time when the eastern portion of our county came within the influence of the sea. Chalk cliffs then formed its western, and for a time its northern boundary, and to their gradual destruction we owe the flint shingle which is such an important feature in the beds. The Crag itself, however, exercises little influence on the scenery: it is only as a sub-soil, on the borders of our river valleys, that it gives a character to the vegetation. Of its fossil forms, many of the Mollusea are now living on our coasts—we find the same Periwinkles and Purples, the same Cocksles, Peetens, and Mussels; while the rivers bore down some of the same species of land and freshwater Mollusca. Nevertheless many forms found in the Crag were different from those now existing in this country, and notably the mammalia. Two species of Elephant, the Hippopotamus, Hyæna, and Mastodon, mark the great distinction in the land fauna. As time went on the Mastodon became extinct in the area, and the physical conditions of the eastern and north-eastern part of Norfolk became estuarine instead of marine. Remnants of the forest growth of this time are preserved to us in the stools of trees, embedded in the gravel and silt of later Pliocene times along the Cromer coast.

"The forest," says Professor Boyd Dawkins, "covered a large portion of the area of the North Sea," and "was mainly composed of sombre Scotch Firs and dark clustering Yews, relieved in the summer by the lighter-tinted foliage of the Spruce and the Oak, and in the winter by the silvery gleam of the Birches, that clustered thickly with the Alders in the marshes, and stood out from a dense undergrowth of Sloes and Hazels."*

The Bear, the Glutton, many remarkable Deer, the Rhinoceros, Hippopotamus, Beaver, two if not three species of Elephant, and other mammals, have left their remains to enrich our museums, and to tell the tale of the former inhabitants of this period.†

Mention has previously been made of the connection of the Norfolk Chalk with that of Lincolnshire. In Miocene and Pliocene times, rivers may have commenced to erode their courses in it, making outlets to the sea. "These actions [to quote Mr. Skertchly] resulted in reducing the barrier to outliers; one between the Witham, and the three united rivers [Welland, Nene, and Ouse], the other between that united stream and the Little Ouse. As submergence went on, the sea added its powers to that of the rivers, and finally the Chalk disappeared entirely. The sea was now brought directly in contact with the widespread outcrops of the yielding Kimeridge and Oxford Clays, and the denudation of the Fenland basin proceeded at a rapid pace."‡ Thus the Wash is a great bay, and not an estuary.

This depression of the area, which allowed the sea to encroach on the land, probably took place in Pliocene times, while the close of this period, marked by the estuarine Forest Bed series, and the forest growth elsewhere, tells of some uprising.

Then a great change came over the surface of our country. It may have come slowly, but surely enough the climate altered from temperate to arctic; and the succeeding deposits, which were spread far and wide over the surface of Norfolk, are the relics of that

* Address to Department of Anthropology, British Association, 1882. See also C. Reid, 'Geology of the Country around Cromer' (1882).

† E. T. Newton, 'Vertebrata of the Forest Bed Series of Norfolk and Suffolk' (1882).

‡ 'Geology of the Fenland' (Geol. Survey), p. 217.

“Great Ice Age” which separates our present fauna and flora, for the most part, from the life which preceded it.

It would be quite out of place here to attempt any detailed sketch of this period, to speculate on its causes, or try to picture the method of formation of its many kinds of deposit. So long as we treat the subject broadly we tread upon safe ground; the moment we enter into particulars we trespass into a region where our present knowledge forbids, although it does not prevent, very positive assertions.

The deposits of this great Glacial period are most important in the history of our scenery, for the present features are for the most part carved out of them, although in the river valleys and other places often deep enough to expose the earlier strata beneath. Nowhere are they better exhibited than in the cliff-sections between Weybourn and Happisburgh; and there we find almost every kind of sediment, from marl to boulder gravel, with the intermediate varieties of clay, loam, and sand. We may see in one place, as at Happisburgh, a stiff blue clay (Cromer Till) containing pebbles of chalk, many of them glacial, and boulders of granite, greenstone, felsite, carboniferous limestone, and septaria, sometimes beautifully grooved and striated by ice-action.

Then, on the same coast, we have exhibited beds of brickearth and marl and sand (Contorted Drift), showing frequent and astounding disturbances. For the beds are twisted up at all angles, in zig-zag or S-shaped forms, now enclosing nests of sand with shells, or patches of marl; and again containing those huge boulders of re-arranged chalk, or even little-disturbed chalk, that form some of the largest transported masses of rock to be witnessed in this country.

Over a considerable portion of South Norfolk, north of Diss, around Tivetshall, Long Stratton, Brooke, Fornectt, and Attleborough, there occurs a tolerably uniform clay, containing chalk-stones, flints, and boulders. It is known as the great Chalky Boulder Clay.

These beds furnish unmistakable relics of times when much of North Britain was enveloped in a mantle of ice, which spread southwards and eastwards over the wolds of Yorkshire and Lincolnshire, bringing *débris* of Chalk and Oolites and other rocks over the Eastern Counties.

The "*Cromer Clay*" (says Prof. James Geikie) "points to the near vicinity of a great ice-sheet, which deployed upon the bed of the sea, and extruded there its morainic mud and stones."* And after this earliest introduction of ice, it would seem that the conditions so altered by further submergence, that there were laid down sedimentary deposits of brickearth and marl, of sand and gravel, still in great measure the product of the land-ice and icebergs.

But these deposits were subsequently acted upon by a force sufficient to produce the violent contortions before mentioned. Whether this force was an ice-sheet pushing against and over the land (after the upheaval of the beds and during the formation of the Chalky Boulder Clay), stripping off masses of Chalk and thrusting them amidst the strata, as Mr. Clement Reid maintains; or whether the huge boulders were derived originally from bordering cliffs, severed by the expansive force of ice in fissures, and shifted by coast ice, as conjectured by Mr. T. Mellard Reade, † is a debatable question. Such transported masses are not confined to Norfolk. There is a well-known boulder of chalk at Roslyn Pit, near Ely, and transported masses of Inferior Oolite and Marlstone have been observed in Lincolnshire, and in connection with Chalky Boulder Clay. That the agent which formed this Clay, brought also the great boulders, and contorted the beds over a considerable portion of Norfolk, seems to me most probable. We are, however, entering into the region of theory, and my object in going so far, was to suggest an origin for some of the great heaps of boulder gravel.

Scattered over the high grounds of Holt and Cromer, on the hills in West Norfolk, and in outliers at Strumpshaw and Poringland, are deposits of coarse flint-gravel, containing large blocks of flint, and sometimes paramoudras; and when I referred previously to the wear and tear of the Chalk in Miocene times, as probably resulting in accumulations of flints, I thought then of these gravels, and have wondered whether they might not have been thus derived and transported by glacial action, partly in the same way as some of the

* 'Great Ice Age' [2] p. 391. See also S. V. Wood, *Quart. Journ. Geol. Soc.* vol. xxxvi. pp. 463—472, &c.

† *Quart. Journ. Geol. Soc.* vol. xxxviii. p. 222.

huge masses of chalk, as well as by floods resulting from the breaking up of the ice-fields. To whatever agent, however, particular deposits may be due, it is hazardous to attempt to be precise in our explanations. All we can do is to picture the great glaciation of the country, and to endeavour to give various icy agents credit for portions of the work, just as ice-sheets, icebergs, and coast-ice may now act, if not in concert, within no great distance one from the other, so that the several forces might come into play over the same tract in the course of no great extent of time.

I have said nothing of man's advent during this cold period, but there is no doubt that he was in existence in southern Europe; and if, as seems probable, he was tempted or forced to make arctic expeditions in those days, we have the evidence of the interglacial brickearth at Brandon to countenance our view.*

It can, however, be asserted with confidence, that after the last glaciation of Norfolk, and whilst glaciers still lingered on the highlands of North Britain, the conditions became suitable for incursions of the arctic mammalia, the Lemming, the Reindeer, the Woolly Elephant, and Rhinoceros, and also of the Hyæna, Hippopotamus, and Lion. Man, too, made his appearance; for his ancient and rudely-chipped stone implements are found in the older valley-deposits of the Thames, and in several localities in West Norfolk near Thetford and Brandon.

Most of our minor features commence to date from this time; for the deposits of the Glacial period formed an extensive plain, out of which our present rivers have shaped their courses. If we are right in considering that the latest Glacial deposits in Norfolk were formed on land by an ice-sheet, and by the floods that resulted from its melting away, then our tract of land may not have been submerged since. Be this as it may, the climate gradually ameliorated, heavy rains and torrents probably ensued, and the wearing away of the river valleys may have proceeded at a greater rate than at present. Eventually a good deal of the West of England and North Wales was submerged to a considerable

* Professor W. Boyd Dawkins now thinks that the palæolithic implements of the Thames Valley brickearth at Erith and Crayford are quite as likely to be pre-glacial as post-glacial (Address to Department of Anthropology, British Association, 1882).

extent,—a depression which diminished eastwards,—and many characteristic members of the old fauna associated with palæolithic man were driven away or exterminated. How long this state of things continued we know not, but after a time the whole area was elevated, and England again formed part of the Continent.

Then, in what may be called the beginning of the Modern period, we turn from a time of extensive deposition and subsequent erosion to one essentially of destruction, although on a more gradual scale. From this date little has been added to Norfolk, much has been taken away, and some material has been transferred from one part to another. Our present features had been roughly marked out of the materials brought together during the ages that had passed, and the further consideration of them leads us to the second part of our paper.

II. PHYSICAL GEOGRAPHY.

At the commencement of the Modern period, England was united to the Continent at its south-eastern portion, and the land in Norfolk stood at a higher level than it does now, apart from the wear and tear it has since undergone. We judge this from the depth of alluvium in our valleys,—at Norwich over forty feet; at Wroxham Bridge as much as seventy-two feet. The land, too, extended considerably further to the north, as we judge from the present destruction of the coast, and from the historic evidence of former villages, whose sites are now buried up by the relentless ocean.

The transition from what is called (by some authorities) the Glacial period to that of Modern times is so gradual that we cannot fix a hard line; but that there were considerable changes is indicated, not only by the difference in the fauna associated with palæolithic man and that associated with his neolithic successors, but also by the marked difference in the stage of culture to which these respective races had advanced.

We have inferred that, towards the close of the Glacial period our rivers had commenced to scour their channels out of the yielding Glacial strata that covered the greater part of Norfolk; and in the first instance their particular courses may have been

marked by irregularities in the deposits, or by the action of torrents that formed the elosing scences in this county of the "Great Ice Age."

Regarded from a physical, but certainly not from a poetical point of view, "a river," says Mr. Mellard Reade, "is a main drain for part of an island, or a eontinent. A ehannel that has been made by the ceaseless rushing of water for untold ages, a silent highway by which water taken up by evaporation in the atmosphere from the great oceans, condensed in the form of rain, returns again to the sea in a collected form, along a line of least resistance."*

Such thoughts lead us to the commencement of our rivers, over a traet made up of gravel and sand, of clay or marl; and this looking baek to the beginning may assist us in understanding how it is that our higher elevations are more usually eomposed of sandy and gravelly deposits, in other words, of porous strata; the low lands of clay or marl, or of impervious strata. This we shall find a well-marked rule throughout the central parts of England—where sandstones, and more or less porous limestones, alternate with elays.

On the elayey strata the rainfall must accumulate or flow away at once towards lower levels; on the sandy and gravelly strata it will sink down until arrested by impervious beds beneath. Henec the earliest exposed ehannels no doubt commened on the elayey areas that formed the surface. And we know for a faet that the action of running water is to erode, to deepen its channel in the higher course of the stream, and wear away the banks, earrying the material to the lower grounds or out to sea. The action of rainwater is also in part chemical, as before mentioned, being potent in wearing away ealeareous strata, such as our Chalk or Chalky Boulder Clay, whose upper surface is generally furrowed in irregular pipes. This material is carried away by the streams. Beneath the gravelly and sandy traets, the rainfall formed subterranean courses, flowing, in some instances, even out to sea in that way, as we now witness in the case of numerous springs issuing from our cliffs on the coast. There deep ehannels or "chines" are in time formed, and the gravelly accumulations

* Trans. Liverpool Geol. Assoc. 1882.

being ultimately cleared out, the clayey strata are exposed. In one case I noticed a narrow gorge, nine feet deep and two and a half to three feet wide—like a miniature cañon—at the bottom of one of these chimes. Many rivers commence in a subterranean course, to which numerous streamlets contribute; and the sources of our present rivers may be at different levels according to the amount of rainfall which saturates the porous strata and swells the numerous feeders at its source. Such is the case with the Weusum in its gravelly valley near Syderstone, and (as pointed out to me by Mr. Whitaker) with the Babingley River near Massingham. In these cases the fluctuations are caused by the level of saturation in the Chalk. And streams flowing for a time underground, and carrying away material from below, will cause the surface to sink. The low-lying gravelly tract at Fulmodeston Gorso seems to have been produced in this way.

From these and other considerations, we may be able to understand how some of our great sheets of gravel and sand, like those of the neighbourhood of Holt and Cromer, have become isolated hills with numerous ramifying spurs; for although some of the great sheets of gravel may have been deposited in patches, yet the surrounding strata have been denuded, and they themselves have perhaps been broken up into smaller patches or outliers. And when once this has taken place, the surface features of these sandy and gravelly tracts may remain for long periods much the same, although the level of the whole may be slowly reduced by springs carrying away material from the lower portions of the strata at their junction with clayey beds beneath.

These remarks may apply to the numerous little sandy hills to be seen dotted about from Cromer westwards along the coast by Sherringham to Weybourn, and again at Glandford, Bayfield, and Blakeney. In this district we find a long and tortuous ridge of gravel and sand forming the Blakeney Downs, looking in places like a great railway embankment, and small gravel hills, little larger than tumuli, sometimes covered with Gorse and Broom in the midst of ploughed fields, at other times looking like artificial heaps, there being little or no earthy matter in the densely-packed mass of stones. Perhaps the earthy matter has been washed away by rain, but their porous nature has, no doubt, helped to preserve them, just as any earthworks of early races are more likely to be

preserved when constructed of porous materials, or when built on porous strata.

Some of these remarkable gravel hills reminded me of descriptions of Eskers, as well as of some I had been shown by Mr. T. V. Holmes on the gravelly plain west of Carlisle. Eskers, whose origin is a much-disputed question, are thought by Dr. James Geikie to have been heaped up principally by the action of sub-glacial waters during the melting of an ice-sheet. Having noticed the resemblance of some of our tiny gravel hills to tumuli, I was much interested to read in a paper recently published by Mr. Holmes, that "Esker mounds are often so extremely like artificial barrows as to be a very possible source of disappointment to the antiquary."*

On impervious strata the sources of rivers may be almost entirely above ground; and as the water-parting that separates streams running in opposite directions becomes reduced, we can conceive how two may rise near together, as is the case with the Little Ouse and the Waveney at Lopham Ford. Streams must often commence in this way underground. And this reminds me of the streams on either side of the high street at Chard in Somerset; one flows into the Bristol Channel as the Parrett, the other into the English Channel as the Axe. Even in the case of the Wensum Valley, when we follow it up beyond West Rudham, towards Harpley, where the streamlets disappear underground, we may, while gradually passing over the watershed, proceed in a kind of valley until we descend into that of a little stream that flows into the Wash near Castle Rising.

Other cases of subterranean denudation occur in the sudden sinkings of ground where "pipes" have been formed in the Chalk (as previously mentioned), and the strata after a time "cave in,"—I use the term in its original sense. Some such origin our meres may have had, and these I have had the advantage of seeing under the guidance of Mr. F. J. Bennett. They occur in a country where Chalk is covered with sand and boulder clay. Granting that a huge pipe had been formed in the Chalk, then the washing in of boulder clay may have "tamped" the hollow, in much the same way as some of our ponds are rendered water-tight.

* Trans. Cumberland Assoc. part vi. 1882.

In the formation of our river valleys, we must remember that the nature of the rocks cut through has exercised some influence on their shape—according to what engineers call the “angle of rest.” We know in making railway cuttings that the slope is calculated in accordance with the nature of the rock, chalk standing in wall-like masses, while clay, or gravel, or sand, have to be cut away at angles of from twenty to forty degrees. In our river valleys, as before hinted, the Chalk gives a bolder feature, as near Norwich, at Attlebridge and Ringwood, at Glandford and Letheringsett, and at Walsingham and Houghton-in-the-Dale, where it rises more or less abruptly to some little height above the river valley, and supports masses of Glacial drift above it.

Gravel forms much steeper slopes than clay, as we may witness on the Blakeney Downs, in the Bure Valley below Briston, and other places. Any marked rise in the ground, or change of feature, is, as a rule, caused by a change of formation. Such features, too, are often indicated on the Ordnance maps by short though abrupt turns in a road, which have been made to avoid the steep ascent, where one formation rests on another. These features are of great aid to the geological surveyor; for it is by noticing the form of the ground, the indications of the soil, of vegetation, and of springs, that he is enabled to draw those boundaries between formations where no direct evidence is to be found, and where the casual observer might attribute the result simply to the imagination.

Although the land has been sculptured in great accordance with the changing strata, our coast-line presents no modifications of any particular kind, because, with the exception of the chalk and sandstone cliffs of Hunstanton, we have no hard rocks capable of offering great and special resistance to the breakers, and thus to stand out in headlands. The coast-line is rapidly receding between Weybourn and Eeeces, at such a rate (two or three yards a year), that we might make calculations to show how much has been lost during the past five or ten thousand years. We cannot say, however, for how long a period the conditions have remained as they are, though, probably, the unfortunate landlords have suffered from “time immemorial.”

The alluvial flats and salt marshes of Burnham, Wells, and Blakeney may have been prolonged further east, and bounded on the north by hills since denuded; for Mr. Clement Reid suggested

to me some time ago, that these flats may have originally formed the alluvial bed of a river flowing eastwards from the region of the Wash. Upon the destruction of the barrier of hills on the north, the sea would eneroach rapidly over the low lands, excepting where hills of blown sands or banks of shingle were raised up to bar its progress. Such has been the case at Waxham and Palling, and westwards at intervals from Blakeney to Brancaster, including the long beach that stretches from Weybourn to the north of Blakeney Harbour. Eceles Church being situated on low land, now stands on the foreshore, by reason of the shifting inland of the sand-hills.

Several villages have been lost north of Cromer; and the town itself, which was anciently called Shipden, has been about half destroyed, including one of its churches. According to Mr. Walter Rye, this was situated about four hundred yards north of the jetty, and was wasted by the sea in 1337. The entire town would probably have gone long ago, had it not been protected by the works of man. Rain, frost, and springs, are almost as potent as the sea in the destruction of the cliffs, the former agents producing great landslips, the latter clearing away the fallen masses.

Mr. Reid has remarked on the decrease of the drainage area of the country around Cromer, through the eneroachments of the sea. As "most of the streams rise near the coast, and flow inland to join the Bure, it is evident that the loss of a strip of land two or three miles wide since the time of the Romans, may have materially affected the amount of water in the Bure, and consequently made it more sluggish."* A study of the geological map of the country suggests that the stream which flows out to sea at Mundesley, may, before the land had receded so far, have been connected with the little tributary of the Ant and Bure, which flows inland from near Bromholm Abbey, Baeton, to Ridlington and Honing.

The sand dunes or "Meals" are picturesque objects, presenting quite a mountainous outline when seen in the distance, especially at sunset, though they do not rise above eighty feet in height, and are generally much less. Near Holkham, among the double rows of hills, there occur small pools of brackish water that lend considerable charm to the scene.

* 'Geology of the Country around Cromer,' p. 131.

In East Norfolk land has been gained, as at Yarmouth, which, to quote Lyell, "first became habitable ground about the year 1068, from which time a line of dunes has gradually increased in height and breadth, stretching across the whole entrance of the ancient estuary, and obstructing the ingress of the tides so completely that they are only admitted by the narrow passage which the river keeps open, and which has gradually shifted several miles to the south."*

Thus while the form of the ground is natural, its various irregularities being due to excavation, we can assign no particular date to its sculpture, excepting that it was subsequent to the Glacial period; for the very agents that have caused it are still at work, though in a more or less modified degree.

Before vegetation had covered the land, denuding forces could have acted with much greater facility, as they can now on St. James' Hill, where human agency assists Nature in the work of destruction, and on our cliffs where streams of mud flow out to sea across the sands. But so soon as the conditions were favourable, and our land still formed part of the Continent, the various plants and animals composing our modern fauna and flora, including several species that have since become extinct, made their homes in the land.

To plant-life our scenery is of course most largely indebted, and the earlier settlers included the Oak, Ash, Willow, Poplar, Alder, Birch, Beech, Hornbeam, Pine, Holly, and Yew;—some specially suited to the moist alluvial tracts, others to clayey soil, and a few to dry, sandy elevations. Forests of Oak probably occupied the greater part of our low-lying clay districts, while the underwood consisted of Hazel, Blackthorn, Hawthorn, Elder, Brambles, and Briars.

With the animals, it may be thought, our subject is but little concerned; yet Gilpin has remarked that, "no landscape is complete without its figures." Many of the forms that graced the scene in the earlier portion of the period we are now considering, have become exterminated; but to most of us the enjoyment of scenery is not lessened by the absence of the Brown Bear and the Wolf. We might indeed welcome an occasional colony of Beavers, whose habits form so interesting a study, and contribute in no small degree to modify their surroundings; while herds of Roe Deer,

* 'Principles of Geology' [11] vol. i. p. 521.

Reindeer, or Irish Elks,* might perhaps be tolerated—at a distance. A few Red Deer remain on the wilds of Exmoor, and it is left to the Fox, the Badger, and the Otter, together with many smaller quadrupeds, to represent the wild animals of this country.†

The presence of both plants and animals is perpetuated in some of our village names, as Mr. W. H. Bidwell has pointed out.‡

We may, however, picture the land, when Nature had it all her own way, as for the most part thickly covered with wood, with here and there wide stretches of heath land, or open park-like tracts of grass land, feeding grounds for the herds of deer and cattle. The river valleys were for the most part swampy tracts.

In Norfolk there remains no forest of historic interest, although I have been informed that remnants of old woodland occur in the parishes of Thursford, Thurning, and Hargham; while the name of Holt speaks forcibly of the wooded character of its neighbourhood, which is still kept up by numerous plantations. In certain situations, as in the woody dells near Sherringham, on the wild heath land of Edgefield or Marsham, and even close to Norwich in a part of Mousehold called Ossian Vale, we may attempt to realize the original state of the country, and may lose ourselves in a reverie until the spell is suddenly broken, as I think one writer has elsewhere told, by the whistle of some not far distant engine—and thus we come to think of all that man has done, or to the consideration of the last part of our subject.

III. INFLUENCE OF MAN, &c.

Of Norfolk, as we now see it, little but the contours are natural; fields, hedgerows, plantations, roads, railways, reservoirs, towns, and villages mark the progress and influence of man. Even the river-courses are artificially modified.

* *Cervus megaceros* was met with at Hilgay. Owen, Quart. Journ. Geol. Soc. vol. iv. p. 44.

† Gilbert White relates that "General Howe turned out some German Wild Boars and Sows in his forests [Ayles Holt in Hampshire] to the great terror of the neighbourhood; and at one time, a wild Bull or Buffalo; but the country rose upon them, and destroyed them."

‡ Trans. Norfolk and Norwich Nat. Soc. vol. iii. p. 212.

We have no written records of the early men who occupied this portion of the country, until long after its present features had commenced to be shaped; but they have left evidence of their existence, and of some of their manners and customs. Their polished stone implements, or celts, are scattered over the surface of the country, and imbedded in the older alluvial deposits of the valleys; while evidence obtained in various parts of England show that Wheat, Barley, and Millet were then cultivated, and that the Hazel, Walnut, Beech, Acorn, Apple, and Pear also contributed to the food of the people.* Later on, in what is called the Bronze period, also prehistoric so far as we are concerned, we find ornaments and weapons of bronze. This Bronze age in our country, according to Mr. Evans, extended from about 1400 or 1200 B.C. to 500 or 400 B.C.; and the Neolithic or Surface Stone period may have endured in Britain for about two thousand or more years previously.

During these periods we have evidence of man's habitations in pits, caves, and lake-dwellings; and of his sepulchres in burial-mounds, tumuli, or barrows. Among his domesticated companions in Neolithic times were the Dog, Ox, Sheep, Goat, and perhaps the Pig; while the Horse was added in later times.

The earliest incomers did little, perhaps, to modify the surface of the country. No doubt they made some clearances, but their settlements, if we believe the evidence of any of the shallow pits (or pitsteads) on the heathy grounds, seem to have been chosen on account of their high and dry, and probably more open, situation.† Although no positive evidence has been obtained to show that any pits on the heaths of Weybourn, Runton, Aylmerton, and other sandy wastes in Norfolk, were really occupied as the foundations of dwellings, and the evidence brought forward in other places has been questioned, yet Professor Dawkins states that such pits were in use as late as the Roman occupation. And how easily all traces of human settlement may be lost, is patent to all who study the surface soils of our country, where relics of modern animal life are so exceptionally preserved. The late Mr. J. H. Druery informed

* J. Evans, 'Nature' (p. 531), Sept. 25th, 1882.

† See H. B. W., 'Midland Naturalist,' 1883.

me that no trophies or memorials of Kett's rebellion had ever been found on Moushold.

Residences were also constructed on lakes, of which instances have been brought to light in cleaning out two of the meres at Wretham.* These habitations were formed of mud and boughs, resting on platforms that were raised above the water by means of oaken piles.

We must not neglect to notice the more important physical changes that took place during the time that man was improving the face of the country.

The land, which stood at a higher level than it does now, must have slowly subsided to its present level, and this depression would of course tend to arrest further deepening of the river-channels, except in the higher parts of the courses. The rivers would, however, widen when they could no longer deepen their channels; the tendency of a stream to flow in a serpentine course, owing, perhaps, to local sources of deviation, causing it to act directly now on one side, and then on the other side of the valley. The streams would become more sluggish, and deposit material in sheltered places where the water had not velocity to hold it in suspension.

Moreover, the depression allowed the sea to flow in, and enlarge the mouths of the streams, and in time to produce the extensive estuarine flats that extend from Yarmouth to Acle and Reedham—flats that were afterwards rescued from the sea by the formation of the sand bank on which Yarmouth now stands, and which did not exist previous to A.D. 1000.

The subsidence just alluded to would cause the rivers to flood the entire breadth of the valleys they may previously have excavated by degrees and during many changes of course, while the estuarine waters would help to erode and to carry away material. In this way we may discern the seemingly very recent origin of our broads.

These shallow freshwater lakes, excepting Breydon near Yarmouth, which is brackish, occur in the lower reaches of the Yare and Bure; only one, that of Oulton, occurs in the Waveney valley. In the Waveney valley there is a good deal more valley gravel than in

* Sir C. Bunbury, *Quart. Journ. Geol. Soc.* vol. xii. p. 355; Prof. A. Newton, 'On the Zoology of Ancient Europe' (Svo. London, 1862), pp. 16—23.

either the Bure or Yare valley, and it may be that the accumulations in the valleys have something to do with the formation of the broads. In the Waveney the base may have been too porous to sustain such sheets of water; whereas in the Bure valley and in the Yare valley they may be supported by beds of laminated clay in the Norwich Crag series (by some called "Chillesford Clay"), of which we have examples at Wroxham, South Walsham, and Surlingham; while the broads of Ormesby, Martham, and Horsey are upheld by the clays of the Lower Glacial Drift.*

The broads of Ormesby and Fritton appear to be alluvial valleys filled with water, whose egress is in great part prevented by artificial dams. Broydon is probably the last remains of the estuarine channel now all but choked up. Barton, and perhaps also Hickling, may have been formed by the cutting of turf, and they are, therefore, more or less artificial. †

In other cases, as at Wroxham and Hoveton, the depression of the land allowed the waters to overflow areas previously excavated in the widening of the valleys, and tidal influence aided for a time in scouring them out. The occurrence in the more remote broads of purely marine, or decidedly estuarine, species of *Ostracoda* and *Foraminifera*, indicates the former presence of the sea. ‡

The formation of the sand bank of Yarmouth, cutting off the sea, changed the character of the area; the waters, now entirely fresh, could no longer fill the valleys, and they became dotted with broads. These are now gradually diminishing in expanse and depth, according to Mr. Gunn, at the rate of one foot in depth in twenty years.

