

LAKELAND
NATURAL
HISTORY

CARLISLE MUSEUM
& ART GALLERY,
TULLIE HOUSE,
CASTLE STREET,
CARLISLE. CA3 8TP.

MUSEUM
LIBRARY No: 1,071

TRANSACTIONS

OF THE

CARLISLE
NATURAL HISTORY SOCIETY

VOLUME VII

PUBLISHED BY THE SOCIETY

ARBROATH

Printed by T. Buncle & Co. Ltd., Market Place

1946



LAKELAND PEREGRINES.

W. C. LAWRIE.

LAKELAND NATURAL HISTORY

COMPILED BY
ERNEST BLEZARD
F.Z.S., M.B.O.U.

LAKEVIEW NATURAL HISTORY

EDITED BY
E. J. ALLEN
1911

CARLISLE NATURAL HISTORY SOCIETY.

FOUNDED 1893.

Past Presidents.

THE REV. H. A. MACPHERSON,
M.A., M.B.O.U.
E. C. STOWELL.
G. B. ROUTLEDGE, F.R.E.S.
L. E. HOPE, F.L.S.
D. LOSH THORPE, M.B.O.U.
FRANK H. DAY, F.R.E.S.
BENJAMIN JOHNSTON.
JAMES MURRAY.
HAROLD CARR.
THE REV. CANON R. BOWER, M.A.

T. SCOTT JOHNSTONE.
JOHN W. BRANSTON.
ERIC B. DUNLOP.
W. R. ROBINSON.
ROBERT LEIGHTON.
MISS S. MOUNSEY-HEYSHAM.
THE REV. H. D. FORD, M.A.
TOM L. JOHNSTON.
RITSON GRAHAM, M.B.O.U.
MAJOR W. J. M. GUBBINS.

OFFICERS FOR 1945-46.

President.

CAPTAIN T. H. HODGKINSON.

Vice-Presidents.

MAJOR W. J. M. GUBBINS. TOM L. JOHNSTON. RITSON GRAHAM,
M.B.O.U.

Council.

W. A. BORSHELL.
J. T. COULTHARD.
CAPTAIN P. S. DAY, R.A.
E. GLAISTER.

T. GRAY, F.L.A.
MRS W. J. M. GUBBINS.
E. STEEL.
MRS T. R. STEWART.

Hon. Treasurer.

FRANK H. DAY, F.R.E.S., 26 Currock Road, Carlisle.

Hon. Recorder.

MRS E. BLEZARD, Blackwell, Carlisle.

Hon. Secretary and Editor.

ERNEST BLEZARD, F.Z.S., M.B.O.U., The Museum, Carlisle.

PREFACE.

THE varied contents of this the seventh volume of the Transactions of the Carlisle Natural History Society are bound together in several respects. Collectively, they are representative of Cumberland, Westmorland and Lancashire North of the Sands which, united as the land of the English lakes, are Lakeland.

All the accounts have been put together by members of the Society, several having been read as papers at Ordinary Meetings. They combine to give some idea of influences and changes in Lakeland affecting the structure and appearance of the area itself, the wild life within its bounds, and the gain of directly related knowledge. A brief consideration of them in their turn may help their common purpose.

Developments in aviation as they affect birds, and the advantages of the aerial observer, instanced in the wider grasp of certain bird activities, enter into an ornithological topic of great moment.

The subject of ice action in glacial times concerns a mighty moulding of the face of Lakeland, a remote process still being interpreted. Its effects can well be read into other sections of the book.

Windermere, the largest of the lakes, is treated as a bird haunt, with considerations of its general formation and ecology. Changes in the composition of its winter-visiting birds are shown.

On an orchid of limited habitat, the wholesale disappearance of colonies is recorded as the result of the extensive felling of pine woods.

The Grey Lag-Goose, illustrative of continually altering bird distribution, here has its local expansion shown to be coincident with the formation of haunts attractive to the species.

The Badger, as described, is an interesting example of a mammal which, all in modern times, from near extinction in the area has become very firmly established.

A regional scan devoted to part of the Pennines associates birds with other forms of life and with natural and artificial features of the country covered. The same region is represented in the succeeding moorland paper.

The narrative of progress traces the part of individual naturalists and societies of naturalists in working up the knowledge of a county.

Finally, the bird supplement includes further evidence of movements in the feathered population, some having become more pronounced in the time since the publication of *The Birds of Lakeland* in 1943.

In acknowledgment, the paper on the Ice Age has been gone over by Dr F. M. Trotter of H.M. Geological Survey, the two maps have been drawn by David Dalton of Carlisle, the frontispiece and Raven picture are the work and gift of W. C. Lawrie of Workington, and the production of the volume has been helped in different ways by other non-members of the Society.

The frontispiece has special interest in showing an old Buzzard nest annexed by Peregrines in a site which, to Mr Lawrie's knowledge, had previously been used by Buzzards for thirty years. Furthermore, while the bird to the left in the picture is definitely known to be the falcon in possession, the bird to the right is not the tiercel, which was afterwards seen, but, as might fairly well be judged, another falcon. At rare times there are three apparently adult Peregrines about an eyrie, and here three were seen several times, the intruder or hanger-on in this instance seemingly being a female.

The Raven family, pictured in illustration of another distinctive Lakeland bird, are in one of five nesting sites variously used by both Raven and Peregrine in the particular locality.

James Storey, that grand old man of the Solway, who is prominent in the account of the Grey Lag-Goose, died on 9 June 1946, in his eighty-second year.