The subsidence before alluded to, perhaps, mainly helped to separate Britain from the Continent, allowing the sea to wear away, in a comparatively short time, the chalky barrier that was left between our coast and France.

We have referred to the many upheavals and depressions of the area, indicated plainly enough by the record of the rocks, and in

* See Geological Survey Map, No. 67, by J. H. Blake.

† 'Geology of the Country around Norwich,' p. 143. For a graphic account of the Broad, see H. Stevenson, 'Birds of Norfolk,' vol. i.; also 'The Handbook to the Rivers and Broad,' by G. C. Davies.

‡ G. S. Brady and D. Robertson, Ann. Nat. Hist. series iv. vol. vi. p. 4.

some places by raised beaches or submerged forests. The evidence is, of course, chiefly inferential; but the results of modern inquiry lead us to conclude that the earth's crust is most unstable, that it is, in fact, in a state of constant movement. The movements may be sudden when portions of the earth's crust yield to an accumulation of pressure, or they may be slow when the pressure is gradual, and insufficient to cause a rupture.

Earthquakes have been recorded from time to time as affecting Norfolk; but they do not appear to have been more than what Scrope termed "sensible vibratory undulations of the earth's surface," caused, perhaps, by shrinkage of rocks at a depth, and the intrusion of molten matter into the fissures.* Our attention has recently been drawn to the subject of earth tremors, and the observations of Messrs. G. and H. Darwin, who have shown that our soil is liable to storms of microscopic earthquakes.† Mr. G. Darwin has also indicated that the rising and sinking of land may be influenced by barometric pressure. Other writers, amongst whom Dr. C. Ricketts, have suggested that upheaval and subsidence may be caused or assisted by denudation or deposition of materials, as well as by the great development of ice during the Glacial epoch, and its subsequent dissolution. Hence we see that the very sculpturing of our earth's surface, in the formation of our scenery, may be one cause of those movements which we infer to have taken place from the character of our strata.

As time passed on we come to the period when historical evidence first tells of some of the doings of man in this country—that marked by the writings of Cæsar. In his time the ancient Britons were so civilized as to have swords of iron, besides a coinage of their own. This Iron age, as it is called, extended backwards for 400 or 500 B.C. The earliest inhabitants in Neolithic times were, probably, of an Iberic type; those who followed (generally known as the ancient Britons) were the Celts and Belgæ. The after struggles, by which the Roman and the Saxon successively overcame the Celt, and the conflicts of Saxon and Dane, are matters of history. The progress of civilization and

* Rev. O. Fisher, *Quart. Journ. Geol. Soc.* vol. xvii. p. 4.

† *Geol. Mag.* dec. ii. vol ix. p. 481.

of great works is due, perhaps, more to the incoming of fresh tribes, than to the actual improvements made by those already in the country. The numerous earthworks mark the sanguinary battles that attended these incomings. And as Isaac Taylor has so clearly pointed out, each tribe has left indications of its settlements in the names of places—the Celt more especially in the names of physical features, of river and hill; the Roman in military stations, and in main roads or “streets;” the Saxon and the Dane in villages.

The Romans embanked rivers and drained marshes; they made sea-walls and taught agriculture; but Mr. J. R. Green has remarked that, even at the close of the Roman rule, our land remained “a wild and half-reclaimed country, the bulk of whose surface was occupied by forest and waste.”* He mentions, however, that “if the towns were thoroughly Romanized, it seems doubtful, from the few facts that remain to us, whether Roman civilization had made much impression on the bulk of the provincials,” and that “over large tracts of country the rural Britons seem to have remained apart from their conquerors.” Hence arose, as I have read elsewhere, the term Pagan, from *Paganus*, a villager, because idolatry lingered longest in the country villages, Christianity spreading gradually from the towns;—and also the term Heathen, applied to those who (like myself!) are dwellers on the heath.† Whether or not there were any Christian Churches in this country during Romano-British times is uncertain:‡ we have no earlier building than dates from Saxon times. To the Anglo-Saxon we are chiefly indebted for our present county divisions and parishes. And Norfolk, probably from its proximity to the Continent, and the facilities it offered for cultivation, gave more easy access to marauding tribes; to which causes it may owe the fact of its numerous settlements, ultimately formed into seven hundred and fifty-six parishes, which outnumber those of any other English county. This, too, has so much influenced our scenery, that we cannot travel far without seeing the tower of some village church.

* ‘The Making of England,’ pp. 8, 12, 13.

† Note on p. 84 of Mr. W. P. Smith’s edition of the ‘Religio Medici’ of Sir Thomas Browne (1874).

‡ It is asserted that Caractacus brought over Christianity A.D. 58 or 59.

Each settlement led to the clearance of so much forest, or wild land, and the terminology of the names of places generally indicates either the settlement or home, the enclosure, or forest-clearing.*

Although the practice of well-sinking is of great antiquity, such settlements were originally made on spots where a good supply of water was to be readily obtained, by spring, brook, or river. The more important towns are, of course, situated along the river valleys; a fact instanced by a Carmelite Friar "as a striking proof of the superintendence and goodness of Providence, that it almost invariably made a river run completely through the middle of every large city."†

The clayey tracts, as a rule, are less thickly populated than the lighter lands, where springs might be expected, as may be observed if we look at a geological map of the neighbourhood of Tunstead on the north, and of Hardwick on the south of Norwich,—districts whose sub-soil is chiefly boulder clay or brickearth.

The old halls, as at Barsham, Rainham, Baconsthorpe, and Hautbois, and the monastic establishments, as at Walsingham, Castle Acre, and Creak, were mostly situated on low ground near a stream; while churches were more usually erected on higher ground,—gentle slopes or eminences, seldom, as at Burgh-next-Aylsham, on the alluvial ground.

Soils, dependent as they are on the sub-soil, more or less directly affect the present aspect of the land in the vegetation they support; the clays and loams, and mixed soils, being mostly under cultivation, yielding their crops of corn, roots, and grasses; while the very light sandy and gravelly tracts are often left to the more picturesque cultivation of Nature;—hence the Gorse and Heath, the Broom and Fir, and other shrubs and trees thrive in wild luxuriance. Some of these heathy tracts remain as commons for the people; and the wise customs of our forefathers have left also, here and there on the clayey tracts, open spaces, also called commons, by some "waste land," which furnish feeding grounds for the flocks and herds of the poorer classes. Such commons are to be met with at Hempton, Mulbarton, Buckenham, and Wacton. May they remain so! although Bacon,

* I. Taylor, 'Words and Places;' Munford, 'Local Names in Norfolk.'

† Article "*Non Sequitur*" in the 'Tin Trumpet,' by Horace Smith.

in his 'Agriculture of Norfolk' (1844), expressed a hope to see these tracts cultivated, inasmuch as "every acre capable of cultivation is imperatively required for the enlarged employment of an increased and idle population, as well as for the production of food."

More attractive are the parks and ornamental waters of the wealthy: they give a pleasant diversity to our scenery, with their frequently picturesque halls—picturesque when seen at a distance, though often desolate and gloomy when approached. One has to turn to the past to people some of the halls; though, perhaps, one would hardly like to revert to the times and doings of Sir Robert Walpole at Houghton. Delightful, in contrast, is the park of Sherringham, given up on week-days to the tender mercies of the public. Long may they enjoy its charming and diversified scenery, its rhododendrons and ferny dells, and assist in keeping up a cordial feeling between the rich and their less-favoured brethren.

Various incoming tribes have brought with them cereals and other useful plants, as well as domestic animals; and among the latter the Highland cattle—the old Celtic Shorthorn, which may be seen in Holkham Park, form groups pleasing enough, except, perhaps, to the ladies. The Romans introduced the Vine, Cherry, Peach, Fig, and, perhaps, the Elm. Of later introductions, the more conspicuous are the Common Lime, the Horse Chestnut, the Acacia, the Plane, Spruce Fir, Larch, Cedar, Lombardy Poplar, Mulberry, and Laburnum, besides many shrubs. Trees that had been previously exterminated, have been re-introduced with others in our parks, plantations, and hedgerows.

We must not forget how much, indeed, our scenery owes to the trees along the hedgerows; and one cannot help regretting a tendency to cut these down along our highways, not simply for the sake of the timber, but for presumed benefit to the roads. Some of our best roads are well shaded by trees; even the celebrated avenues at Quiddenham and Taverham are in good condition, although, forsooth, there is not much traffic on the latter. The state of the roads is dependent largely on the subsoil, and if they are made and mended in accordance with that, little inconvenience will result from the picturesque bordering of Oak, Ash, or Beech; except, perhaps, in extremely wet situations.

As Isaac Taylor has remarked, "England is pre-eminently the land of hedges and enclosures," and this "passion for enclosures is due partly to the Celts, who were gradually absorbed among the Saxon colonists, and partly to the necessity for protection felt by intruding colonists settling among a hostile and alien race." *

Although the Hawthorn as a hedge-plant in England is said to date from the time of the Romans, yet "on a more extended scale, as the enclosing of corn-fields, meadows, &c., Hawthorn hedges, according to Loudon, were not generally planted in England till after the introduction of the Flemish husbandry into Norfolk, about the end of the seventeenth century." † And it has been remarked by Nall, that, "as a result of the scarcity of timber, nowhere are hedges suffered to stand to so great an age and growth as in Norfolk."

Thus the artificial and formal have usurped the place of the natural and wild. The drainage of marshy land, the embanking of rivers, the cultivation of the soil, and particularly the cutting down of woods, have modified the physical geography, and have led, as Mr. Southwell has pointed out, to the destruction of animal life, and the extinction of many of the larger mammalia.‡ The Great Bustard, which, in the "good old times," found a congenial home in West Norfolk, has for nearly fifty years become extinct.

The greater part of our county is now under cultivation, or in permanent pasture; for, as Mr. Jefferies says, "the wicked turnip is responsible for the destruction of old England; far more than the steam-engine." § Its scenery is entirely changed; and yet we may find comfort in this state of things, for, as Ruskin has observed: || "The essence of picturesque character has been already defined to be a sublimity not inherent in the nature of the thing, but caused

* I. Taylor, 'Words and Places' [5], p. 78.

† P. J. Selby, 'History of British Forest Trees,' p. 71.

‡ Trans. Norfolk and Norwich Nat. Soc. vol. iii. pp. 181, 182.

§ 'Round about a great Estate,' p. 5. The turnip is said to have been introduced early in the seventeenth century, by a member of the Towshend family.

|| 'Modern Painters,' vol. iv. (1856).

by something external to it." Hence, as man is so dependent on the cultivation of the soil for his existence, the aspect of an agricultural district, with its rich cornfields, meadows dotted with cattle, its red-brick homesteads and grey church-towers,—and shall I add its beautiful school-board buildings?—form surroundings that may be as picturesque and quite as enjoyable to some of us, as a country made up of rough moorland or forest-clad mountains. Our appreciation of a scene may indeed differ, as do our tastes. There may be another aspect to this subject, for familiarity with a country often breeds, if not contempt, at least indifference to its charms. To the habitual resident in a town, a walk along a country lane might create sufficient ecstasy to astonish the rustic who had viewed the scene every day of his life; and even the dwellers among mountains scarce take so much interest, or have rambled so far, as the pedestrian who visits them during a fortnight's holiday. Novelty certainly adds greatly to the charm of any district, and even in Norfolk it is a comfort to lose one's way in a new tract of ground.

Our first impressions of a fresh district are often exaggerated, and no doubt this was the case with Arderon when he described our cliffs as "dreadful heights," as "stupendous and amazing precipices."* The same kind of impression doubtless pervaded the mind of the anonymous author of a work published in 1768, entitled, 'A Six Weeks' Tour through the Southern Counties of England and Wales.' Referring to a scene at Langdon Hill, in Essex, he writes (pp. 73, 74):

"I forgot to tell you, that near *Horndon*, on the summit of a vast hill, the most astonishing prospect that ever was beheld by human eyes, breaks almost at once upon one of the dark lanes. Such a prodigious valley, everywhere painted with the finest verdure, and intersected with numberless hedges and woods, appears beneath you, that it is past description; the *Thames* winding through it, full of ships, and bounded by the hills of *Kent*. Nothing can exceed this amazing prospect, unless it be that which *Hannibal* exhibited to his disconsolate troops when he had them behold the glories of the *Italian* plains! If ever a turnpike should lead through this country, I beg you will go and view this enchanting prospect, though a journey of forty miles is necessary for it."

* See Memoir by F. Kitton, Trans. Norfolk and Norwich Nat. Soc. vol. ii. p. 435.

The interest that may thus be excited by the novelty of a scene will not so readily diminish when we study the great physical changes the country has undergone in the past, which appear like so many dissolving views blending the old scenery with the modern. No spot need then be altogether devoid of interest; for the poetic vision of the geologist may restore scenes of grandeur and beauty which may give a charm to the mud cliffs of Cromer, or to the uninviting flats of the Fenland; while the researches of the antiquary and the historian may further excite our interest, by telling how the various incoming tribes have contributed to give our country the aspect it now wears.* Such topics furnish almost endless subjects of study, leading us to consider the advantages we possess over those of the many generations in the past. For there can be no question that the increase of knowledge enlarges our capacity for enjoying our surroundings, and not the least important element in this is the appeal to our imaginations which may be made by a study of the origin and past history of the land in which we live.

* An interesting article on 'The Geological Influences which have affected the course of British History,' has been published by Dr. A. Geikie, in 'Macmillan's Magazine,' March 1882, and 'Geological Sketches at Home and Abroad' [1882] p. 353.

II.

ON THE OCCURRENCE OF THE DUSKY PETREL
OR SHEARWATER (*PUFFINUS OBSCURUS*)

IN NORFOLK IN 1858—

ITS FIRST KNOWN APPEARANCE IN ENGLAND.

BY HENRY STEVENSON, F.L.S., V.P.

Read 28th November, 1882.

IN the 'Zoologist' for 1858 (p. 6096) I recorded the appearance, far inland in this county, of a Petrel, which I felt little doubt at the time was an example of this rare species (rare, at least, on the shores of Great Britain), and which on examination recently, by the best authorities on these oceanic wanderers, has proved to be what I first described it.

My original notes on this interesting bird may be thus summarized. About the 10th of April of the above year it was found dead by a gamekeeper on the Earsham Estate, situated close to the south-eastern boundary of Norfolk, and within a mile of the well-known town of Bungay in Suffolk.* Captain Meade, who at that time hired the Hall and the shooting, brought the bird, in the flesh, to the late Mr. John Sayer, birdstuffer, of St. Giles, Norwich, who at once observed its marked difference in size from any Manx Shearwaters he had ever seen. Being from home, myself, at the time, I did not examine the bird in a fresh state; but I saw it within a week of its being stuffed, and its resemblance to the figure of the Dusky Petrel in the third edition of Yarrell's 'British Birds,' and in the supplement to the second edition (1856), struck me forcibly at first sight; confirmed, to a great extent, by the comparison of its measurements (though a mounted specimen) with the description given of the species by that author.

* Its flight inland, therefore, from the coast would probably have been between Lowestoft and Southwold.

It proved, on dissection, to be a male in very poor condition, and probably had been driven so far inland by a gale, and met its death through coming in contact, at night, with a tree or some other object having a wound on one side of the head, as if from a violent blow. It showed no appearance of having been shot at; and the feathers, except on the spot mentioned, were clean and unruffled; but the inner web of one foot was partially nibbled away, as though a mouse or some other vermin had been at it.* Fortunately I noted these injuries at the time, which have enabled me to identify the specimen again, beyond any doubt, though lost sight of for the last thirteen years. Having been brought to the birdstuffer by Captain Meade, and returned to him, when mounted and cased, I naturally inferred that the Petrel belonged to him; and hearing some time after that he had left England, and all his effects at Earsham had been sold off, I presumed that this rarity was lost to us altogether. In the absence of the bird itself, I was unable to support my previous conviction as to the species; whilst subsequent accounts of extremely small Manx Shearwaters being occasionally met with, made me question my own judgment in the first instance; more especially as my acquaintance with that class of marine birds was somewhat limited at that time. I specially mention this, because it will explain why I did not bring the fact of the Dusky Petrel having occurred in Norfolk under the notice of either the late Mr. Gould, when publishing his 'Birds of Great Britain,' or of Mr. Dresser for his 'Birds of Europe,' neither of which authors have included this species in the above-named publications. The re-discovery of the Norfolk specimen was quite accidental. Early in the present year, Mr. J. H. Gurney, Jun., and myself, being separately engaged in working out a complete list of the "Birds of Norfolk," and comparing notes on the subject, the right of this species to rank with other local rarities was questioned, and, "drawing a bow at a venture," Mr. Gurney put himself in communication with Mr. Hartcup of Bungay, who proved to be a trustee for the family of the late Sir W. W. Dalling, Bart., and the Earsham Estate. From him it was soon elicited that a good many birds killed on

* This was my impression at the time; but the examination of a large number of Pomatorhine and other Skuas, killed on our coast in 1877, showed that the webs of the feet, in this class of birds, are frequently mutilated.

the estate were preserved at the Hall, and amongst these, most fortunately, was found the Dusky Petrel of 1858. The thanks of this Society, and of Naturalists generally, are due to Mr. Hartcup for the opportunities he has afforded for a thorough inspection (with permission to photograph it) of this unique specimen; and, having, myself, first obtained the confirmatory opinions of Professor Newton and Mr. Osbert Salvin, it was exhibited by the latter at a meeting of the Zoological Society on the 16th of May, 1882.*

The following are my notes of the plumage of this bird as taken directly after it had been mounted:—Top and sides of the head, neck above, upper tail-coverts, upper surface of the tail feathers and of the wings, dull sooty-black; the feathers of the back, including the scapulars, dark shining, greenish, black; the feathers of the wing-coverts faintly margined with white; the chin, throat, sides of the head, below the eyes, and including a narrow rim over each eye, pure white, as also the breast, belly, and under wing and tail coverts. On the sides of the neck, and passing downwards in front of the pinions, light greyish bars shading off into the white of the breast. The injury to the head and feet I have already alluded to; but as I did not see the bird in the flesh, I cannot speak as to the true colour of the bill and feet. The former, when I saw it, was dull black; and the latter, as to the webs, yellowish brown. The following are the measurements of the Earsham specimen, as compared with those of an example in the Norwich Museum; and, as compared, also, with two average-sized specimens of the Manx Shearwater, in my own collection, from the Norfolk coast.

DUSKY SHEARWATER (*Puffinus obscurus*.)

	Earsham Bird, stuffed from the flesh.	One in Norwich Museum, stuffed from the skin.
Total length - -	12 in. (scant)	11 $\frac{1}{8}$ in.
Beak - -	1 in.	1 in.
Carpal joint to end of longest primary - -	7 $\frac{3}{8}$ in.	7 $\frac{2}{8}$ in.
Tarsus - -	1 $\frac{7}{8}$ in.	1 $\frac{7}{8}$ in.
Middle toe and claw - -	1 $\frac{1}{2}$ in.	1 $\frac{1}{2}$ in.

* See Proc. Zool. Soc. 1882, p. 421.

MANX SHEARWATER (*Puffinus anglorum*).

Two Norfolk specimens, stuffed from the flesh (sex not noted).

Total length -	-	-	15½ in.*	-	14½ in.
Beak -	-	-	1½ in.	-	1½ in.
Carpal joint to end of longest primary	9⅜ in.†	-		-	9⅜ in.
Tarsus -	-	-	1⅞ in.	-	1⅞ in. (full)
Middle toe and claw -	-	-	2 in.	-	2 in.

The discrepancies apparent in the measurements here given (though as to length only) in but two examples of each of these allied species, may well account for the exclusion by some recent authors of *Puffinus obscurus* from the British list, in the absence of undoubted local specimens; but it should also be noticed that, except as to length, there is an exact co-incident, *inter se*, in the measurement of these two examples of *P. obscurus* and *P. anglorum*; whilst the difference in length in the case of *P. obscurus* amounting to rather over an inch, and in *P. anglorum* to an inch full, may be either sexual or accidental in the stuffing of the birds; yet Yarrell stated that, of six specimens examined of *P. obscurus* (whether stuffed or in skins is not stated) each measured *eleven inches* in length, and the wing six and three-quarter inches from carpal joint to end of longest primary.

The Dusky Petrel, as Yarrell terms *Puffinus obscurus*, though I much prefer the word Shearwater for this particular group of oceanic birds, was included by him in the British list, from the fact of a single specimen having been taken, alive, on board a small sloop off the Island of Valentia, on the south-west coast of Ireland, late in the evening of the 11th of May, 1853. Yarrell says it was brought to him by B. Blackburn, Esq., of Valentia Harbour, in the county of Kerry, but does not state whether the bird had already been skinned, or was still in the flesh—an important point as regards measurements.

Whether a bird taken on board a vessel off (and it is not related how many miles off) the south-west coast of Ireland, can entitle the species it represents to a place in the list of "British Birds" is, I think, much open to question, particularly as the bird was a captive when brought ashore, and of its own free will might never have

* Yarrell gives 14 in.

† Yarrell 9½ in.

landed in Ireland at all. Anyhow, there is the evidence of such a bird passing down the western shores of that country in 1853, and in 1858 another (storm-driven most probably) is found dead, inland, in one of the eastern counties of England. Here also may be mentioned the curious fact as regards these waifs of the ocean, that the only specimen of the Capped Petrel (*Procellaria hesitata*) known to have occurred, not merely in Great Britain, but in Europe, was captured alive on a heath at Southacre, near Swaffham, in this county, in either March or April, 1850, and is preserved in the collection of the late Mr. E. C. Newcome, of Feltwell,—a still greater rarity even than the bird now under consideration.

Whether the Valentia specimen of *Puffinus obscurus* is still preserved, and where, I am unable to say; but in Watter's 'Birds of Ireland,' published in 1853, this species is included on Yarrell's authority; and Mr. Blackburn's specimen is there stated to have been "exhibited at a meeting of the Linnæan Society on the 7th of June" (1853).

As the third volume, with appendix, of Thompson's 'Natural History of Ireland,' comprising the Natatores, or swimming birds, was published in 1851, the Dusky Shearwater is, of course, not included; but in his account of the Manx Shearwater (*P. anglorum*) (p. 413), he mentions the flock of birds of this class described by authors as flying all day over the waters of the Dardanelles and Bosphorus, variously described as *P. anglorum* and *P. obscurus*, but on referring this disputed point to Mr. H. E. Strickland, who had shot one on the Bosphorus in March, 1836, that gentlemen stated that his bird was undoubtedly *P. anglorum*, but he adds: "As both this bird and *P. obscurus* are known to inhabit the Mediterranean, I have no doubt that *both* frequently migrate up and down the Bosphorus, and as their mode of flight and general appearance are similar, they have indiscriminately obtained the name of *oiseaux damnés*."*

* The cause of this startling appellation is thus explained by Bishop Stanley in his 'Familiar History of Birds,' where, in treating of rapidity of flight (2nd edition, 1865, p. 81), he alludes to the restless actions of these birds on the Bosphorus (as described in Walsh's 'Constantinople' and other travellers' stories), and gives as a reason for the above term, the superstitious belief of the Turks, who call them *Armidan*, that their bodies, from

Maegillivray includes *Puffinus obscurus* in his 'Manual of British Ornithology' (part 2, p. 263), with a reference to the fifth volume of his well-known work on 'British Birds,' but, as Yarrell points out, though the 'Manual' was published in 1842, the above-mentioned fifth volume, published ten years later (1852), "does not contain any notice of this bird." I have verified this statement, and find that many similar references in the 'Manual' are made to vol. v. of his large work, but no pages are given; and as the final volume was so long delayed by the state of the author's health, these references must have been made in 1842 to his then unpublished manuscript, from which, when printed, he would seem, from some cause or other, to have excluded all mention of the Irish specimen of *P. obscurus*.

The oceanic range of this species is remarkable; and, if Gould's *P. assimilis* of Australia is, as he presumed it to be, identical with *P. obscurus* of Europe, includes the Atlantic and Pacific Oceans, the Mediterranean, and even the North Sea as a straggler. Temminck, in his 'Birds of Europe,' speaks of it as "rare in the Mediterranean, but common on the coast of Africa to the Cape of Good Hope;" whilst Gould, in his 'Birds of Europe,' says it is "rarely found further north than the Mediterranean, on the European shores of which sea most of the European examples have been procured." It is met with in the Canary Islands, and breeds with other allied species on the Dezertas, a group of small islands about eighteen miles east of Madeira. Audubon

their very spirit of unrest, are "animated by condemned souls thus doomed for ever to frequent the scenes of their former existence." To this belief, and the difficulty of procuring specimens on the Bosphorus (as mentioned by Walsh), owing to the aversion of the Turks to any destruction of animal life, he attributes the ignorance of Naturalists, for so long a period, as to the true character of these birds, formerly taken for Kingfishers, and termed the *Halcyon voyageur*. Scarce however as such specimens may be in collections, thanks to our own Diocesan Bishop Stanley, the Norwich Museum possesses one of two, which, as he states, were killed by a singular accident: two flocks meeting, in rapid flight, immediately above a ship's boat, came into collision, and two were thus picked up by Lieut. Coppinger, R. M., of H. M. S. Malabar. This example, though in many respects answering to the *Puffinus anglorum* (Temm.), represents doubtless the light-coloured variety known as *P. yelkouan* of Acerbi, and *P. yelcouanus* of Coues, the American Naturalist.

included it in his 'Birds of America,' as does Coues in his recent "Check List" of North American birds.

Mr. Osbert Salvin, to whom I submitted our Norfolk specimen, possesses skins from, I understand, Montserrat, West Indies, New Zealand, the Galapagos Islands on the west coast of South America; and Captain Cook is said to have met with it at Christmas Island, in the Samoan or Navigator Islands, New Hebrides. Yarrell, who compared the Valentia bird with others from Madeira and Australia, believed it to be identical with Gould's Australian *P. assimilis*, of which the latter author writes (in his great work on the 'Birds of Australia'): "It is evidently the representative of *P. obscurus* of Europe, which it so much resembles, and to which it is so nearly allied, that *assimilis* appeared to me to be the most appropriate specific appellation I could apply to it." *Apropos* also of our Norfolk specimen, and with an "eternal fitness of things," as a Yankee would say, Mr. Gould further remarks, that all the examples he had seen in Australia were procured on Norfolk Island, and "consequently the seas washing the eastern shores of Australia may be considered its native habitat."

III.

ON THE OCCURRENCE OF THE SOOTY SHEARWATER

(PUFFINUS GRISEUS, GMEL.) AT LYNN IN 1851.

BY THOMAS SOUTHWELL, F.Z.S.

Read 28th Nov., 1882.

IN addition to the Shearwater of which Mr. Stevenson has just been speaking (*antea* p. 467), there are three other species of the genus *Puffinus* known to have occurred in England, and one other (*P. kuhli*, Boie), which appears to be restricted to the Mediterranean, and has not at present been recognized as occurring elsewhere. Of the British species, the Manx Shearwater (*P. anglorum*) is sufficiently well known, but it seems probable that *P. griseus* has been occasionally mistaken for the immature stage of the larger, white-breasted *P. major*. I have the pleasure of exhibiting both the latter species, and, I think, with the birds before us, the specific distinctions will be sufficiently apparent. The larger bird, *P. major*, was taken at Plymouth by Mr. Gatecombe, and by him presented to our Museum; but the smaller bird, *P. griseus*, has the additional interest of having been obtained on our own coast of Norfolk as long ago as the 26th July, 1851. I purchased the bird on the table alive, of a boy who caught it at the mouth of the river Ouse as he was returning to Lynn in a fishing-boat; it was found sleeping on the water in the afternoon of the 25th July, and secured alive. At that time I had a number of living Gulls and Ducks in a netted-in garden, and the Shearwater was added to the collection. It only survived five days; probably having been injured at the time of its capture; but I had a good opportunity of observing its actions during the time it lived. It passed the day sleeping, showing no desire to hide; but as

evening advanced it became more lively, although not particularly active; and never showed any inclination to rise on the wing or escape. The crepuscular habits of the birds of this genus will account for the circumstances under which, not only this, but other individuals have been taken; *viz.*, asleep on the water or in boats. After it died, the bird was set up by Foster of Wisbech, for the Lynn Museum; and he was very successful in giving it the attitude which it generally assumed, and which, I think, may be considered that natural to this genus when on land. At the time I quite believed my bird was an immature *P. major*; under which impression I remained till quite recently, when, at the suggestion of Mr. J. H. Gurney, Jun., I borrowed it from the Lynn Museum, and have now no doubt that it should be referred to the rarer species, *P. griseus*: in this view both Mr. Stevenson and Mr. Gurney coincide. The specimen on the table differs somewhat in colour from other individuals of the same species which I have seen; being rather clove-brown than sooty in colour. This, I would suggest, may be due to its juvenility; but, in the absence of a series of skins of either this or the nearly-allied *P. major*, in various stages of plumage, of course this is a mere suggestion. I am not aware that the plumage of the young of *P. major*, for which our bird was mistaken, has ever been described. In the re-naming of this bird, one species has to be erased from the Norfolk list; but another, and rarer one, added.