The felling of the last-known wood in the immediate Carlisle district, one at Stoneraise, to shelter Creeping Lady's Tresses has been begun in the month here appended.

THE EDITOR.

CARLISLE, August 1946.

CONTENTS.

	Page
PREFACE,	vii
LIST OF ILLUSTRATIONS,	xi
1. AVIATION AND ORNITHOLOGY IN LAKELAND, By Flight-Lieutenant R. A. Carr-Lewty, A.F.C., M.B.O.U.	1 19
2. LAKELAND AND THE ICE AGE, By T. W. K. Skelly, L.C.P.	29 20
3. WINTER BIRDS ON WINDERMERE—A RETRO- SPECT, Together with a List of the Water-Fowl, Waders and Gulls of the Lake. By Marjory Garnett.	49 22
4. CREEPING LADY'S TRESSES IN CUMBERLAND, By Dorothy Blezard.	71 18
5. THE GREY LAG-GOOSE IN LAKELAND, By Tom L. Johnston.	75 19
6. THE BADGER IN CUMBERLAND, By Ritson Graham, M.B.O.U.	88 17
7. THE LAKELAND PENNINES AND THEIR BIRDS. By Ernest Blezard, F.Z.S., M.B.O.U.	100 16
8. A ROUND ON WESTMORLAND MOORS, By Walter Thompson.	116 2
9. THE PROGRESS OF NATURAL HISTORY IN CUMBERLAND, By F. H. Day, F.R.E.S.	118
10. THE BIRDS OF LAKELAND: A SUPPLEMENT, By The Editor,	131

... and ... that all ... to ...
... and ... in ... the ...
...

CONTENTS

... and ...
... and ...
...

PREFACE

... and ...
... and ...
...

... and ...
... and ...
...

... and ...
... and ...
...

... and ...
... and ...
...

... and ...
... and ...
...

... and ...
... and ...
...

... and ...
... and ...
...

ILLUSTRATIONS AND MAPS.

LAKELAND PEREGRINES,	...	...	...	Frontispiece
From a photograph by W. C. Lawrie.				
				Facing page
CREEPING LADY'S TRESSES AT BROADFIELD,				
CUMBERLAND,	...	...	...	71
From a photograph by Ernest Blezard.				
LAKELAND RAVENS,	...	...	...	131
From a photograph by W. C. Lawrie.				

MAPS in end pocket to illustrate
 AVIATION AND ORNITHOLOGY IN LAKELAND
 AND
 WINTER BIRDS ON WINDERMERE.

ILLUSTRATIONS AND MAPS

PLATE I

THE GREAT LAKES

THE GREAT LAKES

PLATE II

THE GREAT LAKES

13

THE GREAT LAKES

THE GREAT LAKES

14

THE GREAT LAKES

THE GREAT LAKES

THE GREAT LAKES

THE GREAT LAKES

15

THE GREAT LAKES

AVIATION AND ORNITHOLOGY IN LAKELAND.

By Flight Lieutenant R. A. CARR-LEWTY, A.F.C., M.B.O.U.,
Royal Air Force.

OBSERVERS, AIRCRAFT AND AERODROMES.

The very great increase in the activities of the various flying services since 1939 prompts an examination of its possible effects on ornithology and its influences on the birds themselves. These aspects are being assiduously studied by a small number of pilots, navigators, air-gunners and others who, by virtue of their service duties have, or have had, ample opportunity of making aerial observations.

There is no doubt that birds have been affected in many ways by this super-invasion of their own natural medium in various directions and to varying degrees. They have suffered in many respects, and some things connected with aviation have been to their benefit. The science of ornithology is, however, only the richer, although the time has not yet arrived when the full measure of this increase in our wealth of knowledge can be properly assessed. It will come when all those ornithologists who have been able to make observations in the course of their flying duties during the war, and before, in Britain and abroad, have had the time and opportunity to publish their notes and findings.

Before the war, the number of ornithologists able to make aerial observations appears to have been very small, and but little has been published of what they saw of birds from the air. In the last five years, however, with the vast expansion of the Royal Air Force, there has naturally been at the same time a very considerable increase in the numbers of ornithologically minded members of air-crews, with a correspondingly large increase in interest taken in this new angle on bird watching. Many members of air-crews who are not ordinarily interested in ornithology have been taking pleasure in noting many interesting features of bird life as seen from the air, such as unusual methods of flight, flocks on migration, birds at unusual altitudes, flight patterns and speeds of flight.

The pilot is, in many respects, in an excellent position for observing birds, although aerial bird watching is not without its disadvantages. For instance, the speed at which the aircraft is travelling is not always such a great asset. Under some circumstances it makes observation very difficult, if not altogether impossible. It must be remembered that each aeroplane has a certain minimum speed below which it is not possible for it to maintain flight. Unfortunately, this minimum speed, or speed at which the aircraft will "stall" is, in almost every type of

aeroplane, considerably higher than the normal flight-speeds of the vast majority of birds. This factor alone makes impracticable the use of most of the more modern aircraft for the purpose of ascertaining the speeds of flying birds.

The speed at which the aircraft flies also makes identification very difficult in many instances, except where the aircraft is overtaking the bird or birds on an approximately similar course. It is also unfortunate that, as far as service flying is concerned, by far the greater part of all flights, except those specifically authorised as low-flying sorties, is spent at heights at which birds are very rarely encountered. The normal height for flights is 2000 feet or higher, and any bird seen in flight at these heights is worthy of special record. Most birds mainly spend their time within 500 feet of the ground.

Some aircraft can be flown reasonably slowly, in practice down to approximately forty miles an hour airspeed, and much can be learnt by the pilots of these slow types. They are not complicated aircraft and they are therefore simple to operate. The actual handling of the machine does not occupy the whole of the pilot's attention as does a large multi-engined type, and he is free to look about him.

The writer has been fortunate in being able to make about five thousand flights in these slow aircraft, most of them training types. This has involved about four thousand hours spent in the air in flights varying in duration from ten minutes to two-and-a-half hours. Of this total, eight hundred hours were spent over Lakeland in 1941 and, in addition to this, a large number of other flights in various types of aeroplanes have been made since 1936 across the area under consideration. In the course of all these flights a large number of observations on birds have been made and these have ranged, even during a single flight, from some on the altitude of Curlews—*Numenius arquata arquata* (L.)—flying above New Hutton, near Kendal, Westmorland, to others on the speed and height of Common Terns—*Sterna hirundo hirundo* L.—over the Cumberland Solway.

During the course of the present war, numerous aerodromes and camps of various descriptions have been constructed throughout the country and many have appeared in Lakeland. The number of aerodromes here has, however, been lower relative to the size of the area than has been the case in most other parts of England. This is due mainly to the remoteness of Lakeland from the war fronts and also to its general unsuitability for concentrated aerial activity on account of its hilly and mountainous nature.

Aerodromes are sited as far as possible in level country with at least a few miles of the surrounding ground clear of high obstructions in the form of hills. The greater part of Lakeland is high ground and the aerodromes have therefore been concentrated mainly in the flat Solway region and the coastal districts.

It follows that the disturbance due to the presence of aerodromes and to great flying activity has been confined almost entirely to these districts, and has not been wholesale and widespread as in other parts of the country. Aerial activity in the vicinity of the Solway particularly has increased a hundred-fold since the war.

The construction of a new aerodrome, entailing the very long runways necessary for modern aircraft, calls for the virtual sacrifice, ornithologically, of at least two hundred and possibly as much as a thousand or more acres of ground. The site chosen for a new aerodrome is usually remote from towns and in the kind of country most frequently rich in bird life. Aerodromes have, in some instances in the Lakeland area, actually encroached on bird sanctuaries.

The perimeter of the aerodrome itself is not necessarily the limit of its influence on local birds. The making of a new aerodrome accommodating modern heavy aircraft which make long, low and flat approaches to land, and which travel considerable distances from the aerodrome after taking off before accumulating sufficient speed to gain height rapidly, involves the felling and clearing of woods to a great depth of country. The hutments and dispersal quarters attached to aerodromes make a large addition to the actual landing ground.

Some remote places are used as bombing and aerial gunnery ranges, and activities in connection with these, rather than the normal taking-off and landing of aeroplanes, tend to frighten birds away. Birds on and near aerodromes quickly become accustomed to the aeroplanes flying about and are not unduly disturbed by them, but are always considerably alarmed by the loud noises associated with air-bombing and shooting ranges. Lakeland, due to its remoteness, has a large share of these ranges; estuaries and saltmarshes are favourable sites and a number of the most interesting ornithologically have ranges. The use of these is not always confined to the daylight hours; night-bombing and night-firing practices are undoubtedly the most disturbing to birds of all aerial activities. As with day-flying, night-flying was noted in Cumberland as having little effect on the local birds and, on one aerodrome near Carlisle, on six successive nights, a covey of Partridge—*Perdix perdix perdix* (L.)—was found in the same place at a point on the field near which aeroplanes had been taking off and landing all night.

Most training aerodromes have special localities set aside where the trainees can get practice in low flying, which is usually done at a height of 250 to 400 feet. These localities naturally have to be selected in the sparsely inhabited countryside and aircraft flying very low there undoubtedly cause great alarm among the birds. They do, however, quickly become accustomed to aircraft flying at 400 feet but, from aircraft below that height varying degrees of consternation are to be observed among the birds beneath.

In Lakeland some of these localities coincide with saltmarshes and, in the autumn and winter months especially, great alarm is caused among flocks of migrating birds and others lately arrived on passage, or for seasonal residence, by the low flying aeroplanes to which they are not yet accustomed. No doubt fewer birds remain in such localities and there is the possibility that any reduction in numbers of geese or ducks noted in recent years on the Solway, for instance, may in some part be due to this cause.

The extent to which the local birds near aerodromes and in these low-flying districts become accustomed to low flying in time can be appreciated and measured by taking a low-flying trip elsewhere and noting the different degrees of reaction of the birds flown over or near.

On and near aerodromes birds take little notice of aeroplanes and rather seem to regard them in a friendly light. Rooks—*Corvus frugilegus frugilegus* L.—most cautious in other matters, allow aircraft to approach within three or four yards, both in flight and on the ground, without moving, but they have learnt to keep out of the way of aeroplanes taking off or landing and they are very rarely killed in collisions.

Other species do not seem to be able to appreciate the danger to the same extent as the Rook and, Lapwings—*Vanellus vanellus* (L.)—especially, are frequently killed, as are also Common Gulls—*Larus canus canus* L.—and Black-headed Gulls—*Larus ridibundus ridibundus* L.—and, less frequently, Starlings—*Sturnus vulgaris vulgaris* L.—and Partridges. The Lapwing on being overtaken by an aeroplane, often keeps on a straight, rising course, and this is usually fatal; the other species mentioned generally make a steep turn to the left or right when the aeroplane gets unpleasantly close, a good evasive manoeuvre which is usually successful. Wigeon—*Anas penelope* L.—and Mallard—*Anas platyrhynchos platyrhynchos* L.—under the same circumstances have been seen many times over the Solway to roll quickly on to their backs and dive vertically away.