The range of *P. griseus* is very extensive: it is found, according to Dresser, in the Atlantic from Greenland to the extreme South, in the Pacific from California down at least to Chili, and off the coast of New Zealand.

IV.

ON THE BEAKED OR BOTTLE-NOSE WHALE
(*HYPEROODON ROSTRATUS*).

BY THOMAS SOUTHWELL, F.Z.S.

Read 19th Dec., 1882.

OF late years the remarkable group of Cetaceans known as the Ziphioid Whales has received the special attention of Cetologists, and the result has been a very great advance in the knowledge of their frequency and distribution, and, to some extent, of their habits also. A few years ago, with the exception of one species, *Hyperoodon rostratus*, literally nothing was known of them further than that, at irregular intervals, and in localities far distant from each other, some member of this ancient family from time to time threw itself upon the shore, and it was believed that, like the marsupials of the Australian continent, the existing Ziphioids (so abundantly represented in our seas during the formation of the Crag deposits) were the survivors of a race now rapidly passing away; this, however, has not proved to be the case to the extent formerly believed; but it is a curious coincidence that, as the continent of Australia forms in the present day the last home of the marsupials, so, both in species and individuals (with the one exception already named), the Australian seas form the head-quarters of these ancient cetaceans.

Three species of Ziphioids in as many different genera have been met with in the British seas, two of these being of great rarity; the third, the Common Beaked or Bottle-nose Whale (*Hyperoodon rostratus*), is of frequent occurrence; but of the life history of even this species, which was known and figured by Hunter as early as 1787, and which in summer congregates in considerable numbers in the North Atlantic, so little was known till quite recently, that the adult male was by some believed to belong to a different species or, even, genus, and it is to the observations made during the past

two summers by Captain David Gray, that Naturalists are indebted for a solution of the problem, as well as for much valuable information as to the habits of these creatures during their summer migration to the Greenland seas.

The examples of this species which have occurred on our coast, have hitherto generally been adult females, frequently accompanied by a single young one, no adult male having been examined in the flesh by any competent Naturalist; so that from actual acquaintance with the animal itself, the adult male has hitherto been absolutely unknown.* The skulls of these females or young males present a remarkable appearance in the greatly elevated crests of the maxillary bones, but they are wide apart, narrow, and not higher than the occipital portion of the skull. There are, however, some skulls known (for instance, one in our own Museum), in which the maxillary bones are raised much higher than the hinder part of the skull, and so thickened, as almost to touch each other in front, and to present a remarkably flattened anterior surface. Writing of one of these skulls, Dr. J. E. Gray, in a paper "On the British Cetacea" (*Ann. and Mag. Nat. Hist.* vol. xvii. 1846, p. 83), says, under the head of *Hyperoodon hunteri*, that in the British Museum there is a head of this genus, in which "the elevated crests of the maxillary bones are thickened, so that their inner surfaces nearly touch in front of the blower;" adding, "I suspect it may be a different species." This skull Dr. Gray subsequently figures and describes in the *Zool.* of the 'Erebus and Terror' under the name of *Hyperoodon latifrons*; and later

* In the postscript to a paper by Professor Flower, read before the Zoological Society of London, "On the Whales of the genus *Hyperoodon*," and published in the 'Transactions' of that Society (1882, pp. 723—726), the writer says: "Since the above note was communicated to the Society [Dec. 19th, 1882] I have received a letter from my friend Mr. Robert Collett, of the Christiania Museum, giving an account of a specimen of *Hyperoodon latifrons* (as, according to the common belief, he names it) which was washed ashore at the Lofföden Islands in April, 1881 [see "Meddelelser om Norges Pattedyrs i Aarene, 1876—81," by R. Collett]. He describes the head as perfectly quadrangular, just like a 'Kuffert' (portmanteau), with rounded angles, and altogether more like that of a *Physeter* than an ordinary *Hyperoodon*: the anterior part of the forehead being perpendicular, and the rostrum scarcely projecting beyond it. The body was proportionally slender as compared with the head."

on (P. Z. S. 1863, p. 197, and 1864, p. 241) he creates for it a new genus, which he names *Lagenocetus*. Dr. Gray evidently had never examined an individual of his new genus in the flesh; and the only instance which he gives in support of his assertion that "males and females have been seen and preserved of both species," will not bear investigation. There are doubtless, as he says, both males and females of *H. rostratus* known; but the males have all been immature; and the adult female, which he states to have been killed in the Firth of Forth in 1839 (and which he does not say that he examined himself), does not appear to answer to his type of *Lagenocetus latifrons*. The particulars of the occurrence of the female referred to by Dr. Gray will be found in the 'Ann. and Mag. Nat. Hist.' vol. xvii. (1846) p. 153: it is there said that preparations had been made of the soft parts by Mr. John Goodsir, "for the University Museum [of Edinburgh], where the skeleton itself will eventually be placed." There is no actual record of this skeleton, but Professor Turner tells me that in the Anatomical Museum at Edinburgh there is the skeleton of a *Hyperoodon*, which has been there many years: unfortunately it is not labelled, but he has always been under the impression that it was acquired by the late Professor Goodsir, and may be of the date of 1839, and if so, it is probably the one referred to by Dr. Gray. This skull, Professor Turner says, is of the same form as that of the young males; showing that the cranial characters of the adult females conform to those of the young male, which is what we might expect; but it disposes of the only instance adduced by Dr. Gray in favour of his new genus, in which the sex was said to have been noted in the flesh. All his other examples appear to have been skulls only, which of course would be useless in support of his conclusions, unless their former proprietors had been ascertained whilst in the flesh to have been females, which does not appear to have been done. Amongst continental Naturalists, both Professor Eschricht and M. Gervais were of opinion that the type of Gray's *Hyperoodon (Lagenocetus) latirostris* was a fully adult male of the common species *H. rostratus*. Criticising the opinion of the latter, Dr. Gray remarks, that M. Gervaise only gives (Zool. et Paléont. Franç. t. 38 f. 6) a reduced copy of his figure from the Zool. 'Erebus and Terror,' "instead of figuring a skull *in the intermediate state of erest*, which would have proved that such a

specimen existed and had been seen by him" (Cat. Seals and Whales, p. 310). This requirement has been amply complied with by Captain Gray, for, in the series of photographs of five excellently chosen skulls, copies of which, through his kindness, I now have the pleasure of exhibiting, every intermediate stage of the development of the maxillary crests, is most clearly exhibited from that of the young male (No. 1), in which the crests are thin, wide apart, and lower than the occipital portion of the skull, to No. 5, in which they exhibit their perfect development, and seen from the front, present a singularly massive appearance, rising far above the hinder portion of the skull.* These skulls were all prepared by Captain Gray from specimens killed by his crew, and I think cannot fail to convince the most casual observer; and although, viewing only the two extreme forms No. 1 and 5, it is not matter of surprise that, judging from the skulls alone, Dr. Gray should have described them as different species or even genera, yet, taking them all together, they cannot fail to settle, at once and for ever, the vexed question of the identity of *H. rostratus* and *H. latifrons*.

This is the first result of Captain Gray's observations. I will now refer to the light which he has thrown upon the habits of these curious animals in their summer quarters.

Soon after leaving the Shetland Isles, early in the month of March, Captain Gray expects to meet with Bottle-nose Whales, and proceeding northward to the West of Greenland they are found in Davis Strait, as far as seventy degrees north latitude, wherever there is open water; as also Hudson's Strait, Cumberland Gulf, and the numerous bays on the western shore of the main straits. To the eastward of Greenland they are met with from Cape Farewell, round Iceland and Jan Mayen northward to seventy-seven degrees north latitude, and eastward to Bear Island, and probably to Novaya Zemlya. Here they frequent the open water near the margin of the ice, swimming in small "schools" of from four to ten; numerous "schools" often

* I regret that the funds of the Society will not permit of these being reproduced in our pages, but engravings of four of the photographs, and the outlines of a series of four male Bottle-nose Whales, showing the progressive development of the head, will be found in the 'Proceedings of the Zoological Society' (1882, pp. 728 and 729), illustrating a paper by Captain Gray on the same subject.

swimming in close proximity, but apparently never mixing. The females and young males are generally together, with often an old male as a leader; but, as a rule, the latter keep apart. In this respect, as in many others, their habits greatly resemble the Sperm Whale of the South Pacific; and, like the latter, on one of their number being harpooned, the remainder refuse to desert it whilst it is alive, and frequently fall victims to their solicitude; and this is sometimes not confined to the herd of which the wounded Whale is a member, for Captain Gray says, "They will come from every point of the compass towards the struck one in the most mysterious manner." They are very difficult to kill, and dangerous to approach without great caution when wounded; and Captain Gray has known them to run out seven hundred fathoms of line, and to remain under water for two hours.

The outlines of the male at various stages of growth will convey some idea of the form of the adult. It is an even more singular-looking beast than the Sperm Whale, the forehead being almost quadrangular in shape and abruptly truncated; from the head to the back fin, which is situated about two-thirds of the distance from the head, the body decreases very little in diameter, but the remaining third rapidly diminishes in size till the tail is reached. The flukes, instead of having a medial notch, are entire along the margin, and nearly straight. The female, as is proper, has much more graceful outlines. The front of the head in the male extends beyond the junction of the upper surface of the beak, so as to produce a sort of hollow or notch, like what is known as a "beetling" brow; the flippers are small, and placed just behind the eye. The young animals are black, but with age the hue becomes lighter, till, in very old individuals, they are almost yellow; the beak and front of the head being quite white. The belly is always grayish-white. They are much infested with parasites; and the piece of skin, of which I exhibit a photograph, will be seen to be covered with a curious-looking creature, apparently all legs. Professor Flower, to whom Captain Gray sent the piece of skin, informs me that the parasites are *Cyamus thompsoni*—a sessile-eyed crustacean belonging to the order *Amphipoda*. The pursuit of these creatures is quite a new feature in the Whale fishery, and it was not till the year 1881 that they were taken in any number, the total catch of that year being one hundred

and eleven. In the season of 1882 Captain Gray alone killed two hundred and three out of a total of four hundred and three brought home. The proportion of ages and sexes killed by Captain Gray were as follows:—Ninety-six old males, fifty-six cows, and fifty-one younger males. From one of the cows killed on the 28th May, and which measured twenty-nine feet in length, a young one was taken, measuring ten feet ten inches in length, by five feet six inches in girth. Captain Gray had the skull of this fetal Whale cleaned; but, unfortunately, the rope by which it hung overboard parted, and it was lost.

It will be seen that Captain Gray's great experience of these animals for the past two seasons enables him to speak with authority; and there can be no question that he is correct in his strongly-expressed opinion that the great differences in the skull and external appearance observed in these strange creatures is sexual, and gradually assumed as maturity is reached.

There are some curious points of similarity between the Bottle-nose Whale and the Sperm Whale in addition to those of food and habits. The commercial products yielded by them are almost identical; the head contains the "case" and "junk" of the latter species; and the oil is little, if any, inferior to the true sperm oil, its market value being about £60 per ton.

At the approach of winter these creatures retire from the Arctic seas and disperse to the South. Most of the individuals occurring on our coasts are met with in the autumn; and from the fact of the old females being so frequently accompanied by their young, it seems probable that their meeting in such numbers in the Northern Ocean is for purposes maternal and matrimonial; after which, like the Seals, which visit the same seas in such vast numbers, they disperse and resume their solitary wanderings. Captain Gray has certainly rendered a great service to science in studying the habits of these animals, and in making known the results of his investigations he has solved one of the most pressing problems in Cetology.

V.

SEALS AND THE SEAL FISHERY.

BY THOMAS SOUTHWELL, F.Z.S.

Read 19th December, 1882.

AN apology is needed for offering to a Natural History Society a paper which may appear but too much like the history of a commercial industry, and which may be considered by some as altogether foreign to the scope of a local society. I trust, however, that a somewhat liberal reading of the fourth article of the fundamental objects of our Society may be allowed in this case; for most assuredly the creatures of which I shall have to speak are in great danger of extermination, and have already so diminished in numbers, at least in one of their chief resorts, as to render their history almost that of an expiring race; and it is, unfortunately, the commercial value of the northern Seals which has brought about this danger; in speaking, therefore, of their decrease it is most desirable to give prominence to the cause which, it is to be feared, is rapidly bringing about the effect of their extermination. It must also be remembered, that for the successful pursuit of these creatures an intimate acquaintance with their habits and distribution is absolutely necessary, and that as the most successful sealer is he who has best learned this lesson, it is impossible to study the mode adopted for their capture, without at the same time obtaining an insight into their life history. From the disastrous effects of the indiscriminate slaughter of the breeding Seals a very instructive lesson may be learned by the Naturalist, as well as by the professional sealer, and although it seems too much to hope that it may be productive of good in the future, it still seems desirable, if only by way of warning, to place on record the abuses which eventually led to protective legislation, alas! too long delayed.

Kindly assisted by my friends Captain David Gray of Peterhead and Mr. David Bruce of Dundee, I have for some years watched the results of the sealing voyages, and will endeavour to give some

idea of the mode of proceeding in the Greenland seas, and of the effects of the system pursued upon the vast packs of Seals which formerly resorted, and in vastly reduced numbers still resort, to the northern ice for the purpose of reproduction. With regard to the Newfoundland sealing, without some brief notice of which, as it has now become the sealing ground *par excellence*, my notes would be very incomplete—fortunately, the United States Government, in one of that series of admirable publications so worthy of an enlightened government, has, by the pen of Mr. J. A. Allen, in his ‘History of the North American Pinnipeds,’ given an exhaustive account; and to this I am very largely indebted for the brief notice of this branch of my subject.

It is difficult for us, whose lot is cast in more favoured latitudes, adequately to appreciate how vastly important to the inhabitants of the far North are the marine mammals which, more particularly at a certain period of the year, frequent the teeming waters which lave their ice-bound shores. We have not always, however, enjoyed this immunity, for in the far past, before the solitude of the temperate waters of the Atlantic was broken by the commerce of the world, and when the inhabitants of the mighty deep were still monarchs of their native element, and man, though yet in the hunter stage of his existence, was powerless seriously to diminish their numbers—the sea contributed, even in our more southern latitudes, largely to his sustenance; for in those remarkable refuse heaps known as “Kitchen Middens,” left by early man on the sea-shore and by the estuaries of large rivers, the bones of marine birds and mammals occur in such numbers as to show that in pre-historic times in temperate Europe, as in the present day in some northern countries, the flesh of Seals and cetaceans formed no inconsiderable portion of the food of the coast-dwelling tribes; and, it is said that, even so late as the fifteenth century, the principal food of the poor in some parts of the Basque provinces consisted of the flesh and fat of Whales. All this is now changed,—the Whales are exterminated, and the Seals have become rare, without our suffering inconvenience, but in the Polar seas it is far different; for, even in the present day, to the inhabitants of the Arctic Circle the Seal and the Sea-horse form the staff of life—food, light, clothing—the tent which shelters them in summer, the

boat which bears them on the sea, the barb which arms their harpoons and fish-hooks, and the runners for the winter sledge, are all furnished by these useful animals;—without them the Esquimaux would cease to exist, and the high latitudes which they inhabit would be incapable of supporting human life.

Although it is doubtful whether Seals were ever sufficiently abundant upon the shores of the British Isles to be of any economic importance, in some few favoured spots, or outlying islands, they must, during the breeding season, have congregated in considerable numbers. Low, in the 'Fauna Orcadensis' (*circa* 1790), says, that "a ship commonly goes from this place once a year to Soliskerry, and seldom returns without two hundred or three hundred Seals;" he also adds that, in North Ronaldsha, they take Seals for the purpose of eating. Martin also, in his 'Descriptions of the Western Islands of Scotland' (1716), says, that an annual slaughter formerly took place in the Hebrides, when as many as three hundred and twenty old and young Seals were sometimes killed at one time. These, as also the Orkney Seals, were doubtless *Halichoerus gryphus*; and in the Farn Islands, in 1778, the same species was still so numerous in the breeding season that seventy-two young ones were killed in that year. But, at the present day, no species of Seal is found in sufficient numbers on any part of the British coast to pay for the pursuit. In the Arctic seas the whalers, doubtless, have always given more or less attention to sealing; but it has, until the commencement of the present century, been generally subsidiary to the Whale fishery. At the present time the Greenland and Newfoundland Seal fisheries are actively prosecuted by the British, Norwegians, Danes, and Germans; and at the latter station by the British-Americans also. These two form the most important sealing grounds; but there are a few other localities also visited by sealers, which will be referred to later on. Before entering into the particulars of their capture and ultimate disposal, it will be as well to give a brief account of the Seals themselves, and of their habits and geographical distribution.

There are five species of Seal, which are principally hunted by the sealers in the northern seas. 1. The Common Seal of our own Shores (*Phoca vitulina*, Linn). 2. The Ringed Seal (*Ph. hispida*, Schreber). 3. The Greenland Seal (*Ph. groenlandica*, Fab.).

4. The Bearded Seal (*Ph. barbata*, Fab.). 5. The Hooded Seal (*Cystophora cristata*, Erxleben). One other species, the Grey Seal, which has already been mentioned as formerly abundant on the northern shores of our Islands, has occurred in the Greenland seas, but is not known to the Seal-fishers.

The Common Seal (*Ph. vitulina*) is too well known to need a description. It has a very wide distribution in temperate and Northern Europe and America, often following fish far up fresh-water rivers. Although highly prized by the Esquimaux for its flesh and skin, it is not sufficiently abundant to be of much value to the Seal-fishers.

The Ringed or Rough Seal (*Ph. hispida*), known to the Greenlanders as the Floe-rat, is the smallest of the northern Seals. It is very like the preceding species in external appearance; and notwithstanding the extremely unpleasant smell of its flesh, which renders it distasteful to more fastidious palates, it is even more highly valued by the natives, as it is resident all the year, and affords them their chief winter supply of food: from its skin, also, are made the softest and best of their garments. This species has once been captured on the coast of Norfolk; but its true home is the Arctic shores of both hemispheres, having, perhaps, a more northerly habitat than any other known mammal. It rarely ventures far from the coast, frequenting the ice formed in the bays and fjords, therefore does not often fall a prey to the sealers, but the skins are collected by the natives and sold to the whalers.

The Greenland, Harp, or Saddle-back Seal (*Ph. groenlandica*), is the chief object of the sealer's pursuit both in Newfoundland and Greenland. It is a very abundant species, highly gregarious, and of restless, wandering habits. At the breeding season they make their appearance upon the ice of the Greenland seas in countless numbers, and shortly after the mother has given birth to her single young one they are attacked by the sealers, many thousands being annually killed. The young ones do not take to the water till they are about fourteen days old, at which time they are very fat. No Seal differs so much in appearance as this species, in the various stages through which it passes before assuming the adult white coat with the characteristic band of dark brown on either side, which, commencing on the upper part of the back between the shoulders, and coming downwards, is continued along the sides till

it gradually disappears before reaching the hind flippers. The young are produced about a fortnight earlier on the Labrador ice than in the Greenland seas; and are noticed by the sealers, in the latter seas, coming north about the middle of May, in great numbers. They keep the margin of the ice all the way, taking a rest every day until they reach latitude seventy-six degrees, when they change their course to east by south, and steer for the south end of Spitzbergen. They then pass onward until they reach the shores of Novaya Zemlya, and even Franz Josef Land, where they were seen by Mr. Leigh Smith in the season of 1880. The Greenland sealers know that these later migrants come from Labrador, not only from the vast increase which they observe in numbers, but also from the fact of their frequently finding small shot lodged in the skins of the new-comers, this mode of attack being peculiar to the Labrador sealers, the Greenland crews always using a single bullet. A full grown Harp Seal will weigh two hundred and thirty pounds, and produce about one hundred pounds of skin and blubber. This species has been captured at least once on the British coast, and probably seen in a few instances.

The Bearded Seal (*Ph. barbata*) is solitary in its habits, and nowhere very numerous. It is believed to be the "Square Flipper" of the Newfoundland, and the "Ground Seal" of the Greenland sealers. To the Esquimaux it is very important, its blubber being esteemed a luxury from the delicacy of its flavour, and the skin which is exceedingly tough is used for making the lines attached to their harpoons. The young of this species take to the water immediately after birth. It is not sufficiently numerous to be of much commercial importance.

There remains one more species, the Hooded or Bladder-nose Seal (*Cystophora cristata*), and this, like the Harp Seal, is also a migratory species, and has been known to stray as far south as our own shores: its true home, however, is the circumpolar seas. Many of them are taken between Iceland and Greenland in the month of June, in which seas they arrive later than the Harp Seal; but their chief resort is the ice in the seas surrounding Jan Mayen. The Bladder-nose is very fierce in disposition, and difficult to kill with the club, in consequence of the curious "hood" which, in the adult males covers the front part of the head, where Seals are ordinarily most vulnerable, and which it can inflate at pleasure. This is one of the

largest of the northern Seals, and when full grown will reach two hundred pounds in weight.

It may be well here, before speaking of the great sealing grounds of Newfoundland and Greenland, briefly to refer to a very considerable branch of this industry carried on in the fresh waters of the Caspian Sea. Mr. J. A. Allen ('North American Pinnipeds') says, that the annual average take of Seals in the Caspian, for the six years ending 1872, was one hundred and thirty thousand, and that the Seals are said to measure from three to six feet in length, and to weigh from seventy-two to one hundred and forty-four pounds. Whether or not the Caspian Seal is a distinct species seems doubtful. It was described by Pallas as a variety of the Common Seal (*Ph. vitulina*), and by Nilsson as a distinct species, under the name of *Ph. caspica*; notwithstanding its abundance, however, very little is known about it, but it is probable that this, and a Seal found in the fresh waters of Lake Baikal, are both very closely allied to the Seal already mentioned under the name of *Ph. hispida*.*

We have no very precise information with regard to the early history of the Greenland Seal Fishery, although, no doubt, from the time when our whalers first visited the Greenland seas, it has more or less occupied their attention. On the west coast of Greenland the hunting is mainly carried on by the natives for their own support, and it is only the produce not required by them that is exported. Dr. Rink estimates the annual catch by the natives at about 89,000 Seals, about one-half of which are required for their own purposes: the skins of the remainder are exported. Until of late years the vessels from the ports of Northern Europe took no part in the Newfoundland Seal fishery, but confined their visits to the seas surrounding Jan Mayen, the ice-fields lying between the east coast of Greenland and Spitzbergen, and the shores of Novaya Zemlya, known as the Greenland seas. Here the Seals captured are mainly the Harp and Hooded species, whereas on the western coast of Greenland, although the Harp Seal forms the bulk of the capture, the Hooded, Bearded, Ringed, and Common Seals figure largely in the returns.

Both the Whale and Seal fisheries from this country are now virtually

* For an account of the method pursued by the sealers of the Caspian Sea, see an article in the 'Field' for April 14th, 1883 (p. 474).

confined to the ports of Dundee and Peterhead;* but the Dutch, Danes, Germans, and Norwegians all send out vessels. Since the introduction of steam many of the vessels, after taking their share of the Seals, either at Newfoundland or Greenland, proceed to the Whale fishery.

The history of the Seal fishery, from the wasteful and cruel way in which it has been prosecuted, has for many years been a declining one. In 1850 there were forty sail of ships of various nations amongst the Greenland Seals, and there were few vessels which had less than 10,000 Seals—some of them had as many as 15,000. In that year six of the Peterhead ships took 61,837 Seals, one ship alone having 16,135. Ten ships went out, but four of these—which took 31 Whales between them—evidently neglected the sealing, taking only 1619 Seals; omitting these four, the average of the remaining six vessels was 10,306. It was believed that the supply of Seals was inexhaustible, and the result was, that the Peterhead ships alone were increased from ten in 1850 to twenty-eight in 1859, and those from other ports in proportion. As neither experienced masters nor men, capable of conducting the fishery successfully, could be found, although a large number of Seals were taken, enough could not be secured by so large a fleet to make the venture pay. Two of the vessels were lost in the latter year, the remainder took 43,110 (out of which 9639 fell to one vessel), or an average of 1,658 Seals each; in 1861 the returns were still worse, fourteen vessels took only 8,457, or an average of 604.

Steam was first introduced into the Whale fishery in 1857, when the iron steam-ship 'Inuit' was sent out to Davis Strait, and the following spring she proceeded to the Greenland Seal fishery, returning to Peterhead, after a voyage of three weeks, with one hundred and fifty tons of oil. Her success raised the cupidity of the iron-steamship owners of Hull and Newcastle; and as the Baltic, where most of these steamers were employed, is often closed during the months of March and April, it is not surprising that the prospect of earning some ten thousand pounds in about thirty days was irresistible to them. The consequence of this was, that in 1859 fifty-two vessels were lying in Bressay Sound, bound for the Seal fishery; so difficult was it to make up their compliment of men, that some of the

* A few vessels owned in Liverpool and Greenock also go to the Newfoundland fishery, but as I have no exact statistics with regard to them, they will only be mentioned incidentally.

vessels had to go on to Orkney to complete their crews. The result of the voyage has been given above.

Iron steam-ships, however, had but a short reign. In due course they sailed, but some never returned. Meeting with rough weather several of them came in contact with the ice, and the 'Empress of India,' the 'Recruit,' and the 'Innit' went to the bottom. Since this disastrous voyage (with one exception, the 'River Tay,' from Dundee, which met with a like fate in Davis Straits in 1868, her first year) no iron steam-ships have ventured to brave the thick-ribbed ice.

The Dundee whaler 'Tay,' a full-rigged ship of 600 tons, was fitted with an auxiliary screw in 1858; and the introduction of steam soon proved so advantageous that new wooden steam-vessels were speedily built, and the old sailing vessels converted, so that in 1869 the whole of the Dundee fleet were screw-steamers. At first the crews of the steam-vessels, from want of knowledge of the habits of their prey, were not very successful; but after a time it was discovered, that if the Seals were sighted in the water and followed till they took to the ice to produce their young, by allowing two or three days to elapse, they became so reluctant to desert their offspring that both parent and young fell easy victims. The men were then let loose, and shot down every mother Seal which ventured upon the ice to suckle its young, or even showed its head above water: the young Seals being of little value so early in the season were allowed to crawl away and die. It need hardly be said that this mode of hunting the Seals simply meant extermination, and rapidly produced most disastrous effects.

Captain David Gray, in a touching letter published in 'Land and Water' for May, 1874, pleading for a close-time in order to afford some protection to the Seals when most required, after giving a most interesting account of the habits of the Seals when nursing their young upon the ice, thus describes the manner in which the sealing was at that time prosecuted:—

"To give some idea of the reverse of this picture, I will endeavour to describe what came under my notice on the 29th of March. The men belonging to the five ships were all on the ice by four o'clock in the morning; the harpooners, to the number of forty or upwards, shooting the old ones, the rest of the crews dragging the skins to the ships, and before night upwards of *four thousand*

old Seals had been taken. The ice was streaked with blood in all directions and spotted with carcases, the young ones in thousands yelling for their mothers, following the skins as the men dragged them to the ships, and sucking the crags (*i.e.* skins) in desperation.

“In many instances, old Seals with a bullet through them, or a hole in the back of their neck that one could easily put both hands into, could be seen attempting to nourish their young. Very frequently the mother was shot in the act of suckling its young; this being considered the most favourable chance, as there is no risk of the Seal sinking, and saves the labour of hauling it on the ice. In this case the young usually continued to suck, unconscious of the change until driven away by the fletcher.

“It was quite a common occurrence for an old Seal coming on to its young to be surrounded by five or six starving wretches, which she would drive off very savagely; but as soon as one was away another would be at her, until her patience would be utterly exhausted, and she would run into the water again in desperation, without effecting her purpose.