In Lakeland, as in other parts of the country, the Lapwing is a very common aerodrome nester and as many as seventeen nests have been counted on a single occasion on one aerodrome in Cumberland. Sky-Larks—*Alauda arvensis arvensis* L.—are also common on aerodromes, and a Ringed Plover—*Charadrius hiaticula hiaticula* L.—successfully hatched a brood on an aerodrome in Cumberland in such a position that, at least a hundred times a day, aircraft must have passed within fifty feet of the nest.

From counts made, the number of nests in the hedges and trees surrounding aerodromes does not appear to be any less than the average for nearby districts. Rookeries are commonly seen near aerodromes, frequently being situated within the circuit made by the aeroplanes as they go round the aerodrome, and as

often in such a position that the machines coming in to land and taking off pass within a few feet of the nests. Sitting Rooks rarely quit the nest on account of close-flying aircraft, and the same has been observed regarding sitting Herons—*Ardea cinerea cinerea* L. When coming in to land pilots often are able to see the eggs in the nests of Rooks and Herons and, where rookeries and heronries are conveniently situated near aerodromes, useful tallies can be made of laying dates and the numbers of occupied nests.

AERIAL OBSERVATION ON BIRDS.

When flying at an altitude of 2000 feet or more the aerial observer can identify with certainty only a very limited number of birds which are at ground level, and then only under the most favourable conditions of light and visibility, conditions which exist very infrequently, especially near towns. Some of the larger and more distinctly marked or coloured species such as the Common Heron, Gannet—*Sula bassana* (L.), Sheld-Duck—*Tadorna tadorna* (L.), Cormorant—*Phalacrocorax carbo carbo* (L.), Lapwing, Curlew, Black-headed Gull—*Larus fuscus graellsii* Brehm—can be distinguished from this height. One thousand feet above ground level is a common height for aeroplanes to maintain when in the vicinity of aerodromes and from this altitude the pilot can identify with certainty many more species at ground level. There is usually little difficulty in recognising Magpie—*Pica pica pica* (L.), Lapwing, Curlew, Black-headed Gull and most species of duck from 1000 feet under normal conditions of visibility.

Many species can, of course, be identified from much greater heights when they are in flight than when they are at rest. Black-tailed Godwit—*Limosa limosa limosa* (L.), Oyster-catcher—*Hæmatopus ostralegus occidentalis* Neum.—and Redshank—*Tringa totanus britannica* Math.—can be identified from heights of 2000 to 3000 feet when they are in flight. From these heights it would be impossible to pick them out when they are on the ground. In flight, the characteristic action of a bird arrests the pilot's eye, especially of a species with light coloured or white-barred plumage. From an altitude of five hundred feet the scope of identification is greatly extended; Wood-Pigeons—*Columba palumbus palumbus* L.—can be seen easily, Blackbirds—*Turdus merula merula* L.—distinguished in their flights from hedge to hedge, and Moorhens—*Gallinula chloropus chloropus* (L.)—and Coots—*Fulica atra atra* L.—easily identified one from the other. An aircraft flying at this height does not unduly alarm the birds below, although aircraft flying at much lower altitudes do have a disturbing effect on birds. This is most noticeable in places away from aerodromes because the bird populations around aerodromes appear soon to accept aircraft as harmless and ignore them in much the same way as birds in hedgerows and fields adjoining the roads ignore motor-cars.

Below five hundred feet, the greater apparent size and greater noise of aeroplanes will cause some apprehension amongst the birds underneath. This is evident when aircraft are flying across stretches of water. At an altitude of four hundred feet most of them will then cause the waterfowl below to make an unhurried retreat towards the nearest bank or shelter; at three hundred feet there is a more determined movement away from the path of the aeroplane and, at heights much less than this, all birds panic, usually diving, if diving species, or else flying away more or less at right-angles to the track of the aeroplane.

Most species can be identified from two hundred and fifty feet and, at this height above ground level, the airman frequently has oblique views of birds in which the manner of flight of the species often assists in identification. A difficulty in low-flying observation is the speed of the aircraft. At great heights the ground from an aircraft flying at even a hundred miles an hour or more appears as a slowly moving panorama. At low altitudes the ground and its features appear to rush past the pilot who obtains a very similar view of the surrounding countryside to that seen from a swiftly moving railway train travelling along a high embankment.

Only fleeting observations are possible during low flying at speed and the relative lack of manoeuvrability of the aircraft also prohibits a prolonged study. A subject is spotted, but the radius of turn of the aircraft is so great, perhaps half-a-mile or more, that it is lost to sight when the airman makes his turn and it cannot readily be picked out again except under very favourable circumstances. At one hundred miles an hour an aircraft covers a distance of seven hundred and thirty-three yards in fifteen seconds and, at this speed an aerial observer noting a bird three hundred yards ahead will be abreast of it in about six seconds and will have left it behind in another seven or eight seconds.

The type of background and the prevailing weather conditions are very important factors affecting the identification of birds from the air. Quite small species of waterfowl can be identified on smooth water on a clear, calm day from surprising altitudes. Over Bassenthwaite Lake and Derwentwater in August and September 1941, in perfectly clear visibility, Moorhens could be seen swimming when the aircraft was at a height of 1650 feet above the water level. Against a background of mud it would be totally impossible to see these birds with the naked eye from this altitude. Moorhens and Coots have been easily identified from an aeroplane flying at 1800 feet above Thurstonfield Lough on a very calm day when the surface of the water was unruffled. On this occasion even the wakes left by these birds as they swam along could be discerned.