“As the work went on we could easily distinguish the cubs that had been without their mothers for one, two, or three days; the last being mostly dead, the others crawling over the ice in lots, huddling together for heat, and trying to suck one another, until they also succumbed. The first day the men were directed to kill the pup when they were certain it belonged to a dead mother; but we were obliged to stop this, it was so difficult to tell which was the right one.

“Above I have given a faithful description of how the Seal fishery is conducted at present, without exaggerating in any way. I overheard some of my men saying to one another, ‘It is a shame, this sort of work,’ and so it is.” All honour to Captain Gray, who, amongst others, did his utmost to prevent it. It was entirely by the efforts of the sealers themselves that a better state of things has been brought about.

Before the introduction of steam, a few of the sailing ships usually managed to get amongst the Seals when they were with their young; but most of the vessels had to wait and watch for the young brood coming to sea; and, although they also frequently secured good cargoes, this method was far less hurtful than that just described, because the majority of the old ones were allowed

to bring forth and rear their young in peace, and afterwards to get away themselves to renew the ræe in the next season.

About this time, the English, Dutch, and Danes quietly went out of the trade: the Germans made a feeble attempt to get up a steamer or two, but did not enter into it with any spirit. Their ships were old, and converted from sailing ships into screw-steamers, and wanted power. In a short time they also disappeared.

The Norwegians had more spirit. They came over and bought a number of the Scotch sailing vessels, thinking that by hard work and superior skill they could still compete with the steam vessels; but they soon found they had undertaken a fruitless task, and abandoned the old-fashioned vessels. At the present day they have a fleet of fifteen steamers, which often secure large cargoes of Seals, taken in the month of June between Iceland and Greenland, and almost entirely of the "Hooded" species. This fishery only commenced in 1877, and has been very successful until the present year (1881), when, owing to the very bad weather experienced, the ships returned with very poor cargoes. The Hooded Seals come across to the Greenland ice when the ice on the Labrador coast disappears.

By 1871 this wasteful mode of fishing had made itself seriously felt, and the ships could only average about half a cargo before the young Seals were all taken. By some it was believed that the main body of the Seals had divided, and that those encountered were only a portion of the pack. Others thought that bad weather had washed the young Seals off the ice and drowned them. One thing, however, was painfully apparent: the number of Seals had grown gradually less, till there were not sufficient left to fill the ships which were fortunate enough to get amongst them. In 1871 one Peterhead ship took 10,942 Seals; in 1874 the same ship, under precisely similar circumstances, secured only 1402. In 1875 the same vessel took 9769; but there were only *five* steamers present. Had the whole fleet got amongst the Seals they would have been very badly off indeed.

Writing in 1868, Dr. Brown predicted that, supposing the sealing prosecuted with the same vigour as at that time, he had little hesitation in stating that before thirty years had passed away the Seal fishery, as a source of commercial revenue, would come

to a close, and the progeny of the immense number of Seals then swimming about in Greenland waters would number comparatively few. In 1877 this prediction was so far verified, that the Dundee vessels had deserted the Greenland seas for Newfoundland; Captain Adams having "for some years been of opinion that that ground [the Greenland] was practically used up, and hence his visit to Newfoundland."

In the meantime both the Norwegian and Scotch sealers had been anxiously striving to secure some enactment to prevent the total destruction of the Seals, and consequent extinction of an important branch of commerce. In 1871, Captain Jackob Melsom of Tönsberg, in an article in Petermann's 'Geographische Mittheilungen,' traced the great decrease in the number of Seals to the introduction of steam, and the too early arrival of the vessels at the sealing grounds, and suggested a "close-time" as a remedy. In 1874, Captain David Gray, the veteran Peterhead whaler, in a letter to 'Land and Water'* (before quoted), pointed out the horrors of the sealing trade as at that time prosecuted, and pleaded for speedy legislation with regard to a close-time. In September, 1874, a meeting of the managers and owners of the Seal and Whale fishing vessels belonging to the port of Peterhead passed a resolution, memorializing the Board of Trade to prevent by legislative enactment, and if, necessary, by international agreement, the prosecution of the Greenland Seal fishery at a date earlier than the 6th of April. A letter was also printed in 'Land and Water' † in 1875, from Mr. Looenskiold, embodying the views of the ship-owners of Southern Norway with regard to a "close-time," and giving some startling statistics with regard to the decline of the fishery as carried on from that country.

Her Majesty's minister at Stockholm having also brought the importance of the matter before the Home Government, the Board of Trade at length held an inquiry at Dundee, on the 1st of December, 1874, at which the principal owners and commanders of Whale and Seal fishing vessels, of the ports of Dundee and

* 'Land and Water,' May 9th, 1874.

† 'Land and Water,' Aug. 28th, 1875 (p. 160).

Peterhead, were unanimous in their request that a "close-time" might be enacted; the only difference of opinion being as to the day on which it was considered desirable that the fishery should commence. The result of this universal feeling was, that after consulting with the Norwegian Government, an Act was passed in 1875, prohibiting any British subject from killing, capturing, &c., any Seal within an area included between the parallels of sixty-seven and seventy-five degrees north latitude, and the meridians of five degrees east and seventeen degrees west longitude, under a penalty not exceeding £500 for each offence, one-half to go to the prosecutors. The time when it was to become legal to take Seals was left to be determined by an Order in Council, and after mutual concessions on the parts of those concerned, it was fixed to take place on the 3rd of April.

For some reason the Act of 1875 was not enforced till the year 1877, since which time its regulations have been strictly adhered to by all the vessels of various nations which have taken part in the Greenland Seal fishery. The Seals have now been protected for five seasons, and through the kindness of one of our most experienced sealers—Captain David Gray—whose efforts largely assisted in the good work of promoting the Act of Parliament referred to, the writer is enabled to give a brief summary of each subsequent year's operations, showing the effect of the "close-time," so far as can be at present estimated: this cannot be better done than in our informant's own words.

"In 1877 the 'close-time' came into force, and when the opening day dawned, the 3rd of April, thirty-two steamers and one sailing brig put their crews on to the ice to scramble for a share, for it could be called nothing else. Every Seal was cleared off the ice in a day and a half, with about an average of two thousand five hundred Seals per ship. It was still said that this could not be the main pack of Seals, and the ships accordingly went away in search of more but without finding any.

"In 1878, the sealing opened under rather different circumstances, there being only sixteen steamers amongst the Seals, consequently the average catch was about four thousand.

"In 1879, we again had the whole fleet of over thirty steamers congregated about the Seals before the opening day. The result

was a very poor season, the average being only from twelve to thirteen hundred per ship.

“In 1880, the whole of the ships were ready to begin on the opening day, and there certainly was a much better appearance of Seals than there had been for some years, for which I give the close-time credit, by allowing more of the female Seals to get away. The ships averaged two thousand seven hundred.

“This year (1881) it is very difficult to tell what the result might have been had the weather been good. The ice was driven out to sea with heavy northerly gales, which washed the young Seals off the ice, and when the old Seals brought their young ones back again they were so much scattered that it was hardly possible to glean them up. Three thousand fell to my share.

“I am now quite certain that the close-time for the Seals is doing a great amount of good, although many years must elapse ere they recover the unfair, cruel, and short-sighted way in which they have been hunted down.”*

It is very satisfactory to find that at least some benefit has arisen from the close-time; but it is thought, by many persons of experience, that the fishery still opens two or three days too early. On the other hand, there are those who think that it might commence earlier still with advantage. It is to be hoped, however, that the happy medium has been fixed upon. By commencing too early the young are comparatively valueless (every hour makes a surprising change for the better in their condition): the old females also, from their unwillingness to quit the young ones, fall victims at a time when they are in poor condition from nursing. It would seem, therefore, that the date for commencing should be so fixed, as to insure the young ones being in the most profitable condition, and that the old females may escape to renew the brood the next season.

* Since the above was written, another season has passed (1882), not less remarkable for bad weather than the preceding one. Some of the vessels missed the Seals altogether; two took respectively 468 and 102 only; and the remaining six vessels secured amongst them 21,572, or an average of 3,595 Seals each. It is impossible to say what they might have done under more favourable circumstances; and the past two seasons can hardly be taken as tests of the operation of the close-time.

After the young Saddle-back Seal fishing is over—usually about the middle of April—the fleet separates; most of the Dundee vessels returning home to discharge their cargo, and coal up for the Davis Strait Whale fishery, from which they return about the end of October. For some years past, two or three ships belonging to Dundee, instead of returning home with the other vessels, have come South to hunt the Hooded Seals between Iceland and Greenland. It is reported that in future years, unless the Dundee vessels secure larger cargoes than of late, they will not return home from the sealing, but that a coaling-station will be established for them at *Rekjavik*, in the south of Iceland; whence, after filling up, they will proceed direct to the Davis Strait Whale fishery.

The Seal and Whale fishing fleet consists of fine screw-steamers from 233 to 522 tons register, and about seventy-horse power. They are specially constructed for ice navigation, having iron stem-plates, “with iron ice-plates carried round the bows, and iron side-plates. They are strongly fortified, and stanchied inboard; while the outside planking is covered with a doubling of iron-bark [the hardest wood known, imported from Australia] from the lead-line down to the bilge. The stem has considerable rake, so that they can charge the ice at full speed, rise to it six or eight feet, and then come down upon it with crushing force.” With such vessels as these, manned by picked crews, and commanded by officers possessed of a life-long experience of ice navigation, voyages are annually made which they themselves are the last to talk about; but should they chance to become known, as happened in the past season with regard to Captain Adams of the ‘*Arctic*,’ their skill and daring excite universal admiration. Dr. Rae, writing of Captain Adams’ voyage of 1881, points out that he visited three of the most dangerous openings of the Arctic Sea. “as far as, or further than, any of our grand and expensive Government expeditions, and brought his ship safely home—all, too, in one season. In one of these channels *Belcher* abandoned his two ships; in another, *Franklin’s* ships came to grief; and in the third, after a gallant struggle of three seasons, *Sir John Ross* left his little vessel, the ‘*Victory*,’ to her fate;” and yet these feats of daring and seamanship are repeated year after year, as the ice permits, in search of the Right Whales of Davis

Strait and Greenland, with what judgment and skill may be inferred from the small list of casualties recorded.

During the past season (1881) nine Dundee vessels went to the Greenland Seal fishery, capturing 12,559 Seals, and six to the Newfoundland fishery for 139,985 Seals. They afterwards, with two or three exceptions, went north to the Davis Strait Whale fishery.

The Peterhead fleet is now reduced to three steamers, one sailing barque, and one brig. One of the steamers has hunted the Hooded Seals for the past two seasons, the other two have continued to prosecute the Greenland Whale fishery; but in the interval between the taking the young Saddle-back Seals and the 20th of May, on which day they start on the Whale fishery, they either shoot old Saddle-backs, or go south to the east coast of Iceland in search of Bottle-nose Whales. Of the two sailing vessels the barque proceeds to the Seal and Bottle-nose Whale fishery, or to Cumberland Gulf in search of Whales; the brig takes part only in the Seal fishery. The five Peterhead ships have taken 11,425 Seals, and 94 Bottle-nose Whales in the Greenland seas during the past season (1881).

The Norwegians go south, and hunt the Hooded Seals during the months of May and June. Most of their produce comes to Dundee or London.

The Danish settlements on the west coast of Greenland, which were established for the purpose of hunting the Right Whales from the shore in spring, as they came north on their annual migration, capture very few Whales now, their produce being almost entirely Seals and Walrus.

From the statistics of the Dundee sealers given above, it will be seen that vast numbers of Seals are taken annually on the Newfoundland or Labrador ice. I have said that Captain Adams, finding the Greenland Seal fishery "practically used up," determined to try the Newfoundland sealing ground: the result has been, that since 1876 the port of Dundee has been well represented in that quarter, and with considerable advantage to the vessels engaged. The ships leave Dundee in the first week of February, calling at St. John's to complete their crews. They are not allowed to clear at the Customs in Newfoundland for sealing till the 10th of

March, after which they may capture Seals as soon as they can get amongst them. The fishery is from various causes extremely uncertain; and although the Dundee fleet has done well in the past season, out of a total fleet of sixty Newfoundland and Dundee vessels present, twenty are said to have returned empty. There can be no doubt that the Newfoundland Seal fishery will speedily be ruined, like the Greenland fishery, if the present wasteful mode of proceedings is long continued. Many ships, since steam has been introduced, if successful at first, run back to St. John's, land their cargo, and go back again to hunt the old Seals, at which they are often very successful. The number of Seals taken at the Newfoundland fishery by the St. John's and Dundee vessels from 1870 to 1881, both inclusive, is 3,332,157; the smallest take being in 1872 (141,035), the largest in 1879 (441,500). The total number of seal-skins exported from Newfoundland and Labrador for the year ending 31st July, 1881, was 447,903; but these numbers, as will be seen, large as they are, fall far short of the actual destruction which has taken place during that period.

The following account of the Newfoundland Seal fishery is condensed from Mr. J. A. Allen's 'North American Pinnipeds,'* and is by him derived from a work on the 'Seal and Herring Fisheries of Newfoundland,' by Michael Carroll of Bonavista, published in 1873.

It was not till the year 1763 that the Newfoundland Seal fishery was regularly prosecuted in vessels especially equipped for the purpose. In 1787 the business had already begun to assume importance: during that year 5000 Seals were taken. In 1807 thirty vessels were engaged in it. In 1834 the number was three hundred and seventy-five, besides "a considerable number" from Nova Scotia and the Magdalen Islands. In 1857 the number of vessels exceeded three hundred and seventy, and 500,000 Seals were taken. The sealing at this date seems to have reached its maximum, so far as the numbers of vessels and men were concerned, and the number of vessels has since greatly decreased, although, owing to their superior size and the introduction of steam, the number of Seals

* 'History of North American Pinnipeds' by J. A. Allen, U.S. Geological and Geographical Survey of the Territories. Miscellaneous Publications, No. 12, Washington Government Printing Office (1880), pp. 497—499.

taken remains about the same. "According to statistics furnished by Governor Hill, C.B., of Newfoundland, to the Home Government, it appears that in 1871 the whole number of vessels employed in sealing was one hundred and forty-six sailing vessels and fifteen steamers, manned by 8850 men. The exports of Seal products for that year from Newfoundland were 6943 tons of oil, valued at \$972,020, and 486,262 skins valued at \$486,262, the catch for the year being 500,000 Seals, which were sold for the aggregate sum of \$1,452,282. The single steam-ship 'Commodore,' of Harbour Grace, brought in 32,000 Seals, valued at £24,000 sterling."* In the year 1873, the last year quoted by Mr. Allen, the catch was 526,000 Seals.

As to the mode in which the Newfoundland sealing is prosecuted, and the dangers from drifting ice, fog, and storm, to which the ships are exposed, Mr. Carroll gives some interesting particulars, which it is impossible to quote here; but as a specimen of the wasteful destruction of life which annually takes place, a short description of a process technically known as "panning," is too suggestive of the results which must of necessity follow to be omitted. "No greater injury," says Mr. Carroll, "can possibly be done to the Seal fishery, than that of bulking Seals on pans of ice, by crews of ice hunters. Thousands of Seals are killed and bulked, and never seen afterwards. When the men come up with a large number of young Seals, that cannot get into the water, owing to the ice being in one solid pan, they drive them together, selecting a pan surrounded with rafted ice, on which thousands of Seals are placed one over the other, perhaps fifteen deep. A certain number of men is picked out by the ship-master to pelt and put on board the bulked Seals, whilst others are sent to kill more. It often happens that the men are obliged to go from one to ten miles before they come up with the Seals again, and very often the men pile from five hundred to two thousand in each bulk, which bulks are from one to two miles apart; care is also taken that flags are stuck up as a guide to direct the men where to find such bulked Seals. So uncertain is the weather, and precarious the shifting

* This valuation appears too high. 32,000 Seals would yield about 320 tons of oil, worth say £28 per ton; the skins would average about four shillings each, in all £15,360.

about of the ice, as well as heavy falls of snow and drift, that very often such bulked Seals are never seen again by the men that killed and bulked them, as the vessels and steam-ships are frequently driven by gales of wind far out of sight or reach of them, and frequently wheeled or driven into another spot, where the men commence killing and bulking as before. In many instances it has happened that the crews of vessels, as well as the crews of steam-ships, have killed and bulked twice their load. No doubt Seals that are bulked are often picked up by the crews of other vessels; but such is the law, that so long as the flags are erected upon the bulks, and the vessel or steam-ship is in sight, no man can take them, notwithstanding the vessel's or steam-ship's men that bulked them may be ten miles away from them; whilst another vessel may be driven within a quarter of a mile of the thousands of bulked Seals, but, owing to the law, dare not take them."*

Sometimes the vessels are driven quite away, and the bulked Seals deserted; thousands are rendered useless by the effects of either frost or sun; and not unfrequently from the capsizing of the pan all the bulked Seals are lost; or, in bad weather, the drift-ice, "rafting" over the bulks, destroys them entirely. Mr. Carroll asserts that not less than ten or twelve thousand pounds' worth of Seals' pelts are lost annually by this system of hunting.

It seems incredible that, after so many years of wasteful hunting, the Seals should show no decrease. Such is said, however, to be the case. It must be remembered that the numbers of Seals found on the Jan Mayen and Greenland ice were declared to be inexhaustible; but that after a certain limit was reached, they rapidly decreased. That a similar result must follow in the Newfoundland sealing seems inevitable, unless some steps are taken so to regulate the fishery as to prevent the indiscriminate slaughter which annually takes place; and the first step in that direction should be the abolition of "panning."

Since the introduction of gas, and more recently of mineral oils, for the purpose of illumination, the demand for Seal and Whale oil has, of course, greatly decreased; so likewise has the supply.

* 'North American Pinnipeds,' pp. 551—552.

The price has not, therefore, fallen so much as might have been expected: the average price per ton of Seal oil is now from £25 to £30. The bulk of the oil is consumed in Dundee in the manufacture of jute fibre, an industry which has been developed to a surprising extent of recent years in that town; and it is doubtless owing to this fact, that the Whale and Seal fisheries have gradually become centred in the port of Dundee—the only port in the United Kingdom, with the exception of Peterhead, which still sends vessels to the Seal and Whale fishery.

The skins of the Seals are salted as soon as the blubber is removed, and in a rough state are worth about five shillings each. Some are dressed with the hair on; but the bulk are made into leather. They vary very much in size and quality, according to the species from which they are obtained. From the year 1819 to the season of 1881 the Peterhead sealers have taken 1,696,945 Seals; which, at an estimate of eighty Seals to the ton of oil, the oil being valued at £28 per ton, and the skins at five shillings each, would yield £1,018,172. From the year 1860 to the season just closed, the Dundee vessels have taken 1,146,082—the bulk of them in Newfoundland;—which, upon the same valuation, shows a gross return of £687,648.*

The above imperfect sketch of the progress and present position of the northern Seal fishery refers more particularly to those gregarious species, such as the Saddle-back, which at the breeding season collect in vast packs, and when nursing their young fall an easy prey to the hunter. Since the Right Whale and the Walrus have become scarce, the vessels which formerly made these great beasts the primary object of their pursuit, picking up such Seals only as came in their way, have now given their attention to the smaller game; and the introduction of steam has so perfected the

* The past season (1882) has been a very trying one to the Newfoundland sealers. Six vessels left Dundee, and, from the vast accumulation of ice in the Atlantic, only succeeded in reaching St. John's with great difficulty and after much delay. The number of Seals killed was only 63,204, and these were very unequally distributed—24,663 falling to one vessel, the remainder averaging only 7708 Seals each. In 1881 the same six vessels took 139,985 Seals, or an average of 23,301 each; but that year, for the Dundee vessels at least, was an exceptionally good one.

mode of attack, that it is hardly reasonable to expect the Seals will long survive the indiscriminate slaughter to which they are exposed; and it seems probable that, sooner or later, these animals will be so reduced in numbers that it will not pay commercially to incur the heavy outlay now requisite for their successful pursuit.* A remnant will thus be left to continue the species and except those who have so recklessly wasted what might, with common prudence, have for an indefinite period continued to be an important source of profit, probably nobody will be much the worse, but the results of the extermination of the resident species found on the coast ice throughout the year would be disastrous in the extreme.

So long as the natives killed the Seal and Walrus with the rude weapons at their command no harm was done; and an abundant supply of nutritive food, peculiarly suitable to the requirements of life in the high latitudes which they inhabit, could always be obtained; but of late they have been supplied with guns, and are encouraged to destroy the Seals, not only for their own requirements, but in order to dispose of their skins. What the result will be it is not difficult to predict. As the North American Indian was dependent upon the Buffalo for his very existence, so are these northern races dependent on the Seal and the Walrus, and without them must as surely perish; but with this difference, that the Red man will leave a country which in time may be one vast food-producing tract—the Esquimaux, a frozen wilderness, in which no man but himself can dwell. That such a consummation is greatly to be feared there is but too much evidence; and if recent reports are to be relied upon, already in the countries bordering on Behring Strait, the natives are rapidly disappearing in consequence of the wasteful destruction of their staff of life.

The population south of St. Lawrence's Bay are said to have been reduced by the destruction of the Walruses, on which they subsist, by one-third of their former number; and "in a village which formerly contained two hundred inhabitants, only one man survived." The Whalers say that, "for every hundred Walruses killed, a native family must perish by starvation," and they, therefore,

* I am informed that it requires 15,000 Seals, equal to about £7200, to pay the expenses of one of the large Newfoundland steam-sealers,

refuse to kill any more. Since the practice of Walrus shooting has been introduced, not only has the number of animals killed annually been greatly increased, but the proportion of those lost, to those obtained, has likewise greatly increased. In 1879, in Behring Strait, between thirty and forty thousand Walruses are said to have been destroyed, out of which number, only about eleven thousand were secured.*

It will be seen that it is from the Walrus hunters themselves, as also from the sealers, that the cry "Hold! Enough!" comes; but, although their magnanimity is beyond all praise, it is as unwise to subject these men to the temptation which at present exists, as it is unfair to expose them to the injury they are liable to sustain at the hands of others less scrupulous than themselves, should the trade be left quite open as at present. From justice therefore, as well as humanity, surely such a state of things calls for some restrictive legislation, similar in nature to that already in force with regard to the Seals, ere it is too late to avert the evils which must of necessity follow, should the present wasteful destruction of the Walrus be long continued.

P.S.—Since the above has been in type, by the arrival of the Dundee sealer 'Polynia,' Capt. Walker, news has been received of the Greenland sealing fleet. The voyage, so far as reported by the 'Polynia,' has been even less productive than that of 1882; the seven vessels spoken having taken only 16,950 Seals (4000 of which fell to the lot of Captain David Gray, of the 'Eclipse'), or an average of 2421 against 3595 in 1882. The Norwegian fleet of fourteen vessels is reported to have secured 34,900 Seals, or an average of 2493. Captain Walker considers the state of the Seal pack such, that having regard to the large fleet present, there was very little chance of the catch paying expenses.

With regard to the Newfoundland fishery, Mr. Bruce informs me that of twenty-five large vessels present six came off "clean;" the remaining nineteen captured 283,720 Seals, principally young Harps, or an average of 14,932; the greatest number secured by a

* See a report of the Whales and Walrus fishing in Behring Strait, published in the 'Field' for March 27th, 1880 (p. 381).

single vessel being 32,000. Amongst the six Dundee vessels the produce of the voyage was more evenly distributed than in 1882, and the average reached 15,000; but if it be correct that it requires precisely that number of Seals to pay the expenses of one of these costly vessels, the voyage cannot be considered, commercially, a very successful one, notwithstanding the enormous number of Seals killed. It seems impossible, vast as are the packs of breeding Seals which visit the ice-fields of Newfoundland, that they can long survive the yearly attacks made upon them, the results of which are very inadequately represented by the published returns (see p. 499), and that too at a period when quiet and retirement are so necessary to the due fulfilment of the functions of reproduction, and it cannot fail ere long to produce a perceptible effect on their numbers. The turning-point once passed, the Newfoundland fishery must soon, like that of the Greenland seas, be utterly ruined.

 VI.

 ON *LITHOGLYPHUS* FROM THE WEYBOURN CRAG.

BY CLEMENT REID, F.G.S. (H.M. GEOLOGICAL SURVEY).

(Communicated by T. Southwell.)

Read 30th January, 1883.

Among the Mollusca recently found in the Weybourn Crag of East Ranton, near Cromer, were several specimens of a shell, which deserves more than a passing notice. They possess the rimate umbilicus, and other characters, which separate the genus *Lithoglyphus* from the other *Littorinidæ*; and on comparing the fossil shells with the recent *L. fuscus* from the Danube, in the British Museum, neither Mr. Edgar Smith nor myself were able to detect any difference, except that the Weybourn Crag specimens are rather

smaller than the recent ones. This, however, may be due to the practice of selecting unusually large specimens for a museum. The two Danubian species, *L. fuscus*, Zieg. and *L. utricoides*, Fér. are very closely allied, and have apparently been transposed by several German writers.* Under the circumstances it does not seem perfectly certain to which of the two species our fossil should be referred.

A description of the genus, and a figure of *L. fuscus* (the type of the genus) will be found in Woodward's 'Mollusca,' but as it is not included in any monograph on British recent or fossil shells, the generic characters are given below:—

Lithoglyphus, Megerle. Type *L. fuscus*. Shell naticoid, often eroded; whorls few, smooth; aperture large, entire; peristome continuous, outer line sharp, inner lip callous; umbilicus rimate; epidermis divaricous; operculum pauci-spiral.

The Norfolk fossil is semi-globose, thick, solid; spire short, obtuse, whorls 4; length 8 mm., breadth 6 mm. The recent shell lives on stones and water plants.

The discovery of this fresh-water shell in England, associated with *Corbicula fluminalis*, is of especial interest, as *L. fuscus* is now confined to the Danube, and no species of the genus had previously been recorded, either living or fossil, north of the Alps. It seems to be a fresh instance of a genus, formerly distributed over a wide area, which has now become extinct in the intermediate districts. The living species inhabit the Danube, South America, and, according to Woodward, Oregon; the only extinct form of which I have been able to find any record is also from the Danubian basin.

* See Spiridion Brusina, Fossile Binnen—'Mollusken aus Dalmatien Kroatien und Slavonien,' p. 67.

VII.

METEOROLOGICAL NOTES, 1882.

By A. W. PRESTON.

Read 27th February, 1883.

THE following brief notes on the weather of 1882, together with the dates of some of the vernal indications of the remarkably early spring of that year (so far as a resident in so large a city as Norwich could observe), are compiled from personal observation. No regular barometrical or thermometrical readings having been taken, they are necessarily very incomplete, and this remark will also apply to the rainfall (except for the month of December, when the readings were regularly taken from a Symons 5-inch rain-gauge). It is much to be regretted that the admirable papers contributed to this Society by Mr. Quinton, registrar of the Norwich Meteorological Society, have been discontinued, as they formed a valuable addition to the 'Transactions,' the readings being taken from first-class instruments, and the notes supplied by an experienced meteorologist. It is of course a difficult matter for an amateur, whose time is much occupied, to give such an amount of attention to meteorological occurrences as would be required to furnish a proper and complete record, but the accompanying notes may perhaps imperfectly give some idea of the general character of the weather during the past year.

JANUARY.

Following the finest and warmest November that has occurred for many years, and a mild and stormy December, the year 1882 entered with dull and squally weather and much rain. Storms, predicted from America, took place on the 2nd and 6th with heavy rain and gales from the west. These were followed by a bright and warm period to the 13th, when an unusual and protracted high barometrical pressure produced dull, dry, and foggy weather to the 24th. On the 18th the barometer stood at the extraordinary

height of 30.95, which is stated to be the highest reading recorded since the year 1825. The 24th was warm and sunny, with a spring-like temperature; the succeeding days were cooler and dry, with slight fog. Rain on the 29th, then dull to the end of the month. With the exception of the 30th and 31st (when the wind was easterly), southerly to westerly winds prevailed all the month. There was no snow, and little or no frost. Crocuses observed in bloom in the open on the 12th.

FEBRUARY.