It may be found possible to identify different species of waterfowl by the wakes they leave when swimming in a similar manner to the way in which ships at sea may be identified from the

air by photographing their distinctive wakes. This would have to be done with cameras to test the possibility of differences in wakes which might be specifically distinct in small respects due to differences in body shape and size of feet. A long series of photographs of the wakes left by previously identified species would show any differences that existed. This is a subject for research which must await development until after the war. From visual aerial observations made on the Solway, at Thurstonfield Lough, Bassenthwaite Lake and Ullswater the wake of Swans, Moorhens, Coots and Mallard appeared to differ to some extent but unluckily the use of a camera for lengthy study and minute comparison was not possible on account of wartime restrictions.

On a subsequent aerial visit to Thurstonfield Lough, on a day when a slight breeze rippled the surface of the water, no waterfowl could be seen even from a height of seven hundred feet. A descent to a considerably lower altitude revealed that a fair number of Coots and Moorhens were present together with several Mallard. There was also a Heron which had passed unobserved due to the fact that it was standing in the water and well camouflaged by the ripples. On another occasion during the summer of 1941, Black-headed Gulls could be identified and counted on the smooth water off Longnewton Marsh from 1200 feet. An hour later, a breeze which had sprung up had so broken the surface of the water that the birds were completely camouflaged and could not be seen. They were still there but a descent to about five hundred feet was necessary to locate them.

Sands and mudflats are excellent backgrounds for the identification of birds from the air, the smooth parts being much better than those rippled by the tide. Sheld-Ducks, Wood-Pigeons, Oyster-catchers and various species of geese and gulls stand out against these backgrounds and catch the eye at heights up to, and on occasions exceeding, 2000 feet in good visibility. Darker coloured birds such as Cormorants are identifiable from similar heights, on dry sands but not on mud. All these birds are very difficult to see when they are in creeks or against a broken background such as shingle or stubble.

Birds standing in ploughed fields or flying against a similar background are not easily distinguishable due to the general mottled or broken effect, but a background of short pasture such as the turf of the Solway marshes is excellent for seeing almost all species except the very smallest. Against the Solway turf Dunlin—*Calidris alpina schinzii* (Brehm)—in flight can sometimes be seen from above 1000 feet, and Ringed Plover from almost as high. Visibility is greatly reduced, of course, on cloudy days.

The stony parts of the fells are too broken to permit of frequent sighting of birds but an expanse of heather shows up most species well. Red Grouse—*Lagopus scoticus scoticus* (Lath.)—are especially distinctive in flight, even in comparatively poor

visibility. A pack were seen in flight just above the heather in the Borrowdale district from eight hundred feet and at a distance of about five hundred yards on a day on which the sun was obscured by cloud. Curlews are also easily seen above heather.

Visibility in rain is usually very poor, and in hail and snow-storms little better than in fog. It is often restricted in places downwind of large towns due to smoke haze. This does not affect observations made vertically from great heights as much as observations made obliquely from low altitudes. In the latter case the haze is generally more dense, and a greater distance has to be penetrated. This smoke haze often affects localities at considerable distances from towns, depending on the strength of the wind and the amount of smoke being generated.

The aerial observer is often handicapped to some extent by having to fly the aircraft himself whilst taking his notes and this usually makes observation difficult, and sometimes impossible, especially in low flying. After the war it may be possible for anyone interested in the aerial study of birds to hire both an aircraft and a pilot to fly it as and where required whilst observations are being made.

There is very poor downward visibility from most aeroplanes and when they are in level flight it is usually impossible to see immediately beneath them. The pilot may therefore only be able to get oblique views of objects on or near the ground unless the aeroplane is banked. Being restricted to an oblique view entails flying farther away from whatever is being observed on the ground than would be necessary if a vertical view were possible. It is possible to fly with the aircraft banked, or tilted to one side or the other, for only limited periods.

Weather conditions are not always suitable for flying, and bad weather might well interfere with a projected series of aerial observations. Occasionally there are periods of a week and sometimes as much as ten days or more when aircraft cannot leave the ground. It is not possible to make much aerial study of small birds on or near the ground although large passage-movements and flying heights of even the smallest species can be recorded.

Contrary to all these various drawbacks and limitations to the observation of birds from aircraft, there are numerous important advantages. In good visibility the view from an aircraft is very extensive and the pilot by virtue of his speed is able to travel quickly from one place to another. This makes possible, for instance, a survey of a large number of fell tops within a short space of time which would be totally impossible on foot. Similarly, a survey of all waters in an extensive countryside may be made in the course of a comparatively short flight. This could not otherwise be accomplished by a single observer on the ground, but only by a number of co-operators which would involve extensive organisation to produce simultaneous results.

Wide surveys of birds over large extents of sea, mudflats, sands and estuarine waters such as those of the Solway are quite impossible to the ground observer. They can be made with great ease from the air. The extreme difficulty of making anything resembling an accurate survey of a large expanse of mudflats and sands can readily be appreciated by anyone who has attempted this kind of task by ground work. One person on foot could not hope to make an accurate ornithological survey of more than a few acres of this difficult and mostly inaccessible terrain in the course of a day.