This month entered with a few rime frosts and bright days. From the 5th to the 11th another anticyclonic period ensued, the sky being obscured nearly the whole time. From the 11th to the 15th finer, then two days' rain, after which dulness prevailed to the 25th (except the 19th), the barometer continuing high (30.65 on the 20th). The 26th was very mild and squally, the highest shade temperature on that day being 57 degrees and the lowest 51 degrees. Stormy weather followed, culminating in a great rain and heavy gale from the south-west on the evening of the 28th. The prevailing currents throughout the month were again from the south and west. Vegetation was unusually early, the Hawthorn beginning to show its leaves by the 23rd.

MARCH.

The first three weeks of this month were of an unusually warm and pleasant character. Squalls of wind and low barometer (29.00 on the 1st) continued during the first four days, after which, from the 5th to the 20th, an almost summer-like temperature prevailed, with clear skies, westerly and south-westerly winds, and hardly any rain. The thermometer stood above 55 degrees every day during that period, and on the 10th it reached 60 degrees (maximum), and on the 16th and 20th 64 degrees. The usual equinoctial disturbance occurred on the 21st, the wind veering to the north and bringing showers of snow; but it soon passed off, and settled weather again prevailed to the end of the month. The unusually early start vegetation received in the previous month, combined with the warm and sunny period which followed, caused a very premature growth; and by the end of the month it was quite three

weeks in advance of the average, pears, cherries, &c., being in full bloom, and such trees as Horse Chestnuts, Sycamores, and the earlier Elms, in leaf.

APRIL.

A bright and dry period prevailed from the 1st to the 11th, with easterly winds. On the 12th the wind veered to the south, and on the 13th 0·74 of rain fell. Very fine and warm on the 14th (60 degrees), then cold and wet to the 20th. The 20th and 21st were fine and warm (63 degrees), after which a cold, wet, and stormy period continued to the end of the month. A furious and destructive gale from the south-west occurred on the evening of the 29th; its force had been unequalled since the memorable gale of the 14th of October, 1881, and much damage was done to the fruit crop in all parts of England. Vegetation progressed rapidly the first half of the month, after which it received a check. The Oak showed its leaves as early as the 5th, and the Hawthorn bloomed by the 28th (being the first time of its having been recorded in April since 1840). The Nightingale was heard in Norwich on the 18th.

MAY.

On the whole a pleasant month, and not characterized with the usual prevalence of east wind. During the spring it only blew from this quarter on nine days in April and seven in May, and even then it was far from approaching in severity the easterly winds to which we have been accustomed in the spring-time of recent years. The weather was very rainy the first ten days, then fine and warm to the 14th (66 degrees on the 11th), cold to the 17th, then fine and warm to the 25th (72 degrees on the 23rd). Heavy rain fell on the 25th (0·64), after which the weather continued very warm to the end of the month, the thermometer standing at 73 and 72 degrees on the 28th and 29th respectively (Whit Sunday and Monday). The Ashes, which leafed so much later than all the other trees this year, were in full leaf by the 28th.

JUNE.

This month was almost as cold, wet, and ungenial as June, 1879. The first three days were dull and cool, with northerly winds. The 4th was remarkable for a heavy thunderstorm which passed

over Norwich on the afternoon of that day. The weather continued showery to the 7th, and on the 8th, 9th, and 10th deluges of rain fell. The 13th was very cold and wet with slight sleet; dull and unsettled to the 26th, heavy rains occurring on the 18th, 19th, 22nd, and 25th. Variable winds prevailed to this time, much being from the north and north-west, and the air was constantly damp. On the 26th a pleasant change occurred, and the weather continued warmer to the end of the month, the thermometer registering 75 degrees on the 29th.

JULY.

The month of July had scarcely commenced when the brief spell of fine weather which set in at the latter part of June broke up entirely. On the 5th we had a return of the old story of heavy showers, frequent thunder, and cold air, which continued to the third week of the month. On the 15th (St. Swithin's day) torrents of rain fell, and heavy thunderstorms took place on the 23rd and 24th. The weather then continued changeable, but warmer, to the end of the month. No excessive heat was registered, the highest temperature recorded being 77 degrees on the 30th.

AUGUST.

This was the finest month of the summer, the first part of it being very pleasant with occasional rains. The 6th was the hottest day of the year, 83 degrees being recorded. This day and the 12th were the only two occasions during the year that 80 degrees were attained. The wind from the 6th to the 13th was chiefly easterly or north-easterly, with clear skies. Heavy rain fell on the 14th and 15th, then fine and warm to the 19th, on which day rain fell in the evening. The 20th was fine and warm till the evening; and the summer may be said to have ended on that day; for a wet, cold, and unsettled period then set in, and continued with but few fine intervals to the end of the year. Heavy rain fell on the 21st, 22nd, and 23rd, with a westerly gale on the night of the 22nd. Harvest operations were, as in the past five or six years, much interfered with by the frequent rains.

SEPTEMBER.

Entered with wet and squally weather, which continued to the 6th, after which anticyclonic conditions prevailed, with light easterly breezes and calms. Pressure began to give way on the 11th, and the 12th and 13th were very wet. The 14th and 15th were finer, then variable to the 19th, after which heavy rains to the 22nd. Fair to the 28th, but much rain on the 29th and 30th.

OCTOBER.

This month has the reputation of being the wettest October for seventeen years past; in fact, with but two or three exceptions, it was the wettest October ever known. A few fine and warm days at the beginning of the month (68 degrees on the 1st) were followed by a terrific thunderstorm on the night of the 8th, when 1.04 of rain fell, notwithstanding that the barometer stood at 30.14 and the wind east. The weather from the 11th to the end of the month was of the most dismal character, with rain almost daily, and on many occasions it rained without intermission the entire day. 1.30 fell on the 21st, and 1.03 on the 24th, on which day a heavy southerly gale prevailed. On the 27th, at 2 p.m., rain commenced falling heavily, and continued without an hour's abatement for about thirty-six hours, being accompanied by a destructive gale from the east causing many shipwrecks and much damage to property. 1.71 of rain fell in the thirty-six hours, of which 1.05 fell on the 28th. The barometer was highest on the 5th (30.54), and lowest on the 22nd (29.10). The total rainfall of the month was 6.50, or more than double the average, for this, a usually wet month. A bright aurora was seen on the evening of the 2nd.

NOVEMBER.

A mild, but very wet and stormy month, with frequent disastrous gales. Although the rainfall for the month was not half that of October (the total being 2.94), rain fell on no less than twenty-six days. The fiercest gales were on the 8th and 14th, the former from the south-west, the latter from the east. Slight frosts occurred on the nights of the 12th, 18th, 28th, and 29th, but in no case did the thermometer fall below 29 degrees. A brilliant crimson aurora

appeared on the evening of the 17th. The barometer fluctuated much, and was highest on the 6th (30·10) and lowest on the 9th (29·12).

DECEMBER.

Slight snow on the 2nd, followed by rain; squally to the 7th. The transit of Venus on the 6th was, with the exception of the first fifteen minutes after external contact, obscured at Norwich by a heavy cloud-bank. The wind was easterly, and blew up dense masses of cloud and fog. Slight snow fell again on the 7th but was followed by rain, which fell in torrents from the north-east, 0·95 being recorded for that day. Nearly all parts of England were visited with a great snowstorm, and for some days unusually severe weather prevailed; but in Norfolk there was little or no snow, although some rime frosts occurred on the nights of the 9th, 10th, 11th, and 12th. Eight degrees of frost were registered on the last-named night. Dense fogs prevailed more or less till Christmas. The 25th was a day of incessant rain (0·57 fell), and the weather was mild, wet, and unseasonable to the close of the year. The thermometer stood at 55 degrees on the 28th, and 54 degrees on the 29th. Rain fell on seventeen days, the total fall for the month being 3·87.

The total rainfall for 1882 was 34·97, which is the largest amount registered in one year since 1860, and is about 8 inches above the average for the past twenty-four years.

VIII.

ORNITHOLOGICAL NOTES FROM NORTH NORFOLK
DURING THE WINTER OF 1882—83

(SEPTEMBER 30TH TO MARCH 1ST INCLUSIVE).

BY J. H. GURNEY, JUN., F.Z.S.

Read 27th February, 1883.

The past winter* has been on the whole singularly unprolific, as far as Norfolk is concerned. The storm of Jays, alluded to by Mr. J. Cordeaux in the 'Zoologist,' † though specially looked out for, did not appear on our coast, ‡ and though we had the usual migratory arrivals from the far north, there were no such rushes at Cromer lighthouse as sometimes occur. All kinds of game have done well, except Woodcocks. Of Pheasants (tame-bred) there has been an abundant supply, and Partridges were really quite as numerous as in 1881. Two such good years are some recompense for the exceptionally bad seasons which preceded them. The open weather at Christmas gave a fine time of it to the flocks of Fieldfares on our Hawthorn hedges, and to the Blackbirds, which had no

* The following notes, referring chiefly to birds which have occurred in the neighbourhood of Cromer, must only be considered as supplementary to Mr. Stevenson's annual summary for the whole of the county.

† 'Zoologist,' 1883, pp. 1, 76, 77.

‡ This is the more remarkable, as it was noticed in Lincolnshire, Northamptonshire, Hertfordshire, and Hampshire. Writing to me from Hertfordshire, Mr. J. E. Littleboy says, that Jays have been more abundant than for many years past, and that he had heard of them in all directions. They have long been known as migrants to Norfolk, and a remarkable instance is recorded at Tunstal in Suffolk. In October, 1871, I recorded a great many seen at Cromer. A great many were also once seen at Easton, which is eighteen and a half miles from the coast.

thought of migrating while the good fare lasted, while dense little packs of Sparrows, Chaffinches, etc., might be seen here and there,—some of them entering with hearty participation into the threshing out of the farmers' stacks, a game they are always ready to help at.*

On the 30th of September a Honey Buzzard, a dark, somewhat purple-tinted bird, was trapped at Northrepps, in the "Cottage Wood," close to the place where I remember seeing two when a boy, as usual, at a Wasps' nest, which was in a bank.

On November 15th a Peregrine Falcon appeared, and signified its presence by attacking a Gull. The gamekeeper, hearing screams, looked up and beheld, high in the air, the Gull just struck. It flew towards him, and the Peregrine, after another futile attempt, sheered off. Birds, under the influence of terror, will fly to man to escape a Hawk, of which they stand in much greater fear. I remember a Skylark at Blakeney flying towards me, under similar circumstances, with a Merlin in pursuit.†

A marked feature of the autumn migration was the arrival of large bodies of Golden-crested Wrens, in the early part of October. On the 13th there were, literally, hundreds on the highlands of Trimmingham, which is on the coast; the hedgerows of some turnip-fields, about a quarter of a mile from the cliff, being full of them. At the same time I heard from Mr. G. Smith, of Yarmouth, that a great many had appeared there; and they did not escape their share of casualties; for on the 20th I had twelve in a box from Hunstanton lighthouse, of which six were flame-crested males. Again, at Trimmingham, on the same day I saw a great many, and

* Last year was quite as mild. On the 5th of December Martins were flitting up and down at Cromer, evidently late migrants from the far north, following the line of the coast, and not in any hurry to get on. Trees and all vegetation were very forward, a still greater proof of the mildness of the season. Celandine, Primroses, and other spring flowers were early in bloom.

† As bearing on this *trait*, perhaps the following incident will not be considered irrelevant, which occurred at Beaumaris, and was communicated to my father by the person to whom it happened. One day, when fishing at sea, a Skylark appeared, pursued by a Merlin; the Lark took refuge in the boat, and the Merlin in its impetuosity dashed into the sea, and was captured. The Hawk paid the penalty, and the Lark died of fright in twenty-four hours, during which interval it was observed constantly panting.

at Cromer it was reported that some had appeared, with a Greater Spotted Woodpecker, in the gardens of the town. From a letter received from H. Gätke, it appears that the migration extended to Heligoland. He writes, in answer to some queries: "Towards end of October very great numbers of *Sylvia rubecula* and *Regulus flavicapillus*, the latter during the night, on the 28th and 29th myriads, on the 29th, early, the island covered with them." From the date it appears they did not come from Heligoland to us; more probably both Norfolk and Heligoland were supplied from a country further north. Goldcrests have frequently been known to come to our lighthouse,* but this migration only produced four, two of which were on October 14th, when I was in the lighthouse for several hours, but they did not turn up until I had left. With them appeared an Owl, which was supposed to be trying to catch them.

The Greater Spotted Woodpecker remained more than three weeks, and was often to be seen on some rustic palings close to a house, the surface-bark of which was denuded for several yards in its search for insects. It was the only example I heard of, of a species sometimes very frequent, and which I have more than once seen, passing over fields on migration in autumn, at Cromer.

On October 12th I found any amount of Thrushes in the low scrub on the sand hills at Blakeney, most likely a large arrival that very morning. Every little bush was full of them, and, as they seemed rather small and dark, some were shot to make sure what they were. These dark, foreign Thrushes have been often noticed in Lincolnshire by Mr. J. Cordeaux, but when one has them in the hand there is not so very much difference.

On December 6th I received a notice from Mr. C. R. Whitty of a Waxwing shot at Holme, but the only examples killed in our neighbourhood were one sent to my father on the 15th from Palling, and two shot about the same time at Sherringham out of a

* In the first of those three valuable reports on migration, drawn up with so much care and labour, by Messrs. Harvie-Brown and Cordeaux ('Zoologist,' 1880, p. 161). Cromer lighthouse is credited with arrivals of "Wrens" on May 23rd, May 27th, and Sept. 12th (*l.c.* p. 176). I imagine, from the fact that the name of "Wren" is applied very indefinitely by the Principal, who has made no speciality of Ornithology, that in this case Goldcrests are intended, and not the real *Troglodytes parrulus*.

flock which were seen on a hedge in the middle of the village. The last great arrival was in 1867; so it is about time we had another "rush" of them, sixteen years having passed since this "harbinger of famine" appeared among us, which is about the same period which had previously elapsed after the great invasion of 1850. It is quite certain that their appearance has nothing to do with severity of weather in this country, an extra prolific breeding season in their own being more probably the cause, as occasionally happens with the Sand Grouse, and Rose Pastor, and other species.

About the middle of January we had a decided arrival of Wood Pigeons, and the farmers began to complain that they were punishing the young blades of the future hay crop, which in the open weather were appearing above the ground. Some of them had very dark backs, like Wood Pigeons I have shot in Durham, and they may have come from that county, where a general smokiness pervades the plumage of all birds. The keeper caught forty-eight alive in a contrivance sometimes used here—a shed with a net to let down in front of it. One was a whity slate-colour, while three were young birds, apparently very late hatched, and showing only a trace of the neck ring. The Wood Pigeon seems sometimes very late in hatching. I once found a nest with two eggs, and the old bird on them, on the 7th of September. I have some notes from Mr. Frank Norgate on the subject:—In 1871, on the 8th of September, he took a fresh egg from which the old bird had been shot on the 2nd; and the same day saw another old bird sitting, whose young ones did not fly until about the 13th of October; while in 1878 he shot four very young ones on the 1st of February.

The keeper took several more subsequently, which showed immaturity in some part of their plumage. Thus, of seventeen netted on the 18th of February, no less than eight were decidedly marked with brown on the back and wing-coverts. The slate-coloured bird is still alive: it has for its companion a Stock Dove, which is as tame as the other bird is shy. This also was caught in the net, and is the first of the kind I have seen at Northrepps for a long time, though they used to be fairly common. It seems that as they, like the Red-legged Partridge, extend the area of their distribution they become thinner at the centre; though it may be in this parish merely the effect of "thinning" the woods and the absence

of hollow trees. After we had had them a short time they had a battle with a wild Wood Pigeon through the bars of their respective cages. The pugnacity consequent on the amatory season led to the attack I suppose; the result was sad loss of plumage.

The first Woodcock I heard of was at Sherringham, on September 6th, and followed by extraordinarily few others; for, with the exception of eight at Felthorpe, and twelve at Sandringham, I did not hear of any day which could be called even good until the middle of December, when on the 13th I saw about thirty at Hempstead. In the beginning of January we had another flight.* Mr. G. Smith tells me that on the 9th of November a Woodcock was seen to come off the sea, and strike slightly the window of a house in Yarmouth, after which it flew round the corner of the house, and was lost among some small gardens. Some reflection on the glass may have been the cause, as Ducks have more than once in foggy weather been known to mistake skylights for ponds.

On November 13th a Red-necked Phalarope paid us a visit, choosing the most public ponds it could find by the road, for the space of four days, when it was shot in the adjoining parish of Roughton, and proved a female—I think adult; for on comparing it with seven others (all Norfolk killed), I find that two of them have buff stripes on the back, and sides of breast grey. These I take to be young birds, and the others, which lack these characters, to be old ones. I learn from Mr. C. R. Whitty that two more were shot between Lynn and Sutton Bridge, on the last day or two of October. I think this bird has occurred more times in Norfolk than the Grey Phalarope, though the reverse is the case in most counties, particularly in the south of England.

On January 22nd, hearing from the Rev. H. H. Lubbock that there were Goosanders on Gunton lakes I went over, and was much pleased at getting a view of thirteen, all females, or young males. However, ten days later the number had increased to sixteen, among which I was told were four old males. On the 16th it had dropped to eleven. Gunton lakes have been known as a winter resort of the Goosander—which, by the way, is decidedly a commoner bird in Norfolk than the Merganser—for the last sixty

* It is a well-known fact on our coast that the autumn migration of several species of birds goes on until long after Christmas.

years, since Hunt recorded one there in 1827; and as their habit is, when they have found a large lake with plenty of fish, to stick to it, they will probably remain at Gunton some time, though on the 19th they were seen on some ponds at Antingham, having been shot at and frightened.

A good many Ring Ouzels were seen at Weybourne about September 20th. A Kentish Plover occurred at Blakeney, September 26th, a species sometimes overlooked from its extreme resemblance in immature plumage to the Ringed Plover. A young Merlin was caught at sea somewhere off Yarmouth, October 11th, and is flourishing in our aviary. A young Knot was caught at Cromer lighthouse, October 14th. The Principal, who had no idea what it was, could not be sure if he had ever caught one before; but I once had one from a lighthouse on the south coast; and among bird wings received by Mr. E. T. Booth from light-vessels off our coast, he mentions two Knots, and adds that it was known by the keeper of the "Newarp" to be of frequent occurrence. A Lapwing was caught about the 6th of February, which I was just in time to prevent being entered in the migration schedules as a Curlew! And this was the only thing which Cromer lighthouse afforded all the winter, except a few Starlings and Larks. It has always been a mystery to me why so many Starlings should be killed against lighthouses. The number of Redwings and Thrushes is as nothing to them. With their straight steady flight, they hurl themselves upon the lantern, and next morning are lying, stiff and stark and open-mouthed, a few yards from the tower, as I have seen them when riding on to the hills before breakfast.

IX.

ORNITHOLOGICAL NOTES FROM SCOTLAND.

By J. H. GURNEY, JUN., F.Z.S.

Read 27th February, 1883.

The following Notes refer to a fortnight spent very pleasantly at a shooting-box in the valley of Clova, near Kirriemuir in Forfarshire. The height of the valley above the sea is from five to eight hundred feet, and the mountains adjoining from one to three thousand feet. The higher of these are well suited to Ptarmigan, which, with a few Dotterel and Golden Plover, live at a much higher range than the Grouse.

Golden Eagles frequent these lofty solitudes, seeking often for the Mountain Hare, but their prey occasionally consists of such small game as Beetles.* There were two nests this summer at the head of the valley; one of them exactly opposite the drawing-room window at Glendole, and I was told the young could be seen in it with a telescope. The old deerstalker said that they more often than not got off only one young one. To use his own expression, the young ones "barked like a puppy." They had left the neighbourhood long before I got there, and I had to content myself with one fine view of an old bird, and a more distant inspection of the nests through a telescope. They were not so inaccessible but that any one who went at the right time of the year might be easily lowered into them with a rope. A short time ago the deerstalker, having been requested by a person to get him some very rare plant, which grew only on the crag near the Eagle's nest, found himself assailed by the Eagle in a very ticklish position, and nearly shared the fate which it is said often awaits Chamois attacked by a Lammergeyer.

Other birds of prey are not very numerous. A pair of Peregrines nest every year at Glendole; and I got a brief view of a Kite, a bird which all the gillies agree in saying is now extremely rare. The

* An unmistakable Eagle's pellet contained multitudinous Beetles' remains, which had evidently been swallowed by the Eagle in some form or other.

deer-forests are the salvation of such birds as the Kite, the Kestrel, and the Merlin, which are rigorously kept down on preserved Grouse-moors; and what these moors are, may be judged from the fact that fifteen hundred brace, or even more, in a season is a moderate bag for a first-class moor.

I had expected to find the Buzzard common, having on a previous visit to Scotland seen several (and, as I recollect, three nailed to a barn-door, with lesser fry, too far gone to skin); but I only saw one at Kirriemuir.

Of small birds the Titlark is the most abundant, and the Chaffinch where there are trees; and the Ring Ouzel, and the Water Ouzel, or "Water-Crow" as the natives term it, are of course two of the most characteristic birds of the valley. The Ptarmigan is found in some plenty on one or two of the taller mountains; in one day we saw about forty, exactly like the cairns of boulders which they inhabit, a wonderful protection for them from birds of prey when there is no other shelter whatever. In another search after them we only saw twelve. As the Ptarmigan takes the tops of the mountains, and the Grouse takes the lower slopes, so the Black Grouse keep to the woods in the valleys. I am told there is sometimes a separation of the sexes in this species; and to a certain extent I noticed it at Clova, the males frequenting a wood by themselves, and the females another wood by themselves. Right down to the valley you find the Black Grouse, and even below them, as it were, the common Partridge, puny insignificant birds compared to the plump fellows we are accustomed to in the turnip-fields of Norfolk. A great triumph was the shooting of an old cock Capercaillie. It was sitting on a middle-sized Larch tree, near the top, and its crop was full of the Larch needles on which it had been regaling. Its weight was seven and three-quarter pounds. At Dunira, in Perthshire, they are so common that thirty have been shot in a day; and as many as nineteen were shot there this season; so much have they spread since they were reintroduced into Scotland by the Marquis of Breadalbane and Sir T. F. Buxton forty-four years ago.* Clova is thirty-five miles from where they were introduced.

* The subject is very thoroughly treated in Mr. Harvie-Brown's 'Capercaillie in Scotland,' and a map of the present range of the species is given.

X.

OBSERVATIONS ON THE HABITS OF
THE BEARDED TIT (*PANURUS BIARMICUS*)
IN CONFINEMENT.

By J. YOUNG, F.Z.S.

Read 27th February, 1883.

THE difficulties in the way of observing this charming bird in its natural state, owing to its scarcity, its shyness, and the nature of its haunts, are so great, that I venture to think that a few observations on its habits in confinement may not prove altogether uninteresting.

I may remark *en passant* that the English name is quite a misnomer, for it has, in my opinion, no affinity whatever to the true Tits, of which genus (*Parus*) I have kept every indigenous species and some others; indeed, I do not consider that it is nearly allied to any other British bird.* I have kept Bearded Tits almost continuously from 1870 to 1882, when my last—a male which I had had nearly five years—died.

In the spring of 1875 I possessed a cock and two hens, the former obtained in November, 1873, and the latter in November, 1874. They were, I have every reason to suppose, at the time of purchase, birds which had been recently caught and imported from Holland. Observing that they evinced a desire to breed, I procured some coarse grass which I found growing on a railway embankment. The stems of this grass were from eighteen to twenty-four inches high. I imported as much as I could get, roots and all, into my aviary. In the centre of one of the thickest tufts I placed a wire nest such as is used for Canaries. The birds displayed the

* See foot-note by Mr. Stevenson, p. 522.—ED.

liveliest interest whilst I was placing the grass in the cage,* which it nearly filled; and in the course of a few days, in fact before I had found time to supply them with nesting materials, they had laid four eggs in the bare wire nest, bare with the exception of a few blades of grass which they had plucked from the growing plants. The eggs, which were extremely fragile, were broken and the nest was forsaken.

They then commenced a nest on the floor of the cage, amongst some hay and grass I had thrown in, which was soon finished, but deserted when seventeen eggs had been laid in it. In the meantime I introduced a quantity of the tops of the common Reed, about eighteen inches in length, dropping them into the cage in an upright position amongst the growing grass. I also supplied strips of bass matting, cut into lengths of from twelve to eighteen inches, nests of the Meadow Pipit, and the downy catkins of the Sallow. A third nest was built among the upright grass and reed-stems, about six inches from the floor: this was a deep, cup-shaped edifice, the exterior of which was composed of bass matting. The lining was of fine grass from the Pipits' nests, with here and there a piece of Sallow down. When a bird was on this nest, nothing was visible save the end of its tail. After laying twelve eggs they began to sit, but after eight or ten days this nest was abandoned and pulled to pieces, the materials being used in the construction of a fresh nest. Subsequently two others were built, making six in all, containing the following numbers of eggs; viz, 4, 17, 12, 8, 4, and 4, total 49, laid between the 30th May and 2nd August. At this latter date I removed the materials from the cage, fearing that the birds might become exhausted; indeed, they did not live long, the cock dying in the next April, whilst the hens died in the following November and July. On removing the remains of the nests, &c., I found a quantity of broken egg-shells, showing that other eggs must have been laid. Two eggs were frequently laid in the same nest in one morning, so that I presume the nests were common to both hens, and I frequently saw the cock-bird pair with both.

I had birds laying in 1876, '77, and '78, and found that the simplest plan for providing nesting places was to stick the tops of Pampas Grass round a six-inch pot of earth, a site they took to

* The size of the cage was four feet by two feet, and about three feet high.

readily. The cock was the principal architect, and he also took his turn on the eggs during the day. The nests were so well concealed, that the only way I could see them was by looking down at them from the roof of the cage. The eggs were laid about eight or nine o'clock a.m., and when the birds had left the nest I found that the lining was invariably pulled over the eggs. I have observed that the eggs of the Blue and Cole Tits are sometimes hidden in this way.

The ordinary notes of the Bearded Tit are exceedingly musical, quite unlike those of any other bird with which I am acquainted. It has no song, but makes a sort of crowing, which consists of three or four notes uttered slowly, great stress being laid on the last, which is much drawn out. This utterance is accompanied by an elongation of the neck, somewhat after the manner of the barn-door cock. It has also a curious habit of scratching in the sand, when searching for food, like the common fowl; this may have given rise to the name "Reed Pheasant," by which it is known among dealers. It moults once a year, in the autumn. It has no spring moult, nor does it shed the tips of its feathers as some birds do. The plumage of the cock when new is suffused with a delicate bloom, and he is then truly lovely to look upon; but this soon fades in confinement. They will eat a variety of seeds, and are fond of Canary and Millet, and especially so of the small gunpowder-like seed, sold as "maw" seed (? a species of Poppy). They are partial to Meal-worms, Gentles, and many other insects.

It is a pretty sight to see a number sitting close together, preening each other's feathers with their eyes half shut, murmuring softly to one another. I can well imagine a family party thus sitting on a prostrate Reed in the middle of some thick reed-bed, sheltered from the mid-day sun, "dreaming the sultry hours away." The least noise, and they disperse in every direction; and then wait in silence till the danger is past, when a few musical call-notes reunite them side by side as before. At other times their clear ringing alarm-notes would reduce the other occupants of the aviary to silence in a moment. It is by far the most interesting cage-pet of which I have any knowledge. At first shy and timid, it soon however acquires confidence, and becomes exceedingly tame to those who are kind to it. Its affectionate disposition makes it desirable to keep a number together; quarrels are unknown, even in the breeding season, when most birds become more or less pugnacious.

Should one die, the rest proclaim their grief by loud and incessant calls, nor do they cease calling for some days. It is almost impossible to keep one alone. The hen of a pair in my possession having died, the cock was inconsolable, refusing to touch his food. Hoping to divert his attention, I allowed him to fly about the room, when he at once settled down in front of his own reflection in the looking-glass with every sign of delight. This little incident suggested to me the idea of hanging a small looking-glass in his cage: this I did, and he at once appeared perfectly happy, taking to his food, and nestling close to the glass, uttering a series of low, soft, musical notes, eminently expressive of happiness. Whether he eventually discovered the deception I know not, but he did not long survive his loss.

The following curious accident happened to one of these birds in my possession, which but for its timely discovery would have caused its death. It would seem that, whilst preening its feathers, the sharp point of the lower mandible penetrated the loose skin of the upper part of the breast, and the poor bird was unable to extricate it. When discovered, the feathers of the breast were saturated with the saliva which had escaped from its open mouth; and the lower mandible was found to be so bent, that it was two or three days before it could close its beak properly. As soon as the lower mandible had been disengaged, and the bird returned to the aviary, it at once went to the water and drank copiously, evidently suffering from severe thirst, doubtless caused by the loss of saliva.

I do not think it would be at all difficult to breed this bird in confinement, provided one could hit upon suitable food for the young ones. In the case of Siskins I successfully overcame this obstacle, after ten years of failure, by supplying the old birds with the pupæ of the Gentles of the common Blow-fly. This food might possibly answer in the case of the Bearded Tit.

[The following note on the above paper has been kindly furnished by Mr. H. Stevenson.—ED.]

NOTE.—My long acquaintance with this beautiful species on our Norfolk Broads, in a purely wild state, must be my excuse for supplementing some of Mr. Young's remarks upon its habits and

affinities, more particularly as I was unavoidably absent from the meeting of our Society at which his most interesting communication was read.

Mr. Young very properly takes exception to this bird being classed with the genus *Parus*; but whilst arriving at that conclusion, from a close observation and comparison of the diet and habits of the true Titmouse with those of the so-called Bearded Tit, he is probably not aware that Macgillivray, in his great work on 'British Birds,' differing alike from Continental and British ornithologists of his day, maintained the Fringilline affinities of this strangely beautiful creature.

Even though the eccentric names given to many of our familiar British birds by that accomplished Naturalist have in scarcely a single instance been adopted, still his professional skill in studying the digestive and other internal organs of the species which came under his notice has established his fame, and in this species he pointed out, from its diet alone, a connection rather with Passerine birds than the *Parinæ*. A single specimen contained in its crop (though feeding mostly on seeds) twenty examples of *Succinea amphibia*, and four *Pupa muscorum*, whilst, as he remarks, "none of the *Parinæ*, nor, indeed, any bird of the whole order of the *Cantatores*, has a crop, which, on the other hand, occurs, in a greater or less degree of development, in all the *Deglubitores*."

These views of the great Scotch Naturalist were fully confirmed by Mr. R. F. Tomes in a paper on this species, published in the 'Ibis' for 1860,* in which, from internal and osteological evidence, he decides that it has little in common with the Tits, but, from its digestive organs, as pointed out by Macgillivray, is closely affined to the Huskers, and, therefore, distantly allied to its reed-bed companion the Black-headed Bunting (*Emberiza schoeniæus*) of this country, and the "American genus *Ammodramus*, whose mode of life is very similar." "The affinity to the Tits," he remarks, "is very remote; the bird in question has not the abrupt bristle-tipped tongue of a Tit, and its œsophagus is dilated towards the right side, as in all the birds which I have referred to the order of Huskers."

* "Remarks on the Internal Structure of the Bearded Tit-mouse (*Calamophilus biarmicus*)," by Robert F. Tomes, C. M. Z. S. (1860, p. 317).

To the above, as of purely local interest, I may add that the specimens upon which Mr. Tomes founded his opinion on this somewhat vexed question, were procured by myself, in Norfolk, and forwarded to him through Dr. Sclater, Secretary of the Zoological Society.

This would seem to be the only known species of the genus *Calamophilus*, as Mr. Dresser, in his recently published 'Birds of Europe,' considers the *C. sibiricus* of G. R. Gray's 'Hand List' by no means established, and not known in Kamskatca. Mr. Young alludes to the term "Reed Pheasant" as applied to this species, which is a common name for it amongst the Broad-men of Norfolk, but simply, I believe, from the length and form of the tails of these birds suggesting a resemblance to the still longer appendages of the Pheasants of our woods.

It has been said that this is not an indigenous species in this county, but imported, many years ago, from Holland; still, though Sir Thomas Browne does not include it in his 'Account of Birds found in Norfolk' (as published in Wilkin's edition of his works), nevertheless, in a communication to John Ray,* he mentions "a little bird of a tawney colour on the back, and a blew head and yellow bill, and blaek legs, shot in an osier yard," to which, for distinction sake, he gave the name of *Silerella*.

From such a description, written so far back as 1674, it is not difficult to recognize the Bearded Tit of our Norfolk Broads at the present day.

* This extract is from an extremely scarce little book by John Ray, entitled 'Rays Collecti,' containing "a collection of English words not generally used, &c.," in two catalogues, one for the northern and one for the southern counties. Also "Catalogues of English Birds and Fishes, and an account of the preparing and refining such metals and minerals as are gotten in England." London, 1674.

XI.

ADDITIONAL NOTES

ON THE SPRINGS AND SPAS OF NORFOLK.

BY H. B. WOODWARD.

Read 27th February, 1883.

My former communication on this subject (p. 318) has been so far productive of good as to elicit some additional facts of interest.

In a nonsensical work, entitled 'Is Geology Antagonistic to Scripture? . . . containing a geological description of the Hunstanton Cliff, in Norfolk,' by an M.A. of Cambridge (1863), mention is made (pp. 148, 149) of "the Chalybeate Spring, in the Ringstead Downs, about a mile and a half distant from the new hotel of Hunstanton,"—the 'Golden Lion,' I presume. The spring is situated in the yard, close by the old farm-house in the Downs, and is described as a "powerful Spring, strongly impregnated with iron."

Mr. W. Whitaker, to whom I am indebted for the reference just given, also kindly lent me a copy (imperfect) of an epistle in verse on Reflex Spring, addressed to "Dear Joe," and dated Lynn, October 26th, 1804. It was not signed, nor was the title-page preserved; but there can be no doubt this was the work (previously noticed, p. 321) by John Grisenthwaite. The following extract gives all the information it contains, of any interest, connected with the spring:—

"In the midst of a wood, like all others I ween,
Where hedges, trees, bushes, and briars are seen,
Mother earth disengages her chrySTALLINE store,
Still running and running, yet ne'er running o'er.
(Such phenomena strange long excited much doubt,
'Till wondrous 'twas found, as 't ran in, it ran out.
Nor less cou'd they guess, though of knowledge brim-full,
Why ferruginous water by acids turn dull.)"

Mr. R. J. Morton has informed me of a Chalybeate Spring at Seething; I learn of another at Holkham from Mr. A. J. Napier; and Mr. F. J. Bennett reports the discovery of one at Shelfhanger; but these call for no further mention.

Mrs. Herbert Jones tells me (by letter) that there was a spring in Wormegay, just out of Seteh (spelt Setehy on the Ordnance Map), south of Lynn, to which people used to go some years ago, as they did to Reffley, to drink the water; and she mentions the "tradition about the Walsingham Wishing Wells, that only those who, when lying down between them, could touch the waters of each well with the fingers of their outstretched hands, could get their wish."

Professor T. Rupert Jones has written to inform me that the names "'wishing well' and 'wish well' are recognized as containing the ancient British or Celtic word for water (perhaps spring) and that, as these wells retain the Celtic name, they were probably *pre-historic*, and were also at places of old occupation; and probably their neighbourhood would be found, on search, to abound with flint-implements. At all events those old springs known in many parts of the country as *wish-wells* thus bear evidence of Celtic or ancient British occupation,—the origin of the word is worth remembering (wish-water *)."

XII.

A LIST OF BIRDS THAT HAVE OCCURRED IN GREAT BRITAIN, IN WHOSE NEST THE EGG OF THE CUCKOW HAS BEEN FOUND.

COMPILED BY EDWARD BIDWELL.

Read 27th March, 1883.

ALTHOUGH in the two most recently published standard works on Ornithology lists of the foster-parents of the Common Cuckow (*Cuculus canorus*) have been given, I am able still further to augment the number. In the 'Birds of Europe,' by H. E. Dresser, the list includes seventy-six species; to this Professor Newton, in the fourth edition of Yarrell's 'British Birds,' adds three species,—

* The derivation would be the same as that of Wash, Ouse, &c.

the Golden Oriole, Mistletoe Thrush, and Daw. Since this last list was compiled eggs have been found in the nests of three fresh species (the Pied Fly-catcher, Fieldfare, and the Alpine Accentor). Two records, which seem to have escaped observation, I have been able to trace (Common Dipper and Twite); and two species, in whose nests Cuckows' eggs had previously been found, have been added to the list of British Birds (the Black-throated Wheatear and Barred Warbler) which also enables me to include their names thus making my total eighty-six species. In the list I have followed the order and nomenclature adopted in the last edition of Yarrell, and in species where the Cuckow's egg has only been found on a few occasions I have endeavoured to give the authority. I have also denoted with an asterisk (*) such kinds as have been taken in Great Britain. Where I have only received information by letter I have added the letters *m.s.*

PASSERES.

LANIIDÆ.

1	<i>Lanius excubitor</i>	Great Grey Shrike	A. E. Brehm
2	„ <i>minor</i>	Lesser Grey Shrike	A. Benzon, <i>m.s.</i>
3 *	„ <i>colluris</i>	Red-backed Shrike	
4	„ <i>auriculatus</i>	Woodchat	A. Benzon, <i>m.s.</i> N. Habicht, Nau. 1853, p. 105

MUSCICAPIDÆ.

5 *	<i>Muscicapa grisola</i>	Spotted Fly-catcher	
6	„ <i>atricapilla</i>	Pied Fly-catcher	A. Benzon, <i>m.s.</i>

ORIOIIDÆ.

7	<i>Oriolus galbula</i>	Golden Oriole	Des Murs, 'La Vérité sur le Coucou' (Paris 1879) pp. 82 & 83.
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CINCLIDÆ.

8	<i>Cinclus aquaticus</i>	Dipper	W. Thienemann 'Fortplanz der Vogel Europas,' 1825, p. 50
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TURDIDÆ.

9	<i>Turdus viscivorus</i>	Mistletoe Thrush	A. Müller, Zool. Garten, 1878, p. 177
10 *	„ <i>musicus</i>	Song Thrush	G. T. Porrett, Huddersfield, <i>m.s.</i>
11	„ <i>pilaris</i>	Fieldfare	Henke, 'Ibis,' 1882, p. 373
12 *	„ <i>merula</i>	Blackbird	
13 *	„ <i>torquatus</i>	Ring Ouzel	R. Small, <i>m.s. E. Mus.</i> A. Hogg, Edinburgh.
14	<i>Monticola saxatilis</i>	Rock Thrush	Graf v. Wadzicki

SYLVIDÆ.

15	<i>Accentor collaris</i>	Alpine Accentor	A. Girtanner, Zool. Garten, 1880, p. 28
16 *	„ <i>modularis</i>	Hedge Sparrow	
17 *	<i>Erithaeus rubecula</i>	Redbreast	
18 *	<i>Daulias luseinia</i>	Nightingale	Brehm F. Bond, <i>m.s.</i>
19	<i>Ruticilla suecica</i>	Bluethroat	Pallas
20 *	„ <i>phoenicurus</i>	Redstart	
21	„ <i>titys</i>	Black Redstart	Dr. E. Rey A. Benzon, <i>m.s.</i>
22 *	<i>Saxicola rubicola</i>	Stonechat	W. M. Crowfoot, Beebles, <i>m.s.</i> A. Benzon, <i>m.s.</i>
23 *	„ <i>rubetra</i>	Whinehat	J. Harrison, Wilstrop, <i>m.s.</i> R. Collett
24 *	„ <i>oenanthe</i>	Wheatear	
25	„ <i>stapazina</i>	Black-throated Wheatear	Dr. Krüper, <i>E. Mus.</i> H. Seebohm
26	<i>Hypolais icterina</i>	Icterine Warbler	Braune
27	<i>Aerocephalus arundinaceus</i>	Great Reed Warbler	Dr. E. Rey
28 *	„ <i>streperus</i>	Reed Warbler	

- 29 *Aerocephalus*
palustris Marsh Warbler
- 30 * „ *schœnobœnus* Sedge Warbler
- 31 „ *aquatius* Aquatic Warbler Dr. Thienemann
 Dr. E. Opel
 A. Benzon, *m.s.*
- 32 * „ *nævius* Grasshopper Warbler F. Bond, *m.s.*
 Dr. E. Rey
- 33 * *Melizophilus undatus* Dartford Warbler P. Crowley, *m.s.*
 F. Bond, *m.s.*
- 34 * *Sylvia rufa* Greater Whitethroat
- 35 * „ *curruca* Lesser Whitethroat
- 36 * „ *salicaria* Garden Warbler
- 37 * „ *atricapilla* Blackcap
- 38 „ *orphaea* Orphean Warbler Dr. Kriiper
- 39 „ *nisoria* Barred Warbler
- 40 * *Phylloscopus* Wood Warbler C. Stubbs, Zoologist,
sibilatrix 1863, p. 8681
 Dr. E. Rey
- 41 * „ *trochilus* Willow Warbler
- 42 * „ *collybita* Chiffchaff H. E. Rawson, *m.s.*
- 43 *Regulus cristatus* Golden-crested Wren Dr. Thienemann
- 44 „ *ignicapillus* Fire-crested Wren Brehm

TROGLODYTIDÆ.

- 45 * *Troglodytes parvulus* Wren

CERTHIDÆ.

- 46 *Certhia familiaris* Tree Creeper H. E. Dresser, 'Birds
 of Europe,' vol. v.
 p. 210.

PARIDÆ.

- 47 *Parus major* Great Tit Brehm

MOTACILLIDÆ.

- 48 * *Motacilla lugubris* Pied Wagtail
- 49 „ *alba* White Wagtail
- 50 * „ *sulphurea* Grey Wagtail F. Bond, *m.s.*

51	<i>Motacilla flava</i>	Blue-headed Wagtail	C. B. Wharton, <i>m.s.</i>
52 *	„ <i>raii</i>	Yellow Wagtail	A. Benzon, <i>m.s.</i>
53 *	<i>Anthus trivialis</i>	Tree Pipit	
54 *	„ <i>pratensis</i>	Meadow Pipit	
55	„ <i>spipolotta</i>	Water Pipit	Homeyer
56 *	„ <i>obscurus</i>	Rock Pipit	F. Bond, <i>m.s.</i>
57	„ <i>campestris</i>	Tawny Pipit	Dr. Thienemann A. Benzon, <i>m.s.</i>
58	„ <i>richardi</i>	Richard's Pipit	Dr. Dybowski, 'Journal für Ornithologie,' 1871, p. 394

ALAUDIDÆ.

59 *	<i>Alauda arvensis</i>	Skylark	
60 *	„ <i>arborea</i>	Wood Lark	
61	„ <i>cristata</i>	Crested Lark	Dr. E. Rey
62	<i>Calandrella</i> <i>brachydactyla</i>	Short-toed Lark	

EMBERIZIDÆ.

63 *	<i>Emberiza</i> <i>schoeniculus</i>	Reed Bunting	
64 *	„ <i>miliaria</i>	Bunting	
65 *	„ <i>citrinella</i>	Yellow Bunting	
66 *	„ <i>cirlus</i>	Cirl Bunting	H. Saunders, <i>m.s.</i> C. Bygrave Wharton, Zool. 1882, p. 265
67	„ <i>hortulana</i>	Ortolan	H. E. Dresser R. Collett

FRINGILLIDÆ.

68 *	<i>Fringilla cœlebs</i>	Chaffinch	
69	„ <i>montifringilla</i>	Brambling	J. Wolley Henke, 'Ibis,' 1882, p. 373
70	<i>Passer montanus</i>	Tree Sparrow	A. Benzon, <i>m.s.</i>
71 *	„ <i>domesticus</i>	House Sparrow	A. Newton, 'Ibis,' 1865, p. 180

72	<i>Coccothraustes</i>		
	<i>vulgaris</i>	Hawfinch	A. Benzon, <i>m.s.</i>
73 *	„ <i>chloris</i>	Greenfinch	
74	<i>Serinus hortulanus</i>	Seriu	H. Seidensacher, <i>E. Mus.</i> H. E. Dresser
75	<i>Linota linaria</i>	Mealy Redpole	Des Murs
76 *	„ <i>cannabina</i>	Linnet	
77 *	„ <i>flavirostris</i>	Twite	‘Trans. Cumberland Association,’ Pt. ii 1876-77, p. 172
78	<i>Pyrrhula europæa</i>	Bullfinch	Des Murs

CORVIDÆ.

79	<i>Corvus monedula</i>	Daw	
80	<i>Pica rustica</i>	Pie	Des Murs
81	<i>Garrulus glandarius</i>	Jay	A. E. Brehm

HIRUNDINIDÆ.

82 *	<i>Hirundo rustica</i>	Swallow	H. Nichols, junr., <i>Zool.</i> 1869, p. 1866 G. Rooper, <i>Zool.</i> 1877, p. 260
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COLUMBÆ.

COLUMBIDÆ.

83	<i>Columba palumbus</i>	Ring Dove	Willughby Brehm
84	„ <i>œnas</i>	Stock Dove	Brehm
85	<i>Turtur communis</i>	Turtle Dove	Des Murs

PYGOPODES.

PODICIPEDIDÆ.

86	<i>Podiceps minor</i>	Little Grebe	L. Martin, ‘ <i>Journal für Ornithologie,</i> ’ 1876, p. 391
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XIII.

FAUNA AND FLORA OF NORFOLK.

PART X. MARINE ALGÆ.

BY HERBERT D. GELDART, *President.**Read 27th March, 1883.*

THE following list of the Marine Algæ which have been found on the coast of Norfolk is, like the other botanical lists which I have contributed to the 'Transactions' of this Society, more of a compilation of the records already published by others, than an original work; still, by the observations of Miss A. M. Barnard and myself, a considerable number of species (about thirty) have been added to former publications; and there is not the least doubt that if any one resident on our coast, who could give attention to the subject all the year round, would take it up, their efforts would meet with good reward in the discovery of many fresh species.

The principal lists already published are that of the Messrs. C. J. and James (now Sir James) Paget, in their 'Sketch of the Natural History of Yarmouth,' in 1834; and one by the late Rev. George Munford, in White's 'History and Directory of Norfolk,' in 1864. There are also various Norfolk localities mentioned in Harvey's 'Phycologia Britannica.'

The late Dawson Turner of Yarmouth, in his 'Historia Fucorum' (vol. ii. p. 84), alludes to Lilly Wigg as being the discoverer of seven species of "Fuci," as they were then all called; viz., *F. (Delesseria) hypoglossum*, (*D.*) *ruscifolius*, (*Laurencia*) *dasyphyllus*, (*Rhodomela*) *subfuscus*, (*Chrysemenia*) *clavellus*, (*Bonnemaisonia*) *asparagoides*, and (*Naccaria*) *Wiggii*; and also of *Ulva (Cutleria) multifida*, *Conferva (Ectocarpus) Mertensii*, *C. (Callithamnion) rosea*, and *C. (Polysiphonia) stricta*, which last is said, in the Synopsis of 'Phycologia Britannica,' to be the young state of *Polysiphonia formosa*.

In the case of a coast like that of Norfolk, where but few, if any, rocks are accessible, even at the time of the lowest tides, and most of the Algæ found are water-borne, and often show by their condition that they come from a considerable distance, it is useless to attempt to indicate the distribution of the Algæ recorded. It is true that sometimes for a few days of very fine weather certain species of Algæ will be found to come ashore at definite spots day after day, showing their place of growth to be on submarine reefs in the vicinity; but one rough tide will alter all this, and not a single fresh specimen will occur even for weeks afterwards on the same beach.

I have felt some surprise at omissions in this list, which, as the species omitted are too conspicuous to have been overlooked by such careful observers as the algologists who watched the Yarmouth beach towards the close of the last, and in the earlier part of this, century, must be held to be really absent; these are *Laminaria digitata* and *L. bulbosa*, and the whole of the spinous section of the genus *Ceramium*; viz., *C. echionotum*, *C. acanthonotum*, and *C. ciliatum*. Of no one of these have I myself ever seen even a fragment on our coast; and I can only attribute their absence to a want of sufficiently deep water, with a rocky bottom, towards the north, within the reach of the carrying power of the tide.

I have rejected from the present list *Sargassum vulgare*, which, as Harvey says (Man. Ed. vol. ii. p. 15), "has no claim on our Flora;" and I have doubts as to the justice of retaining some other species which appear to have only been recorded as occurring once, and therefore may be only "casuals;" such as *Fucus canaliculatus*, *Cystoseira granulata*, and *Conferva collabens*. A few more species appear to me to be doubtful or uncertain; such as *Cystoseira barbata*, *Ectocarpus brachiatus*, and *Cladophora diffusa*. If the publication of this list should, by arousing attention, cause some of these casuals to be rediscovered, or some of the doubtful species to be accurately determined, my object in compiling it will have been fully answered.

The nomenclature and arrangement followed are, so far as I can make them by comparison of synonyms, those of Harvey's 'Phycologia Britannica,' which must, until the publication of some more recent and comprehensive work, be considered the standard of British Marine Algology.

MELANOSPERMEÆ.

FUCACEÆ.

- HALIDRYS SILIQUOSA. Lyngb.
 CYSTOSEIRA ERICOIDES. Ag.
 „ GRANULATA. Ag. A single specimen, Paget.
 „ BARBATA. Ag. Munford's list.
 „ FIBROSA. Ag. "Abundant in the winter of 1798:" Paget.
 PYCNOPHYCUS TUBERCULATUS. Kütz. Cromer, H. D. G.
 FUCUS VESICULOSUS. Lin.
 „ CERANOIDES. Lin. "Sparingly in 1806, Mr. Turner:"
 Paget.
 „ SERRATUS. Lin.
 „ NODOSUS. Lin.
 „ CANALICULATUS. Lin. "Once found by Mr. Wigg:"
 Paget.
 HIMANTHALIA LOREA. Lyngb.

SPOROCHNACEÆ.

- DESMARESTIA LIGULATA. La.
 „ ACULEATA. La. Yarmouth, Miss A. M. B.
 „ VIRIDIS. La.
 ARTHROCLADIA VILLOSA. Duby.
 SPOROCHNUS PEDUNCULATUS. Ag. In fruit, Runton, 1876: H.D.G.

LAMINARIACEÆ.

- ALARIA ESCULENTA. Grev. Cromer, H. D. G.
 LAMINARIA SACCHARINA. La.
 „ PHYLLITIS. La. Rare, Paget.
 CHORDA FILUM. La.

DICTYOTACEÆ.

- CUTLERIA MULTIFIDA. Grev. Rare, Paget.
 TAONIA ATOMARIA. Grev. Cromer and Yarmouth, Miss A. M. B.
 DICTYOTA DICHOTOMA. La.
 PUNCTARIA LATIFOLIA. Grev. Munford's list.
 „ PLANTAGINEA. Grev.
 ASPEROCOCCUS ECHINATUS. Grev. Cromer, Miss A. M. B.

CHORDARIACEÆ.

- CHORDARIA FLAGELLIFORMIS. Ag. Cromer, Miss A. M. B.
 MESOGLOIA VIRESCENS. Carm. Cromer, Miss A. M. B.
 ELACHISTA FUCICOLA. Fries. Cromer, Miss A. M. B.
 „ SCUTULATA. Duby.
 „ VELUTINA. Fries.
 MYRIONEMA STRANGULANS. Grev. Cromer, H. D. G.

ECTOCARPACEÆ.

- CLADOSTEPHUS VERTICILLATUS. Ag.
 „ SPONGIOSUS. Ag.
 SPHACELARIA SCOPARIA. Lyngb.
 „ CIRRHOSA. Ag.
 ECTOCARPUS SILICULOSUS. Lyngb.
 „ FASCICULATUS. Harv. Cromer, Miss A. M. B.
 „ TOMENTOSUS. Lyngb.
 „ LITORALIS. Lyngb.
 „ GRANULOSUS. Ag. Cromer, Miss A. M. B.
 „ BRACHIATUS. Harv. Cley, 1808 : Sir W. J. Hooker.
 „ MERTENSII. Ag. Very rare, Paget.
 MYRIOTRICHIA FILIFORMIS. Harv. Cromer, Miss A. M. B.

RHODOSPERMEÆ.

RHODOMELACEÆ.

- RHODOMELA LYCOPODIODES. Ag. Cromer, Mr. Woodward :
 Phyc. Brit.
 „ SUBFUSCA. Ag.
 BOSTRYCHIA SCORPIOIDES. Mont. "A small quantity found 1830 :"
 Paget.
 RYTIPHLEA PINASTROIDES. Ag. Cromer, H. D. G.
 „ THUYOIDES. Harv. Cromer, Miss A. M. B.
 POLYSIPHONIA URCEOLATA. Grev.
 „ FORMOSA. Suhr. Cromer, Miss A. M. B.
 „ ELONGATA. Grev.
 „ FIBRILLOSA. Grev. Cromer, Miss A. M. B.
 „ NIGRESCENS. Grev.

- POLYSIPHONIA ATRORUBESCENS. Grev.
 „ FURCELLATA. Harv.
 „ FASTIGIATA. Grev. Munford's list.
 „ BYSSOIDES. Grev.
 DASYA COCCINEA. Ag.

LAURENCIACEÆ.

- BONNEMAISONIA ASPARAGOIDES. Ag.
 LAURENCIA PINNATIFIDA. Lamour.
 „ DASYPHYLLA. Grev.
 CHRYSSEMENTIA CLAVELLOSA. J. Ag.
 CHYLOCLADIA OVALIS. Hook.
 „ KALIFORMIS. Hook. Munford's list.
 „ ARTICULATA. Grev.

CORALLINACEÆ.

- CORALLINA OFFICINALIS. Lil.
 JANIA RUBENS. Lamour.

DELESSERIACEÆ.

- DELESSERIA SANGUINEA. Lamour.
 „ SINUOSA. Lamour.
 „ ALATA. Lamour. Cromer, H. D. G.
 „ HYPOGLOSSUM. Ag.
 „ RUSCIFOLIA. Lamour.
 NITOPHYLLUM PUNCTATUM. Grev. Cromer, Miss A. M. B.
 „ GMELINI. Grev.
 „ LACERATUM. Grev.
 „ UNCINATUM. Munford's list.
 PLOCAMIUM COCCINEUM. Lyngb.

RHODYMENIACEÆ.

- RHODYMENIA BIFIDA. Grev.
 „ LACINIATA. Grev.
 „ PALMETTA. Grev.
 „ CILIATA. Grev.
 „ JUBATA. Grev. Yarmouth, Miss A. M. B.

- RHODYMENIA PALMATA. Grev. Munford's list.
 GRACILARIA CONFEROIDES. Grev. Grows in the cracks of the
 chalk beach at Runton: H. D. G.
 HYPNEA PURPURASCENS. Harv. Grows in the chalk beach at
 Runton: H. D. G.

CRYPTOMENIACEÆ.

- GELIDIUM CORNEUM. Lamour.
 " " var. CRINALE. Both recorded in Munford's list.
 CHONDRUS CRISPUS. Lyngb.
 PHYLLOPHORA RUBENS. Grev.
 " MEMBRANIFOLIA. J. Ag.
 GYMNOGONGRUS Plicatus. Kg.
 POLYIDES ROTUNDUS. Grev.
 FURCELLARIA FASTIGIATA. Lamour.
 DUMONTIA FILIFORMIS. Grev. Cromer, Miss A. M. B.
 HALYMENIA LIGULATA. Ag.
 GINNANIA FURCELLATA. Mont. Extremely rare, Paget. Cromer,
 Miss A. M. B.
 NACCARIA WIGGII. End. Yarmouth, 1852: Miss A. M. B.
 Runton, H. D. G.

CERAMIACEÆ.

- PTILOTA PLUMOSA. Ag. Cromer, Miss A. M. B.
 " SERICEA. Gmel. Cromer, H. D. G.
 CERAMIUM RUBRUM. Ag.
 " DIAPHANUM. Roth. Cromer and Yarmouth, Miss
 A. M. B.
 " GRACILLIMUM. Griff and Harv. Cromer, H. D. G.
 " NODOSUM. Kütz. Cromer, Miss A. M. B. and H. D. G.
 GRIFFITHSIA EQUSETIFOLIA. Ag.
 " SIMPLICIFILUM. Ag. Norfolk, Phyc. Brit.
 " SETACEA. Ag.
 CALLITHAMNION PLUMULA. Lyngb.
 " TURNERI. Ag. Found on Cromer beach, 4th June, 1880;
 showing the "trichogynes" well: H. D. G.
 " PLUMA. Ag. Cromer, Miss A. M. B.
 " TETRICUM. Ag.

CALLITHAMNION HOOKERI. Ag.