From an aircraft a hundred square miles of ground can be systematically quartered and carefully examined in the course of one short flight. In one aerial survey carried out over the Solway, fifteen thousand Pink-footed Geese—*Anser fabalis brachyrhynchus* Baillon—were estimated; this on a day in October 1941. The whole of this great number would at no time have been within the view of a single ground observer on the Solway, and the approximate numbers of such a multitude could not otherwise have been estimated than from the air. On another occasion in 1941 four large groups of ducks, mostly Wigeon and Mallard, were present on the various marshes fringing the Solway. The four groups kept quite separate, but constantly moving from marsh to marsh and side to side of the firth, not more than two groups being visible from any one point at one time. It is unlikely that a ground observer would have been able to make a reasonably accurate estimate of the number of duck, as was possible from the air.

BIRD FLIGHT MOVEMENTS IN RELATION TO WEATHER CONDITIONS.

On almost every occasion on which flying birds have been seen from the air, the speed and direction of the wind relative to their movements have been noted. It is strange that the wind direction was most often found to be contrary to what might have been expected. A tail- or following-wind would seem to be the most favourable to migrating birds yet, in the majority of cases noted from the air in Lakeland, birds have been found to be migrating at least partly against the wind and, in some instances, actually battling against a strong head-wind. Some passage-movements were noted in which the birds were being assisted by the wind.

When in flight a bird is flying in a body of air which is itself passing at a certain speed and in a certain direction over the ground. A bird going in the same direction as the wind would be assisted to the extent of the speed of the wind. Flying at thirty miles an hour in still air a bird would cover thirty miles in one hour but, flying with a ten miles an hour wind, it would cover forty miles in the same time. Against a wind of the same strength it would cover only twenty miles in the hour. Birds

might be expected to take advantage of wind assistance wherever possible, but the speed of passage does not appear to be all-important. The high speed at which birds pass over the ground when flying with a strong wind may be objectionable because of difficulty in following landmarks; but this is not very likely as, at the heights at which they usually travel, there is little sensation of speed. A more probable reason is a lack of desire to fly with a strong wind due to the possibility of their being carried astray should the wind in any way change direction. This is what probably happened in the instance of the Lapwings that were carried across the Atlantic on an easterly gale. Once having got off-shore it would be impossible for them to regain it owing to the fact that the wind speed was greater than the maximum speed of which the birds were capable. Nevertheless, movements and migrations seem to be more frequently made on windy than on calm days and the sight of a flock of birds making slow ground speed against a strong wind is a common one.

Observations on movements relative to the prevailing wind were made over a period of ten consecutive days in the autumn of 1941. A strong westerly wind blew on seven of the days at speeds of twelve to twenty miles an hour. On two days a north-easterly wind blew with moderate force, and one day was almost windless. On six of the seven days of westerly wind numbers of migrants, mostly geese, ducks and waders, were seen coming from the direction of Bewcastle Fells and the Irthing valley towards the Solway region. Practically all these movements were into the wind. During the same six days no arrivals were noted from a north-westerly direction by way of the Nith or the Annan valleys; nor were any noted coming with the wind along the Solway from the west. No movements from a north-easterly direction were noted on the day of calm, nor on one of the days on which a north-easterly wind was blowing although, on the other day of north-easterly wind, one skein of eight geese were seen coming from approximately north-east with the wind. On both days of north-easterly wind fair numbers of geese and many separate groups of waders crossed the Solway from the direction of the Nith on the Scottish side.

Several other series of observations on movements relative to wind direction and speed were made with roughly similar results. In this connection it must be borne in mind that, in autumn and early winter, the general trend of bird movements into the area is from north-east and east, and that the wind at that time of year blows more frequently from westerly points than from any other quarter.

An interesting subject for aerial observation, and one studied with comparative ease from heights up to 1000 feet or slightly more, is the foraging of Rooks from their nests and the effect of wind and weather on the direction and scope of their expeditions. A detailed study of a rookery near Kingstown, Carlisle, was made-

and it was found that the Rooks foraged as far away as three and a half miles, often overlapping ground occupied by other rookeries. Most of the birds appeared to work at a distance of from half a mile to about one mile from their nests. A very interesting point emerged from a careful study of a large series of observations made on these foraging movements relative to the prevailing wind direction.

This rookery is surrounded in every direction by eminently suitable feeding grounds and it was discovered that, on calm days or days when the wind did not exceed one or two miles an hour, the Rooks appeared to forage haphazardly in all directions. Many outward and inward movements were then noted from all points of the compass. On days, however, on which the wind was appreciable, of a speed of five miles an hour or stronger, it was found that the majority of Rooks were foraging into wind and returning to the rookery with the wind. The strength of the wind seemed to have little influence on the distance foraged, except on days of high wind, in which case there was a definite tendency to forage nearer the rookery.

On one day during which a westerly wind of eight to twelve miles an hour was blowing, a study of rook movements was made from the air. In the course of several flights a hundred and seventy-four Rooks were counted returning to the rookery, and the compass direction of their return carefully plotted. Landmarks to the north-west, north-east, south-east and south-west of the rookery were first chosen and then notes of Rooks returning and the points between which they passed were made. Ninety-seven Rooks returned between the landmarks to the north-west and south-west of the rookery; between the north-westerly and north-easterly landmarks thirty-four Rooks returned in the same period of observation. Twenty-seven were seen to return from points between south-west and south-east, but only sixteen were seen to return from points between north-east and south-east.

At the same rookery another test was made when the wind was blowing almost from the north and at a speed of between ten and fifteen miles an hour. On this day a hundred and forty-two Rooks were plotted returning to the rookery and the same landmarks were used as previously. Between north-west and north-east sixty-nine Rooks flew back to the rookery with food, and between north-east and south-east twenty-four returned. Thirty-one were seen to arrive between north-west and south-west, and only eighteen between south-west and south-east. Both of these series of observations show that most of the birds had been foraging into wind. The slower speed at which birds pass over the ground when flying into wind, with possible consequent greater ease in selecting feeding and foraging ground, may have some bearing on this tendency.

It was noted at other seasons that Rooks feeding together in flocks commonly moved across the fields into wind, no doubt due

to the greater comfort and preservation of heat resulting from this procedure as opposed to walking down wind with the wind continually ruffling their feathers. From this preference may develop a general tendency habitually to head into wind where possible. Heading into wind does, of course, ensure the most rapid "take-off" in case of emergency. Detailed counts were not made at other rookeries, but the preference for foraging into wind appeared to be general and was noted at Scaleby and near Crosby-on-Eden and at Kirkbampton.

A detailed count was made, by way of a check, on the Kingstown rookery on a day of calm, and Rooks were seen returning in roughly equal numbers from all points. Exact figures taken in the course of eight aerial observations were sixty-two between north-west and north-east; fifty-four between north-east and south-east; fifty-nine between south-east and south-west and fifty-one between south-west and north-west.

The land surrounding the rookeries watched is generally level and fairly low-lying with equally suitable feeding and foraging grounds on all sides. It is possible in the case of rookeries which are not surrounded on all sides by suitable foraging grounds to equal depths of country, such as those situated in hilly or heavily-wooded districts, or on the coast, or near the shores of large lakes, that this apparent preference for into-wind foraging cannot always be indulged owing to the uneven or inconvenient distribution of favourable grounds. That topographical features do affect this tendency is evidenced by the fact that the tenants of a rookery near Rockcliffe have no option but to forage across or down wind on many days of high tides, the prevailing wind being from the direction of the Solway. At other times the general tendency to forage into wind was noticed here.

The Common Heron seems to have a similar preference, judging from observations from the air on birds from a heronry at the eastern end of the Solway. Birds were seen to forage widely over the saltmarshes and mudflats up to a distance of eight miles fairly commonly, and once to a distance of eleven miles, although most birds foraged at a distance of two to four miles. On days when there was no westerly wind, or wind blowing from the Solway to the heronry, there appeared to be less foraging activity on the saltmarshes and more on the inland streams and ponds. The choice of site for this heronry may have been influenced as much by its situation down wind of the Solway, relative to the prevailing westerly wind, as by its convenient nearness to the ideal foraging grounds of saltmarsh, mudflat and creek. There are many alternative and equally suitable sites north and south of the Solway with the latter qualification.

Local movements of birds as affected by adverse weather conditions are infrequently noted from the air. On one occasion a hailstorm was in progress in the north-west of Cumberland, covering some two square miles between Wigton and Waverton, and

slowly advancing in a south-westerly direction. Visibility, other than in the hailstorm, was fairly good at the time. A party of five Curlews were noticed flying approximately on a northerly course which, if held, would have taken them into the centre of the storm. They were seen to change course towards the west when about a mile from the hailstorm and to skirt round it at this distance. When once more on a northerly heading they continued forward in the direction of the estuary of the Wampool.

Isolated showers are clearly seen from the air over large extents of country in good visibility, the fringes of heavy showers usually being fairly clean-cut. Several instances of parties of Rooks in flight avoiding heavy rainstorms by altering course so as to pass round, instead of through them, have been noted. One instance particularly comes to mind of two to three hundred Rooks which were flying down the Eden valley towards Kirkoswald where there was a heavy thundershower. An alteration of course to the left, to the Lazonby side of the river, took the birds behind the shower which was passing from left to right across their front in a westerly wind. A mile downstream from Lazonby an alteration in course, this time back to the right, brought them once again to the Kirkoswald side, but behind the shower. Whether considerations of visibility, generally bad in flight in a shower, or of comfort of flight influenced this manoeuvre it is impossible to say. Birds are, of course, sometimes seen flying in fairly thick mist so visibility was probably not the primary factor influencing this particular movement.

A flock of four to five hundred Starlings flying approximately west at Urswick in North Lancashire, in autumn 1937, were heading towards a large rainshower. There were other rainshowers to the south of this with an intervening belt of clear weather about a mile wide. The birds made an alteration in heading to the left to take them through the clear weather and so they passed successfully between the two masses of heavy rain.

In general, birds show less inclination to fly under conditions of bad visibility than they do in clear weather. The airman's humorous comment in foggy weather that "even the birds are walking" has some slight foundation on fact. Anyone long associated with large, open expanses of grassland, such as aerodromes, knows that the Lapwings and Rooks which usually figure so largely all day and every day on these places, show a definite disinclination to rise high, or to fly any appreciable distance, when disturbed in fog.

One foggy day in the autumn of 1941, on an aerodrome in northern Cumberland, a party of sixteen Golden Plover—*Pluvialis apricaria*—were seen when visibility was only about fifty yards. When the plover were approached on foot they took wing, and being followed in the direction in which they had disappeared, they were found and put up only about seventy yards from their first place. Several more times they were followed

and flushed at no more than seventy or eighty yards from where they last took wing. It was evident that on each occasion on which they were disturbed they had flown only a sufficient distance to be out of sight of the cause of their alarm. Golden Plover have been seen on this particular aerodrome on a number of other occasions in clear visibility, and they have then usually flown right away from the place if disturbed. The times on which they have again pitched within the confines of the aerodrome have been very few.