- " ROSEUM. Lyngb.
 " BYSSOIDEUM. Arn. Cromer and Runton, H. D. G.
 " POLYSPERMUM. Ag. Cromer, H. D. G.
 " FASCICULATUM. Harv. Very rare, Paget. Yarmouth,
 Mr. Borrer.
 " BORRERI. Ag. Very rare, Paget. Cromer, Miss A. M. B.
 " THUYOIDEUM. Ag. Very rare, Paget. Cromer, H. D. G.
 " PEDICELLATUM. Ag. Cromer, on a live mussel-shell said
 to have been brought from Blakeney : H. D. G.
 " ROTHII. Lyngb.
 " DAVIESII. Lyngb. Weybourne, H. D. G.

CHLOROSPERMEÆ.

SIPHONACEÆ.

- BRYOPSIS PLUMOSA. Ag. Grows in cracks in the chalk beach at
 Runton, H.D.G. ; and in the large pool at Cromer,
 1858, Miss A. M. B.
- CLADOPHORA PELLUCIDA. Kütz.
- " DIFFUSA. Harv. Cromer, Miss A. M. B.
 " RUPESTRIS. Kg.
 " LETEVIRENS. Kütz. Cromer, Miss A. M. B. and H. D. G.
 " FLEXUOSA. Griff. Munford's list.
 " GRACILIS. Griff. Cromer, Miss A. M. B.
 " REFRACTA. Kütz. Cromer, Miss A. M. B.
 " ALBIDA. Kütz. Cromer, Miss A. M. B.
 " LANOSA. Kütz. Munford's list.
 " ARCTA. Kütz. Cromer, Miss A. M. B.
 " FLAVESCENS. Kg. Cromer, Miss A. M. B.
 " FRACTA. Kg.
- RHIZOCLONIUM RIPARIUM. Kütz. Yarmouth, Mr. Dillwyn.
- CONFERVA LINUM. Roth.
- " TORTUOSA. Dillw.
 " MELAGONIUM. Web and Mohr. Runton, H. D. G.
 " ÆREA. Dillw.
 " COLLABENS. Ag. Yarmouth, floating timber ; only one
 found : Sir W. J. Hooker.

- CONFERVA YOUNGANA. Dillw. Yarmouth, Sir W. J. Hooker.
 ENTEROMORPHIA CORNUCOPIE. Hook.
 „ INTESTINALIS. Link.
 „ COMPRESSA. Grev.
 „ CLATHRATA. Grev. Cromer, H. D. G.
 „ PERCURSA. Hook. Cromer, H. D. G.
 ULVA LATISSIMA. Lin.
 „ LACTUCA. Lin.
 „ LINZA. Lin.
 PORPHYRA LACINIATA. Ag.
 „ VULGARIS. Ag.
 BANGIA FUSCO-PURPUREA. Lyngb. Yarmouth, H. D. G.

OSCILLATORIACEÆ.

- RIVULARIA ATRA. Roll.
 CALOTHRIX CONFERVICOLA. Ag.
 „ SCOPULORUM. Ag.
 LYNGBYA FLACCA. Harv.

XIV.

NOTES ON THE HERRING FISHERY OF 1882.

BY THOMAS SOUTHWELL, F.Z.S.

Read 27th March, 1883.

THE Herring voyage of the past year has been characterized by extremes, both of catch and prices; the weather has also been extremely unpropitious, a succession of severe storms having proved most disastrous both to life and property; but during intervals of fine weather very large catches have been made by the Yarmouth boats especially. The spring voyage from Yarmouth is never of any importance: last year it yielded 197 lasts of 13,200 fish as compared

with 236 lasts in 1881; but the Lowestoft boats fill up the time from March till the end of May, when the Mackerel season commences, in fishing for Herring. The spring of 1882 produced 1793 lasts against 2797 lasts in 1881; the prices too, as a rule, were very low, in some instances as low as 4d. per 132, and repeatedly not more than 7d. or 9d., whilst 2s. 6d. per 132 appears to have been considered a good price. In the spring of 1881 prices ruled much higher, 12s. to 18s., and in one instance 19s. per long hundred having been given. One of the reasons assigned for the low prices is that very few French boats were fishing for Cod, and, therefore, the demand for Herrings for bait was much less than usual; a reason very significant of the value of these spring fish. Upon the whole the Lowestoft spring voyage may be considered to have been very unsatisfactory, many of the boats having scarcely paid their expenses.

It will be seen from the table below that Herrings are present in the North Sea during the whole year; and although at all times more or less gregarious, it is only during the spawning season that they congregate in the vast shoals which frequent the shallow waters around our coast; the so-called "migration" being simply the gathering together, for the purpose of reproduction, of the scattered parties which, although at greater distances from the shore, and in greater depths of water, are still permanent inhabitants of the sea.

During the months of June and July a few fish are taken, and a larger quantity in August; but it is not till September that the autumn fishery commences in earnest. From that time to the end of the year the boats are busily occupied, and the fish-wharves exhibit an animated scene. There were about 50 more Yarmouth boats engaged this year than in 1881, and about 200 Scotch boats also used the port. Very large deliveries were made early in the season, and at one time the Yarmouth delivery reached about 5000 lasts in excess of the same period of the previous year; but a succession of heavy gales, towards the end of the season, reduced this excess to about 450 lasts; whereas, the Lowestoft men, who seem to have lost all spirit towards the end of the season, and were making very small catches at a time when the Yarmouth men were doing well, ended with a deficiency as compared with last year of some 2346 lasts (representing, at £15 per last, a money value of £35,490), not to

mention loss of gear from stress of weather and Ostend trawlers. Prices, as usual, fluctuated from £5 to £36 per last, according to quality or supply.

The following table will show the results of the year's fishery from Yarmouth and Lowestoft. As the spring, summer, and autumn voyages merge into each other, and any division must be arbitrary, I give a continuous monthly record for the whole year. For the Yarmouth return I am indebted to Mr. H. Teasdel, Jun., the Corporation Accountant, and for Lowestoft to Captain Massingham, harbour-master at that port.

RETURN OF HERRINGS LANDED AT THE YARMOUTH AND LOWESTOFT
FISH-WHARVES IN 1882.

		YARMOUTH.			LOWESTOFT.		
		Lasts (13,200).	Thousands (1320).	Hundreds (132).	Lasts (13,200).	Thousands (1320).	Hundreds (132).
Spring	January .	—	—	—	—	—	—
	February .	—	—	—	—	—	—
	March .	31	1	5	212	4	2
	April .	162	4	1	1567	5	9
	May .	4	2	8	13	7	6
Summer	June .	6	6	9	14	2	2
	July .	33	4	1	10	9	4
	August .	938	6	5	102	2	1
Autumn	September	3238	4	2	210	2	1
	October .	7833	5	5	2914	9	4
	November	3920	—	1	1582	2	4
	December	986	1	5	440	7	8
		17,154	7	2	7069	3	1

XV.

ORNITHOLOGICAL NOTES FOR 1881.

By HENRY STEVENSON, F.L.S., V.P.

Read 27th March, 1883.

ALTHOUGH the Americans had forecast a "sample" of severe weather for us, early in January, we question if the sagest weather-prophet would have ventured to predict such a specimen of a "good old-fashioned" winter as prevailed between the 12th and 26th of that month. Time-honoured "indications" counted for nothing—such as a green Christmas, and a very general absence of berries on the Holly and White-thorn (now generally regarded as a sign of ungenial summers, not of sharp winters to follow)—and with the wind veering from S.W. to N.W. the year commenced raw and damp rather than frosty. Gradually, however, the change was creeping on. By the 7th, the first of a series of sharp hoar-frosts commenced, with the wind N.E., but though, during the subsequent bitter cold, the wind was chiefly in that quarter and N.W., yet on some days of intense frost the weather-cock stood W., W.N.W., and even W.S.W. on the 15th. At nine o'clock on the evening of the 11th, a frost of four degrees was recorded, and from that time until the night of the 26th (with the exception of a few hours on the 22nd and 23rd), the temperature never rose above the freezing-point.

A slight fall of snow early on the 12th was followed by eight degrees of frost at night, and the following morning we had four or five inches of snow on the level, and skating had commenced. On the night of the 13th we had eighteen degrees of frost, and in the morning the sun shining on the leafless trees, laden with hoar-frost, was a glorious sight.

Still the wave of cold crept on, till it reached its climax early in the morning of the 15th, when in Norwich twenty-one degrees, and in Yarmouth twenty-two degrees, of frost were registered; the ice forming with extraordinary rapidity by 9 p.m. The skating was now at its best, even the larger Broads being safely "laid," and a good stretch of sound ice was afforded, two days later, on the

Yare, from Coldham Hall to Surlingham Ferry. On the night of the 15th we had seventeen degrees of frost, freezing all the following day, when the highest temperature recorded was nine degrees below freezing. The frost continued throughout the 17th, though with a S. and S.W. wind which, with a bright sun in the morning, caused a considerable shrinkage of snow.

Little did even the "weather-wise" anticipate the change so shortly to follow. A gale suddenly burst upon us, unprecedented, almost, in the recollection of the present generation, for severity and the damage effected by it in the space of twenty-four hours; accompanied as it was by such snow-drifts in railway cuttings, country roads, and lanes, as, to octogenarians, recalled the winters of the old coaching-days. About 12 o'clock at night on the 17th, the wind suddenly veered to the east, and from that time, though chiefly from the E.N.E., a terrible gale raged throughout the day on the 18th, through that night, and part of the next day. The effect of such a storm, the velocity of the wind on the 18th being registered at five hundred and forty-eight miles, and four hundred and ten miles on the 19th, was to sweep the roofs and trees, and even the ground in open places, of the half-frozen snow, and bank it up, many feet high, to be added to considerably by a heavy fall of snow between eight and nine in the evening. Skating matches were everywhere postponed, as many skaters could not keep their feet, whilst others, spreading out the skirts of their coats, sailed along with the wind. At Yarmouth, even in the streets, several people were blown down. By huge snow-drifts in the railway cuttings (reaching up to the top of the engine-tender in one case) trains were stopped, both on the Yarmouth and Cromer lines, and passengers, at Buckenham, Salthouse, and Wroxham, had to seek shelter at the railway stations for the night, till powerful engines could reach the blocked-up trains in the morning. The mail-carts were stopped by the snow-drifts in various parts of the county, and all communication was cut off from several towns and villages for two or three days. Owing to a fearful sea on at Yarmouth and Lowestoft, the shipping disasters were numerous, with a sad loss of lives, and the disaster to the Yarmouth lifeboat, and the drowning of several of her crew will be long remembered. The sky all day had a dull leaden hue, and the thermometer registered 32.0 degrees in Norwich. Sleet,

driving with the wind, into every hole and crevice, fell throughout the afternoon, and at night, as before stated, the heavily laden clouds discharged themselves, and added largely to the difficulties of traffic, by a heavy snowstorm. Abating a little of its force about five o'clock in the afternoon, it still blew hard during the night, the keenness of the blast making itself felt even within doors, and to snowed-up travellers it must have been fearful. Between eleven and twelve on the morning of the 19th we had a fresh fall of snow, but the storm itself was over, though the cold continued, with ten degrees of frost at night. On the 21st more snow fell, and the hoar-frosts commenced again; and on the 22nd safe skating was afforded on the Yare, between Reedham and Hardley Dyke, though the ice, generally, was much impaired by the frozen snow. More snow fell on the 23rd, with the wind W.N.W., and hoar-frosts and dense morning fogs prevailed up to the 26th, when a thaw set in suddenly, and the snow began to sink into the earth under the influence of a mild soft air, with the wind S.W., almost as rapidly as the ice had formed on the 15th.

No wonder that our resident birds suffered severely during such a fortnight of severe weather, or that numbers, especially in the bleak and exposed parts of the county, succumbed under the combined effects of cold and hunger. Even the Snow Buntings, according to a statement of William Howlett of Newmarket, in the 'Field' of January 29th, were picked up in dozens with many other species on Newmarket Heath and the fens between there and Ely. There was a strange absence of the large flocks of Fieldfares and Redwings usually met with in hard winters, but whether these, owing to the paucity of berries, had passed southward earlier in the season, I am not prepared to say. The rarity of the Thrush's song in the following spring told its own tale, for no bird suffers more or sooner from cold and privation. At first the birds seemed to suffer rather from the deep snow covering their usual sources of food, than from the frost; but the biting wind-frosts, especially on the 18th and 19th, told upon them terribly at last! By the 14th I had not only my usual compliment of garden birds about my "charity board," and that close to the city, but Rooks and Jackdaws joined the throng, and on the morning of the 18th, besides the above, I counted three dozen and a half of Starlings, and a swarm of small birds, including four species of

Titmice (Great, Blue, Cole, and Marsh) and one half-starved Redwing. Even as late as the 25th, I had daily visits from at least two dozen Starlings, with three or four Rooks and Jackdaws; and about 5 p.m. on that day a string of Wild Ducks were seen to pass over my house, flying only just above the chimneys, and calling loudly. They were passing, no doubt, from the Lakenham marshes to those at Heigham beyond the river. Grey Crows were also frequently passing over at this time. No sooner, however, had the rapid thaw set in, and the garden was clear of snow, than my pensioners dispersed, and one or two Starlings, remaining, were whistling as in spring.

On the 31st, killed no doubt before the frost gave way, I saw in our fishmarket the usual trays full of Sparrows and Finches of various kinds, chiefly Greenfinches, with Blackbirds, Skylarks, and a few Thrushes.

JANUARY.

STORM PETREL. A single bird was shot early this month on the coast near Yarmouth.

SHORE LARK. Two specimens were sent up from Yarmouth on the 10th.

GOOSANDER. Three fine old males were shot this month at Yarmouth, one on the 7th, and two between the 26th and 30th; and several young males and females.

SLAVONIAN GREBE. One was caught in an exhausted state on the 26th, on the rocks, at low water, between Runton and Beeston. The iris was deep orange-red, with a narrow golden circle next the pupil.

GREAT GREY SHRIKE. One was killed at Flegg Burgh near Yarmouth on the 26th, and another at Fundenhall near Wymondham on the 18th.

HAWFINCH. These birds I am sorry to say were shot in considerable numbers this month, when pinched for food in the terrible weather that prevailed about the 18th; and one birdstuffer alone, in Norwich, received twenty specimens between the 18th and 30th, of which, singularly enough, only three were females. As all these birds were killed over a wide area of the county, and quite inland, and chiefly from localities where they are known, or

would be likely to breed, I am inclined to think them residents rather than migrants, as three killed at, or close to Yarmouth, about the same time, probably were.

WOOD LARK. Two of these birds were obtained on the 14th, and two more on the 15th, upon the Denes at Caister near Yarmouth, a strange locality and season, as well, for a summer migrant scarce enough, and extremely local, in its nesting haunts on the western side of the county.

GLAUCUS GULL. Mr. G. Smith of Yarmouth received this month twenty-seven of these fine Gulls, killed out in the North Sea, probably on the "Dogger Bank," and brought in by the fishing-smaeks. Of these, seven were fully adult. He had also, at the same time, some remarkably fine adult Great Black-backed and Herring Gulls.

WILD GEESE. Brent Geese were very plentiful at Yarmouth early in the month during the severe frost, and a good many were killed both on the beach and on Breydon. On the 21st two Bean Geese were killed at Hunstanton, and one Egyptian Goose, probably a semi-domesticated bird, and on the same day two Bernicle Geese on Breydon. Another Bean Goose was shot at Yarmouth on the 30th.

SMEW. A young male and an adult female were shot on Breydon on the 15th, and another old female on the 19th, and two on the 27th. Two young birds were also shot at Taverham near Norwich on the 29th.

WATER-RAIL. A considerable number of these birds were observed in Yarmouth market on the 9th.

BEWICK SWAN. A single bird was shot in Breydon marshes on the 21st. Two Wild Swans were also seen, on the 19th, as far inland as the river between Hellesdon and Drayton near Norwich.

SHELDRAKE. A considerable number of these birds, adult and immature, were shot on the coast during this month.

RED-NECKED GREBE. An adult bird in winter plumage was shot at Hickling on the 27th, and another on Breydon on the 30th.

GREAT INFLUX OF SKYLARKS. Mr. F. D'A. Newcome of Feltwell has kindly supplied me with the following particulars of a remarkable immigration of Skylarks, towards the end of January,

into the cultivated portions of the Feltwell Fen. His uncle and himself bought one hundred and nineteen dozen and five, all taken in "kings." These must have been brought in about January 29th. He does not think any were taken before the storm on the 18th, and he paid afterwards for seventeen dozen more. Probably all were caught between January 18th and the 3rd or 4th of February, all the fields being nearly bare of snow from the high wind on the 18th. The Larks stayed some time, and did not lose condition till just at the end of their visit to that neighbourhood. The great passage was on the 17th, the day before the storm; and he heard there was a great passage on the same day at Lyndhurst in Hampshire, all the birds going S.W.

FEBRUARY.

WILD GEESE. A good many Brents were shot on Breydon early this month, after the frost had abated; and eleven Geese, supposed to be Grey Lags, were seen there on the 5th, and some Wild Swans at the same time. About thirty Geese, probably Pink-footed, appeared on Breydon on the 15th.

BITTERN. One shot near Yarmouth on the 9th.

GOOSANDER. A fine adult female was shot at Potter Heigham on the 12th. A female was also seen, with other fowl, on Ganton Lake, near Cromer, on the 26th.

GREAT CRESTED GREBE. A young bird was shot near Yarmouth on the 6th, and some half-dozen specimens were seen in Yarmouth market between the 1st and 15th of this month. One was already in part summer plumage.

RED-NECKED GREBE. One sent up to Norwich from the coast on the 13th.

RINGED GUILLEMOT. An example of this variety of the Common Guillemot was shot at Yarmouth during the last week of this month. It occurs but rarely on our coast.

GANNET. Like the Glaucus Gulls an unusual number of these birds, some fine adult specimens, were brought to Yarmouth by the smacksmen from the North Sea this winter.

SCLAVONIAN GREBE. On the 26th an adult bird, in winter plumage, was killed near Yarmouth.

LESSER SPOTTED WOODPECKER. A specimen was shot at Harleston early in the month, decidedly rare in that neighbourhood. Many Green Woodpeckers were either shot or found dead during the severe frost.

SHORE LARK. Two shot at Wells on the 12th.

GREAT GREY SHRIKE. A male killed at Potter Heigham on the 26th; and another, about the same time, somewhere in the county. One birdstuffer informs me that of three specimens brought to him this winter, each had the remains of a Mouse in its stomach.

MARCH.

GREAT CRESTED GREBE. Mr. J. H. Gurney, Jun., saw on Ranworth Broad on the 18th, with various kinds of wild-fowl, no less than twelve Great Crested Grebes, some in breeding and some in winter plumage,—a difference of age no doubt; as in my aviary-birds I always find the oldest assume their summer dress earliest.

SMEW. Two old males in fine plumage were shot at Hickling on the 6th.

MAGPIE. Two seen at Northrepps on the 15th, two on the 24th near the same spot, and one on the 25th.

HAWFINCH. One shot near Wymondham on the 19th.

APRIL.

LESSER SPOTTED WOODPECKER. The Rev. H. T. Frere of Burston informs me that a bird of this species was killed by a dog in a garden at Diss about the middle of this month, making the fourth, within two or three years, he has known of in that neighbourhood.

SMEW. Two of these birds were shot at Ranworth on the 25th of this month; a remarkably late occurrence of this species.

MAY.

ARRIVAL OF MIGRANTS. The following are a few notes on "first observations" of spring migrants.

CHIFFCHAFF. March 17th, East Norfolk; March 18th, Ranworth.

WRYNECK. March 26th, Harleston.

PIED WAGTAIL. March 24th, eight seen together in a ploughed field at Northrepps.

WHEATEAR. April 3rd, Overstrand.

BLACKCAP. April 3rd, seen and heard at Northrepps.

WILLOW WARBLER. April 10th, Norwich; April 17th, Northrepps.

CUCKOO. April 15th, Northrepps.

RING OUZEL. April 19th, Burston; April 20th, Northrepps.

NIGHTINGALE. April 11th, Norwich; April 13th, Thorpe.

YELLOW WAGTAIL. April 22nd, Carrow.

SWALLOW. April 21st, Carrow. April 23rd, a migratory flock were observed to alight on Cossey Hall in the evening. April 27th, Northrepps.

SAND MARTIN. April 21st, Carrow.

HOUSE MARTIN. April 21st, Carrow.

REDSTART. April 24th, Northrepps.

TURTLE DOVE. May 3rd, Northrepps.

SPOTTED FLYCATCHER. May 7th, Northrepps; May 16th, Norwich.

SWIFT. May 2nd, Yarmouth; May 14th, Norwich; May 16th, Cromer and Keswick.

CORN CRAKE. May 13th, Northrepps.

GOATSUCKER. May 14th, Northrepps.

CORMORANT. On the 14th seven of these birds, in company, were observed flying towards the sea at Yarmouth.

SPOONBILL. Five were seen at 4 a.m. on Breydon, on the 19th, four of which were sleeping with their heads thrown back and buried in their feathers, whilst one apparently stood sentinel, and about twenty large Gulls were in company with them. These passed on, unmolested, but two were recorded as killed at Orford in Suffolk on the 21st, which, possibly, were part of the same flock.

BLACK TERN. Several about Breydon on the 14th.

JUNE AND JULY.

MAGPIE. About the 19th of June four young Magpies were seen in one of the coverts at Northrepps.

MUTE SWAN. A pair of tame Swans at Keswick, near Norwich, this year brought off (May 27th) the prolific number of twelve Cygnets, of which one was afterwards found dead. A few years back I knew of a pair on Surlingham Broad which, for several years in succession, reared ten and eleven Cygnets, and once or twice the hen-bird laid twelve eggs.

SPOONBILL. A single bird on Breydon, June 23rd, escaped.

HERONS NESTING. I was informed this year of a small heronry commenced in a plantation at Strumpshaw, near Brundall, on the Yare.

HOODED CROW. About the 21st of July a Hooded Crow was seen near the cliff at Overstrand. The departure of the main body of these birds was witnessed at Northrepps on several occasions in the spring. On the 9th of March many were seen, with some Rooks, flying seawards, and very high in the air; and again, on the 16th and 17th, flocks of Grey Crows, Rooks, and Jackdaws were observed departing in the same manner; though a few of the former still remained, near the coast, up to the 3rd of April.

AUGUST.

NORFOLK PLOVER ATTACKED BY A HEN. On the 2nd of this month, Mr. Callow of Northrepps heard a screaming noise in his stack yard, which he found to proceed from a bird of this species which a hen, in fear for her chickens, was severely buffeting. The bird, seared and exhausted, allowed Mr. Callow to capture it; and with one wing clipped, it was turned into a walled-in garden, where it remained till its death on the 31st of December. This species bred regularly a few years back on a lofty range of furze-covered hills at the back of Cromer and Runton, and this apparently adult bird may have wandered from that old haunt. This incident was recorded in the 'Zoologist' for 1881 (p. 384) by Mr. J. H. Gurney, Jun.

SANDWICH TERN. A female adult shot on Breydon August 24th.

HOODED CROW. Two were seen at Northrepps on the 31st, which fact, coupled with the appearance, as before stated, in the same locality of one in July, seems to indicate nesting.

SWIFT. Some still seen over the "Close" at Norwich on the 28th.

SEPTEMBER.

HOUSE MARTIN. These birds, by no means plentiful this season in and around Norwich, began to gather together by the riverside at Heigham about the middle of the month, when some eighty or one hundred were seen together.

SPOTTED CRAKE. An unusual number of this species were shot in our marshes during this month.

KENTISH PLOVER. One of these Plovers, by no means common on our coast, was killed on Breydon on the 14th, and two others on the 24th and 25th, the latter on the beach. I also heard of one from the same locality, immature, in August.

GREY SHRIKE. One seen about the middle of the month on the Denes at Yarmouth.

RED-NECKED PHALAROPE. One example was shot on Breydon on the 4th; and another on the 29th at Hopton, swimming in a pond, with Ducks, close to the road. Both immature.

GREY LAG-GEESE. Several flocks of this species were seen on Breydon on the 24th and 25th. Two of them were shot, and one sent to me.

BLUE-THROATED WARBLER. A very immature specimen was shot at Cley by Mr. Power on the 3rd of September.*

SMEW. One shot at Filby this month.

GLOSSY IBIS. Mr. Power's belief that he saw a bird of this kind at Cley, on the 6th, was no doubt well founded, as a male bird, in the possession of Mr. George Cresswell, was killed on the Wolferton marshes near Lynn on the 16th. Others were seen at the same time, and a second example was said to have been shot. This occurrence was recorded by Mr. Southwell in the 'Zoologist' for 1881 (p. 469), and three others were subsequently recorded

* See Mr. Power's notes from Cley (*antea* p. 345).

in the same journal as obtained in Lincolnshire, Hampshire, and at Balls Park, Hertfordshire, about the same time.

QUAIL. One shot at Shotesham on the 6th; and another, in the same locality, on the 10th.

OCTOBER.

SHORE LARK. I had a male sent me alive for my aviary from Yarmouth, on the 10th.

SUMMER MIGRANTS. A Wheatear and Redstart were seen at Northrepps on the 13th, and a Goatsucker was shot on Yarmouth beach on the 23rd of September. On the 16th of October a Chiffchaff was killed at Yarmouth, and a House Martin seen October 16th. On the 5th two Ring Ouzels, one adult and one immature, were shot at Somerton.

SKUAS. One Great Skua, two Pomatorhines (one black variety, the other white-breasted with dark bars), and an adult Richardson were shot off Yarmouth on the 3rd. Also two immature Richardson's on the 21st, two adult and one immature Buffon's Skuas about the 22nd, and an adult Pomatorhine on the 25th. The Great Skua is quite a rarity on our Eastern coast, I have but one in my collection, and that from Lowestoft, Suffolk.

WOOD LARK. A single bird was shot on Yarmouth Denes on the 5th, a strange date and locality.

SPOTTED CRAKE. This species also occurred throughout this month in some numbers in the Broad district.

GREY CROW. A considerable flock seen to arrive on the coast, about Northrepps, on the 4th.

RED-NECKED PHALAROPE. An immature bird obtained at Yarmouth on the 3rd. Mr. Fenwick Hele also recorded in the 'Field' of October 26th two of these birds as shot at Alburgh in Suffolk, a few days before.

SABINE'S GULL. Two immature birds, male and female, were shot on Breydon on the 17th and 22nd; the first occurrence of this species in Norfolk. See paper in last year's 'Transactions.' Two other examples, also young birds, were recorded in the 'Field' and 'Zoologist' as obtained, one at the mouth of the Liffey, and one at Dublin, in the previous month.

LITTLE GULL. Two or three specimens shot on Breydon at the same time as the Sabine's Gulls; whence the report that five of the latter had been obtained.

STORM PETREL. One shot at Gorleston on the 17th, and one at Cley on the 21st.

WILD GEESE. A Bean Goose and Grey Lag-geese, both immature, were shot at Yarmouth on the 15th and 22nd.

KENTISH PLOVER. Two immature specimens killed on Breydon on the 24th, making a most unusual number in one season.

SHORE LARK. Two on Yarmouth Denes, October 26th.

GOLDEN-CRESTED WREN. A considerable number were observed about the Caister Road, next Yarmouth, on the 22nd and 23rd.

TENGMALM'S OWL. Certainly the rarest bird of the season, next to the Sabine's Gull, was an adult male of this species, secured by the keeper of the Cromer lighthouse as it fluttered against the lantern on the night of October 30th. It came into the possession of Mr. J. H. Gurney, Jun., who recorded its capture in the 'Zoologist.' This is the third specimen obtained in Norfolk. In the 'Field' of November 18th, another bird of this species was said to have been shot at Dartford.

NOVEMBER.

SPOTTED RAIL. Again, this month, I heard of some eight or ten specimens shot in the Yarmouth neighbourhood, and four near Lowestoft. I have reason to believe it still nests on the margins of our wildest and most extensive Broads.

SCYAVONIAN GREBE. An immature bird, near Yarmouth, on the 9th.

SHORE LARK. On the 13th I received another live specimen from Yarmouth for my aviary, with Snow Buntings and Twites. It may be mentioned here, that on the 9th thousands of Snow Buntings and Shore Larks were observed, passing south, at Heligoland.

SNIPE DRUMMING IN WINTER. Several of these birds were heard at Ranworth on the 8th, making their well-known sound as in spring.

GREAT GREY SHRIKE. A bird of this species was taken alive at Beeston near Cromer about the 15th.

LATE HOUSE MARTINS AND SWALLOWS. One Martin seen, November 11th, at Overstand, and two Swallows at Cromer on the 18th; and several House Martins were also seen at Cromer on December 5th.

DECEMBER.

WINTER ARRIVALS. A large number of Snow Buntings and Twites (the latter unusually numerous this season) appeared at Yarmouth on the 14th of November; and it is interesting to note that Mr. Cordeaux, in the 'Zoologist,' remarks that, from that very date till the middle of December, "Snow Buntings frequented the stubble fields on the Lincolnshire coast in flocks of thousands, feeding, with almost equal numbers of Greenfinches, flocks of Tree Sparrows, and some Linnets and Twites, on oats that had been shelled out by a high wind on August 26th. Mealy Redpolls appeared in the bird-dealers' shops in Norwich on the 5th, and were said to be plentiful. Siskins were also numerous about the same time, especially near the coast. The number of Wood Pigeons observed migrating near Yarmouth and Northrepps, late in November and beginning of December, was a feature of the season. Mr. G. Smith of Yarmouth informs me that they were seen on Caister Denes, on November 27th, passing by hundreds; and again at Beeches on the 28th. At Northrepps, large flocks were noticed on November 15th going south, and again on December 16th in about equal numbers. Fieldfares and Redwings were scarce everywhere, but a flock of the former appeared at Northrepps on the 1st of December.

ROBINS NESTING IN WINTER. A pair of Robins built their nest and reared a brood of young ones at Merton Hall, their young being hatched on the 8th of this month.

LITTLE GULL. Another immature specimen was shot from the beach at Yarmouth on December 1st.

WAXWING. A few of these uncertain visitants appear to have arrived on the coast late in the month, as one was sent to a Norwich birdstuffer on the 28th; and a few days before two or three were seen near Holt, and one in the neighbourhood of Lamas. One or two were also seen at Burgh near Yarmouth.

LESSER SPOTTED WOODPECKER. A female was shot in a plantation, near Mr. Harmer's house at Cringleford, on the 16th.

RAPTORIAL MIGRANTS. In January a Rough-legged Buzzard was shot at Filby on the 7th, and another at Hanworth, near Cromer, on the 14th; and on the 18th a Peregrine was seen close by at Gunton. On the 28th a live Short-eared Owl was sent me from Yarmouth; and on the 31st five were seen on Roughton Heath near Cromer, and three on the Warren. Again on the 24th of February a Short-eared Owl was observed by a gamekeeper at Northrepps, flying round inside his garden, and dropping down every few minutes after mice. The same keeper, on the 6th of March, saw a Sparrow Hawk chasing a Short-eared Owl. On the 7th of February a young Hen Harrier was shot at Flegg Burgh, and another at Hickling on the 11th; and a Marsh Harrier was seen at Ranworth on the 18th. A Peregrine Falcon was also seen at the same time and place; and a young bird was sent up to Norwich (no locality) early in the month, and a nearly adult bird from Gorleston on the 3rd. A Common Buzzard was killed at Letheringsett in February, and a Rough-legged Buzzard at Thornage on the 1st of March. Short-eared Owls appeared, singly, at Northrepps on March 26th and April 3rd, and a Buzzard on the 18th of April.

An unusual number of Marsh Harriers were seen this spring in the Broad district, and one or two frequented the larger Broads throughout the season, but I have reason to believe they did not nest, as the Short-eared Owls undoubtedly did. An Osprey was seen at Potter Heigham on the 13th of June but from that date, excepting the Hobbies' nests found in Foxley Wood by Mr. F. Norgate, already recorded in our 'Transactions,' I have no other raptorial notes till the month of September, which was remarkable for the

ABUNDANCE OF HONEY AND COMMON BUZZARDS.

The chief Ornithological feature of the year was, undoubtedly, the considerable influx of Honey and Common Buzzards in September, along our whole line of coast and adjoining parts of Suffolk, simultaneously; the specimens seen or obtained, occurring between the 21st and 31st of the month. From my own notes, at the time, from Yarmouth and its neighbourhood, chiefly supplied to me by Mr. G. Smith of the Priory, and from notes made by Mr. Gurney as to examples seen or killed in the Cromer district,

I have made out the following list, which may give some little idea of the extent of the immigration; but I have had some difficulty in avoiding repetition in numbers, as birds recorded from the coast appeared again, in many instances, in our birdstuffers' shops.

Honey Buzzards	.	.	.	.	.	21
Common Buzzards	.	.	.	.	.	10
Seen, not identified	.	.	.	.	.	4
						<hr/> 35

Of these birds, reckoning both species, thirteen occurred at Yarmouth, or on the Broads adjoining, and at Fritton and Somerleyton, on the borders of Suffolk; eleven in the neighbourhood of Cromer and Northrepps; three inland, and one at Hunstanton, near Lynn; the only record I find from that part of the coast. Of five, localities not known.

We have had no such visitation of Honey Buzzards since September, 1841, and the numbers then seen or procured fell far short of the present record.

With the exception of a Buzzard, seen inland, on the 21st, at Cranmer, near Fakenham, the first indication of this raptorial invasion was the appearance, on the morning of the 24th, of three Common Buzzards, three Sparrow Hawks, and a Harrier, washed up dead on the beach at Yarmouth, as stated by Mr. Patterson in a letter to the 'Daily Press,' drowned, evidently, by some mischance on their way to our shores. On the 23rd a Honey Buzzard had been taken alive on the Drive at Yarmouth, and a Common Buzzard shot on the North Denes, but ten, at least, of the specimens included in my list were seen or obtained on the 24th, the rest between that date and the 31st. Two Honey Buzzards were also sent to Norwich on October 1st and 6th, localities not known. I could not ascertain that a single adult bird had appeared amongst the Honey Buzzards. Two young birds, which Mr. Gurney secured alive, were prettily mottled in the immature dress, but died in the spring of the following year. One large Hawk, supposed to be a Buzzard, which was seen soaring at a great height at Northrepps on the 27th, was being mobbed by two flocks of small birds, estimated at about two hundred. A Honey Buzzard, which was trapped at a Wasps' nest at Southrepps, had dug out a hole big enough to get into, and

which, after it was first disturbed, it was seen to enter seven or eight times.

A good many Short-eared Owls also put in an appearance during this month, and some, I understood, late in August. On the 15th a Peregrine was seen at Lower Heigham, flying direct for the city. Several Marsh Harriers were killed about Yarmouth on or about the 24th with the Buzzards; and a "blue-and-red Hawk," seen near the avenue at Northrepps on the same day, was probably an adult male Montagu's Harrier. On the 26th an adult female Peregrine was shot at Blakeney.

On the 13th of October four large Hawks, possibly Buzzards, were seen at Northrepps, apparently fighting in the air; the last, apparently, of the invading host. On the 10th an Osprey was shot at Flitcham, a Peregrine and an immature Hobby somewhere in the county on the 8th, and an immature Marsh Harrier at Yarmouth on the 15th. Probably the first Merlin of the season was shot from Breydon Wall on the 7th of November; and a Barn Owl, caught by a boy in a fence at Seraby, on the coast, was no doubt a migrant; it was dark in tint and much spotted. The first Rough-legged Buzzard of this winter put in an appearance at Somerton on the 5th, and another was shot at Flegg Burgh, also near Yarmouth, on the 22nd, and one close by at Fritton, in Suffolk, on the 15th; and an adult female Hen Harrier at Rollesby on the 26th.

The record of the year, raptorially, closed with the death of a fine young Sea Eagle (of course proclaimed as a Golden Eagle till satisfactorily identified), which was shot early in December, between Sedgeford and Holme-next-the-Sea, close to Hunstanton. One of these birds frequented for some days the park and lake at Kimberley in the autumn, but, thanks to the protection of the noble proprietor of the estate, remained unmolested till it voluntarily took its departure.

MIGRATORY WADERS. The intense frost and deep snow-drifts from the middle to near the end of January were not favourable for Waders on Breydon, or any other part of the coast. Even Dunlins were scarce, and a few Sanderlings, Knots, and Golden Plover, with an occasional Godwit or two, were about all that the gunners brought in; but during the terrific gale on our east coast on the 18th, swarms of Snipe and Dunlin, as well

as wildfowl of various kinds swept down the coast on their passage southward. A Purple Sandpiper was shot at Yarmouth on the 19th, and a Green Sandpiper was seen about the same date at Taverham near Norwich. So soon as the frost began to break by the first week in February, our markets were full of Dunlins, Knots, Redshanks, an Oyster-eatcher or two, and various wild-fowl, all in wretched plight, and lots of Water Hens in a shocking state of emaciation, as one dealer remarked, "not worth picking up." The Coots seeking the salt marshes suffered far less. Although in the hard weather scarcely as many Dunlins were shot on Breydon as have been killed occasionally at one discharge of a duck-gun, yet by the middle of February they appeared in large numbers, about two hundred in a flock, with some Ringed Plovers. Two Golden Plovers with partial black breasts, and a good flock of Redshanks were seen at Ranworth on the 18th of March. On the morning of the 2nd of April a flock of some two hundred Golden Plovers was seen at Castleacre, where large numbers had recently frequented the wheatfields, most of them assuming the black breast.

Amongst the spring migrants on Breydon during the first fortnight in May were two Turnstones, one Black-tailed Godwit, and several lots of Bar-tailed Godwits, and on the 14th a few Grey Plover, assuming summer plumage, one Greenshank, and a few Red Knots. From the 20th to the end of the month the tide of migration set in, and Breydon had its full compliment of Grey and Golden Plovers, Turnstones, Sanderlings, Pigmy Curlews, Oyster-eatchers, two or three Kentish, and many Ringed Plovers, one Greenshank, Dunlins, &c. Dunlins were still numerous on the 1st of June, a Greenshank was shot on the 11th, and large flocks of Redshanks appeared at the same time, and three Dotterel (*morinellus*) were seen on the North Beach on the 15th. Though not included amongst Waders, I may also mention here, several Black Terns in May. Turnstones and Dunlins still frequented the "muds" up to the 23rd of June.

The end of the "close time," August 1st, found Breydon again alive with Dunlins, Pigmy Curlews, Ring Plovers, Whimbrel, Curlews, Redshanks, and Common Sandpipers (eighteen were killed at one shot), of all of which species specimens were killed in the first week of the month. One Turnstone on the 20th, first

Knot 23rd, first Grey Plover 24th, two Knots on the 25th, and a Sanderling on the 27th. Common, Arctic, and Lesser Terns were very plentiful at this time, both on Breydon and the adjoining rivers.

The above Waders, with Oyster-catchers and Bar-tailed Godwits, the latter scarce, were met with throughout August and chief part of September. Amongst the rarer species may be noted a Spotted Redshank, shot on the 25th of August, and two others seen about that date; also three Greenshanks. Little Stints must have been extraordinarily plentiful, as between the 1st and 17th of September I have notes of thirty-four specimens shot on Breydon or close by, and two Temminck's Stints. Seven Sanderlings were killed between the 7th and 11th, and a solitary Woodcock appeared near Yarmouth on the 8th, and a Green Sandpiper on the 4th. Again on the 17th, five Bar-tailed Godwits were shot out of a small flock on Breydon, and two Greenshanks on the 22nd: these, and the Kentish Plovers, separately mentioned, exhaust my autumnal list. On the 2nd of November another Spotted Redshank was shot on Breydon South Wall, in winter plumage, a very Red (for time of year) Bar-tailed Godwit with but one leg on the 5th, and the same day a slightly Red Knot. On the 2nd and 4th very large flocks of Lapwings were seen going west at Northrepps. A Wood Sandpiper was killed on the 5th somewhere in the neighbourhood, and on the 19th a Purple Sandpiper on the beach.

DUCKS AND DIVERS. The commencement of 1881 was anything but a gunner's season, as the intense severity of the frost when it did come, and the deep snow which, drifted by the gales, filled roads and railway cuttings in many parts of the county, drove fowl and other birds, migrants and residents alike, to the southward for a time. My notes, therefore, under this head are but few.

Sheldrakes seemed to have had a bad time of it, and from the localities from which specimens were sent to our birdstuffers, I fear most of those that were shot were reared on our coast. A Scaup Duck was killed on the 11th as high up the River Yare as Thorpe Gardens; and on the 21st a male was picked up, exhausted and nearly buried in the snow, on the top of the Gas-house Hill, Norwich. Two or three good old males occurred

at Yarmouth about the same time, and a fine old male Golden-eye at Hickling on the 27th. Strange to say, when the weather was most severe, towards the end of the month I saw a male Shoveller, anything but a "hard-weather" fowl, in the Norwich fishmarket.

In February more old Scaups were met with on Breydon, and a female Velvet Scoter was also shot at Yarmouth on the 3rd. Pintails, Common Scoters, and other fowl appeared about the 10th and 11th, and by the 27th Duck and Mallard, Wigeon and Pochard were plentiful, and three mature Golden-eyes were shot at Somerton on the 26th. A few immature Merganzers and one or two Black-throated Divers were killed during the frost, but I saw none in good plumage.

At Ranworth on the 18th of March, Mr. J. H. Gurney, Jun., found a strange mixture of winter and summer fowl on the Broad, a pair of Golden-eyes and fifteen Tufted Ducks appearing with a male Shoveller and a Garganey, ten Common Teal, twenty Duck and Mallard, and a flock of Wigeon; the latter all male birds but two.

Shovellers were seen on Breydon, again, as early as the 1st of August, and several lots of this species appeared there on the 20th, with a few Sheldrakes. I have several notes of Gadwalls killed both on the coast and inland, in September and October, but as these birds breed in such large numbers* upon the meres of the Merton and Wretham estates, and in many localities in West Norfolk along the valley of the Nar, and disperse in autumn, it is impossible now to distinguish foreign arrivals.

An immature Long-tailed Duck, a female, was shot near Yarmouth on the 22nd of October, an early date for this species; and a few immature Red-throated Divers were shot both in October and November. In December a female Golden-eye on Breydon, with a few Pintail Ducks and flocks of Scoters at sea complete my notes.

* Sir R. P. Gallwey, in a most interesting paper in the 'Field' of May 12th, 1883, on "Fish and Fowl in West Norfolk," as observed on Lord Walsingham's estate at Merton, speaks of the number of Gadwalls on one private water alone being computed at fourteen or fifteen hundred.

XVI.

ADDITIONAL
LOCALITIES OF RARER NORFOLK PLANTS.

By REV. E. F. LINTON, M.A.

Read 27th March, 1883.

Of the following plants, noticed by me during the past year, some are varieties new to the county; some are mentioned to fill up gaps in Mr. Geldart's four districts, and a few more to throw light upon the distribution of some of our rarest Norfolk plants. Those which are new county records are distinguished by an asterisk (*).

* *RANUNCULUS ACRIS*, LIN., var. *TOMOPHYLLUS*, JORD. On clay soil by the River Bure, Wroxham; a scanty supply.

ARENARIA LEPTOCLADOS, GUSSONE. Borders of Mousehold and Sprowston. Also on ruins at Thetford.

ALSINE TENUIFOLIA, CRANTZ. In abundance on a heath south of Thetford. Also in smaller quantity at Castleacre.

* *SCLERANTHUS ANNUUS*, LIN., var. *BIENNIS*, REUTER. Gravelly ground, Mousehold.

[*HYPERICUM HIRCINUM*, LIN.] Holkham Park, in large quantity. Introduced, I believe, by the late Earl of Leicester as cover for game; now thoroughly established.

TILIA PARVIFOLIA, LIN. One large old tree at the entrance to Sprowston Hall, said to have been planted on the day of the execution of Charles I.

* *GERANIUM ROTUNDIFOLIUM*, LIN. By a roadside, Thetford. This rare species has long been known in Suffolk; but has not, I believe, been found hitherto any further north. There is a fair quantity extending over more than a hundred yards of roadside.

LATHYRUS PALUSTRIS, LIN. For so scarce a plant it is worth while confirming the old records in Mr. Trimmer's book: "Ranaugh; W. A. Marshes at Horning; F.B." "Ranaugh," of course, is the old name for Ranworth; and, perhaps, more correct as agreeing with the local pronunciation.

* RUBUS ROSACEUS, WEIHE. Copse in Sprowston.

* RUBUS SPRENGELII, WEIHE, var. BORRERI, SALTER. Hedgerow, Sprowston.

ROSA MICRANTHA, SMITH. Hedgerow, Sprowston. Only known previously in Norfolk near Ormesby, where recently found by Mr. A. Bennett.

* ROSA RUBIGINOSA, LIN., var. COMOSA, RIP. Hedgerow in Sprowston; a form which scarcely seems to me to differ from the var. *sylicola*, Deseg., of the London Catalogue.

ROSA CANINA, LIN., form LUTETIANA, LEMAN. The commonest form in most places, but not separately recorded for Norfolk.

* ROSA CANINA, LIN., var. DUMALIS, BECHST. Hedges, Sprowston and Newton St. Faiths.

ROSA CANINA, LIN., var. ARVATICA, BAKER. Sprowston, Crosswick.

* ROSA CANINA, LIN., var. FRONDOSA, STEVEN. Two forms; one approaching *R. urbica*, in hedges, Sprowston and Earham; another (in the direction of *R. tomentella*, but declared by Mr. J. G. Baker to be nearer *R. frondosa*) having very small fruit, and rather long-pointed leaves, hedges in Sprowston.

* ROSA CANINA, LIN., var. VERTICILLACANTHA, MERAT. Hedges, Sprowston and Beeston St. Andrew. This variety also occurred in Sprowston with erect persistent sepals, and was pronounced by Mr. J. G. Baker to be a "very interesting form."

* ROSA CANINA, LIN., var. CORIFOLIA, FRIES. A very distinct north country form; not hitherto recorded, I believe, further south than Warwickshire. Only one large bush as yet discovered: Sprowston.

* EPILOBIUM PARVIFLORUM, SCHREB, var. RIVULARE, WAHL. Hellesdon, riverside. This variety is given in Hooker's 'Student's Flora,' and was admitted in the sixth edition of the London Catalogue.

[*ENOTHERA ODORATA*, JACQ.] Self-sown, and running wild in a newly enclosed cemetery and unused part of it: Yarmouth, 1880.

GNAPHALIUM LUTEO-ALBUM, LIN. Self-sown, if not indigenous, over a large piece of uncultivated land not far from the sea near Wells.

TARAXACUM OFFICINALE, WIGGERS, var. *ERYTHROSPERMUM*, ANDRZ. Cultivated ground: Sprowston.

VERONICA VERNA, LIN. Abundant on a heath to the south of Thetford, where also *Scleranthus perennis*, Lin., more sparingly.

* *POLYGONUM AVICULARE*, LIN., var. *ARENASTRUM*, BOREAU. Sandy roadside: Hellesdon.

POLYGONUM MITE, SCHRANK. Peaty ditch, Newton St. Faith. New to "Norfolk E." of Mr. H. C. Watson's two divisions.

* *BETULA ALBA*, LIN., var. *VERRUCOSA*, EHR. Moist copse, Sprowston.

* *BETULA ALBA*, LIN., var. *PUBESCENS*. Moist copse, Sprowston.

ALLIUM VINEALE, LIN. Hedge-bank, Sprowston. "Near Norwich" is quoted by Mr. Trimmer as a former record. The station is now more defined.

CAREX PARADOXA, WILLD. This rare *Carex* was in good quantity last summer at the old station, Hoveton. What is more interesting, I found it also in the Ranworth marshes, more sparingly, and in younger plants; the seed may have well been carried down by floods.

PHILEUM NODOSUM, LIN. A large form of this grass was growing in a Clover field, in Sprowston, during the summer of 1880; and I found a smaller form of the same species (or variety) in a heathy pasture near Thetford, the same summer.

PHILEUM BOEMMERI, SCHRAB. In fair quantity on a heathy pasture south of Thetford; and also in the parish of East Harling in small quantity.

KOELERIA CRISTATA, PERS. Near Thetford; fills up "sc" in Mr. Geldart's list; as does also—

AVENA PRATENSIS, LIN. Near Thetford.

* *POA PRATENSIS*, LIN., var. *STRIGOSA*, GAUD. This small form is plentiful in the sand just north of Yarmouth.

XVII.

MISCELLANEOUS NOTES AND OBSERVATIONS.

GREY SEAL (*Halichoerus gryphus*) ON BREYDON.—At our Meeting in March, 1882, I was able to record the occurrence of an adult female Grey Seal and her young one, in the Wash, near Lynn (*antea* p. 415), which I then stated was the first known occurrence of this species on the Norfolk coast. A second instance has since come under my notice; and I am inclined to think that other individuals of the same species have been seen or killed, which I have not been successful in tracing.

On the 28th November, 1882, a young female Grey Seal was shot on Breydon, which I saw two days after in the flesh at Yarmouth. It measured 4 ft. 3 in. in length to the end of the hind flipper, tail 4 inches, and weighed 58 lbs. The belly and throat were nearly white, the upper parts steel-grey, irregularly splashed with dark-brown blotches very sparingly about the sides and back, but more conspicuously on the head and back of the neck. The claws of the fore flippers were very long, being $1\frac{1}{4}$ in. (in the old female previously recorded the corresponding claw was $2\frac{1}{2}$ in. long, and in the young one $1\frac{3}{4}$ in.); the claws of the hind flippers were also long, but weak and flattened. Mr. W. W. Spelman, of Yarmouth, for whom the Seal has been preserved, very kindly allowed me to bring away the head, and I have prepared the cranium, which is now in the Norwich Museum.—T. SOUTHWELL.

NOTES ON THE CASPIAN TERN. As some uncertainty shrouds the few specimens of this very fine Tern which have been killed in England, the following list of Norfolk specimens, drawn up with the assistance of Mr. Henry Stevenson, and from various sources, will probably be acceptable.

1. Yarmouth. Immature. October 4th, 1825. *Fide* Messrs. Paget & Hunt.
2. Yarmouth. Presented to the Norwich Museum in 1831 by the Rev. G. Stewart.
3. Yarmouth Beach. 1839. This I believe to have been the specimen in the late Mr. Heysham's collection, bought by my father at its dispersal in 1859.
4. Yarmouth. Immature. Presented to the Norwich Museum in 1842, with some other birds. Possibly identical with No. 1.
5. Yarmouth. Female. June 2nd, 1849.
6. Yarmouth. Male. June, 1850.
7. Yarmouth. -- July 16th, 1850.
8. Yarmouth. Male. August 11th, 1851.
9. Yarmouth. Male. May 2nd, 1862.

J. H. GURNEY, JUN.

ON A SUPPOSED OCCURRENCE OF ARDEA CANDIDISSIMA IN NORFOLK. The principal authority for including the Little Egret as a Norfolk bird, is a supposed specimen said to have been killed at Sparham more than fifty years ago.* Being engaged on a catalogue of Norfolk birds, I took a recent opportunity of being in London to run down to Twickenham, where the specimen is preserved; and through the kindness of its owner, Dr. H. W. Diamond, I was allowed to see it, and compare it with an Egyptian skin brought for the purpose. A careful examination showed immediately that the Sparham bird was not the European Little Egret (*Ardea garzetta*). It differed from that species in having many occipital plumes—quite a bunch of them—about three inches long, and in other minor points. I concluded it might be the Asiatic species; but

* Stevenson's 'Birds of Norfolk,' vol. ii. p. 150.

subsequent search in the library of the Zoological Society in London, coupled with an inspection of the series of Egrets in Mr. Osbert Salvin's collection, showed that in the Sparham bird we had an adult specimen of the American *Ardea candidissima*. Whether it was really killed in Norfolk I must leave. It has all the appearance of not having been set up at the time of being skinned, the supple neck, and other signs, which a bird mounted from the flesh generally have, being all wanting. Dr. Diamond, however, informs me that it was decaying when it reached him. It was stuffed by a birdstuffer named Hobcroft, or Haderoft, of New Compton Street, Soho, who went to America and died there. It is inscribed on the back of the case:—"Shot by Roger Stoughton near Sparham, Norfolk, 1831."—J. H. GURNEY, JUN.

NOTES ON THE WEATHER OF 1882-83.—The Rev. H. P. Marsham has been good enough to furnish me with the following notes on the weather of 1882 and the early part of 1883, which, as the seasons have been very exceptional, may be worth recording. The observations have all been made at Rippon Hall, near Norwich.

1882.—Barometer at 9 a.m.—Highest on January 17th, 30·1 in. ; lowest March 1st, 28·6 in. Total rainfall of the year, which fell on 154 days, 28·29. In the month of November rain fell on 22 days. Most rain fell in October; viz., 5·43 in. The greatest rainfall took place on the 22nd October; viz., 1·45 in. in 24 hours, which is the heaviest fall Mr. Marsham has ever registered in so short a period. The total rainfall for the year is about 1½ in. in excess of the average of the past 11 years. During the year the wind (at 9 a.m.) has been in the S., S.W., or W. on 184 days; N.W. or N. for 86 days; S., S.E., or N.E. for 95 days. In the year 1782 the wind was in the like quarters for 143, 109, and 112 days respectively.

The rainfall for the exceptionally wet month of October, 1882, as given in Mr. Du Port's return, was least in Norfolk at Helvergate, viz., 4·38 in., and greatest at Thorpe (Norwich), viz., 7·02 in.

1883.—Mr. Marsham also sends the following comparison of the weather in the month of March in the two years 1845 and 1883, by

which it will be seen that the severe weather from which we have suffered during the past month is not altogether unprecedented:—

MARCH, 1845.*

- 1st. Very cold.
 5th. Good deal of snow fell.
 6th. More snow.
 11th. Snowstorms.
 12th. A deal of snow fell.
 14th. Thermometer down to 9° on east side of house.
 15th. Very cold.
 16th. Snow-drifts.
 17th. A great fall of snow. Snow-plough sent round on turn-pike.
 19th. Snowstorms.
 20th. Very cold in wind; snow melting.
 23rd. Snow all gone.

* The notes for 1845 are from the diary of the late Robert Marsham of Stratton Strawless.

MARCH, 1883.

- 1st and 2nd. Dull.
 3rd and 4th. Fine.
 6th. Gale and snow.
 7th to 10th. Snowstorms.
 11th. Milder.
 12th, 13th, 15th, 18th. Snow.
 20th. Very cold.
 23rd. Bitterly cold.
 29th. Very cold, with snow & ice.
 Snow fell on 11 days.

WIND—

- S., S.W., and W. 3 days.
 N.W. and N. 15 days.
 E. 13 days.

Amount of moisture registered

1 in. 28 hls.

This amount is not accurate, on account of the quantity of snow which fell.

T. SOUTHWELL.

ADDITIONS TO THE FLORA OF NORFOLK. During the past year (1882) I have received from Mr. F. Norgate and the Rev. H. Williams specimens of *Linaria purpurea*, Lin., and *Eriogon canadense*, Lin., from Thetford and Croxton; and Mr. Williams informs me that the latter has been established there for several years. Mr. Williams also finds *Equisetum variegatum*, Schleich., in the same neighbourhood. None of these species have been previously recorded for the county so far as I know.—H. D. GELDART.

POTENTILLA NORVEGICA. Last August I had the pleasure of finding *Potentilla norvegica*, Lin., growing on the river-bank at Thorpe. I am informed by Professor Babington that it has been found in Cambridgeshire, but this is the first time it has been recorded as an accidental immigrant in Norfolk.—A. M. BARNARD.

CHARA TOMENTOSA, LIN., IN NORFOLK. In August, 1881, while 'dragging' for Potamogetons in the Hundred Stream and Heigham Sounds, the drag brought up large numbers of specimens of various Characeæ. Among them two specimens, in bad condition, of *Chara tomentosa*, Lin., which was not only an addition to the Flora of the county, but also to England. With it were growing *Chara contraria*, Kütz., *C. stelligera*, Bauer (in good fruit, in which state it is very rare on the Continent), *C. fragilis*, &c. It has long been known from Ireland, having been found in 1841 in Belvidere Lake, in Westmeath, by the late Dr. Moore; and subsequently in the River Shannon, below Portumna. In Europe it occurs from Sweden! southwards to France! It may be known from all our other species by its large braet cells and stipulodes.—ARTHUR BENNETT, F.L.S.

Chara tomentosa
6. 84.

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