The Carrion-Crow—*Corvus corone corone* L., Rook, Starling, Fieldfare—*Turdus pilaris* L., Redwing—*Turdus musicus musicus* L., Curlew, Redshank, Dunlin, Lapwing and Oyster-catcher have also all been noted to show a similar real disinclination to fly far in bad visibility. This can readily be understood by the airman, who finds great difficulty in orientating himself in flight in foggy weather. An airman experiences other difficulties when flying in fog. One is keeping exact track of position by reference to the very small patches of ground visible to him immediately beneath and over which his aircraft is passing so rapidly. Furthermore, landmarks with which he is normally very familiar appear strange in fog.

In flight an airman maintains his levels by reference to the horizon, and most aircraft are fitted with instruments to assist the pilot to "fly blind" and to maintain his levels when he can see no horizon in cloud or fog, or at night. The pilot under training is taught to rely implicitly on these instruments and not to depend on his own bodily sensations to assist him to maintain his levels when "flying blind" in fog or in cloud. He soon discovers the value of this advice when he ignores his "blind-flying" instruments and finds his aircraft difficult to control. He may be perfectly convinced from his bodily sensations that it is flying straight, but it is quite probably almost upside down, and whilst quite certain that his left wing is down he may find, on emerging from the fog or cloud, that not only is his right wing well down but also that the nose of his aeroplane is pointing dangerously high, a state of affairs he had not even vaguely suspected. The wonder arises whether birds are similarly handicapped when without visual contact with the ground.

Interesting observations in this connection were made during flights from an aerodrome in the north of Cumberland. It was necessary in the course of duty to do considerable periods of low flying over the Solway and its saltmarshes, and frequently when the marshes themselves were obscured by sheets of fog. Occasionally the fog was quite a thin layer, a hundred to a hundred and fifty feet thick, the ground being invisible from the air above it. This indicated that visibility in the fog was certainly less than fifty yards. Under these conditions any bird flying at a height of about seventy feet or more would be out of sight of the ground and "flying blind." No bird was ever seen flying above

these sheets of fog, and no bird was ever seen flying immediately below the upper surface of the fog when the ground was invisible. It was established, however, by several simultaneous ground and aerial observations that many birds were flying actually in the fog on these occasions but were all remaining low enough to be within sight of the ground. The birds included Lapwings, Oystercatchers, Ringed Plovers, Dunlins, Redshanks, Lesser Black-backed Gulls, Black-headed Gulls and Common Terns. An aircraft passing over, or near them, at a height of about two hundred and fifty feet was sufficient to disturb most of them into flight.

Some times the fog is not sufficiently dense to make the ground completely invisible from above, but the same reluctance of birds to rise above it has even then often been noted. Once near Newton Arlosh, fog was about a hundred feet deep, and not dense enough to prevent a view of the ground, and Lapwings, Rooks and other marsh-frequenting species could be seen flying about in the thick haze from above, but not one of them, as far as the eye could see in all directions, appeared above the upper limit of the fog.

During other observations on birds in foggy weather, the fog was not widespread but in fairly large patches over several square miles, and usually with the edges of the patches sharply defined. On days when these edges coincided with some part or other of the Solway, it was easy to note the behaviour of the shore-birds under the then prevailing local weather conditions.

One day in June 1941 when patchy fog covered most of the Solway, an expanse four or five miles square had as its boundaries a line between Beaumont and Drumburgh to the south, another between Eastriggs and Gretna Green to the north, while its eastern edge cut between the last named place and midway across Rockcliffe Marsh to Beaumont Marsh. It was almost static, moving at about one mile an hour in a north-easterly direction, and slowly dispersing.

A good many birds including three Magpies, two pairs of Sheld-Duck, odd Carrion-Crows, a Heron and several Oystercatchers were seen to fly towards this local fog and all turned away as they neared the boundary between good and bad visibility. Several groups of birds flying low over the water at ebb-tide, and obviously making towards one of the sandflats known to them to be quickly uncovered, were prevented from reaching it by the fog which happened to cover it. Of those birds that arrived from a seaward direction, some turned north to settle on the Scottish shore from Browhouses westward, others south to places on the Cumberland side about Drumburgh and Port Carlisle. None were seen to enter the fog.

A pair of Oystercatchers flying approximately westerly were, however, seen to emerge from the fog near its western boundary on Burgh Marsh, and three Carrion-Crows were seen to emerge individually from its eastern boundary and fly away in the direc-

tion of Todhills. None of the birds that emerged were seen to re-enter the fog. It was thought likely that the Carrion-Crows had been caught by the fog, which was slowly moving north-east, whilst they were busy feeding on the ground. A number of Carrion-Crows and Rooks approached the eastern boundaries of the fog at this time from the direction of Metalbridge, but all pitched on Rockcliffe Marsh, on those most easterly parts still uncovered by fog.

Occasionally there is "lifted" fog which does not extend right down to the ground level but has risen to leave an extent of good visibility sandwiched between fog and ground. This condition sometimes prevails on the Solway marshes and elsewhere in level country and, on occasions when the base of the fog was about one hundred to two hundred feet above the ground, as quite frequently happens, there were normal flight movements below it. Birds entered and left the foggy covering and apparently were quite unaffected by it.

Often Lapwings, Redshanks, Common Terns and Lesser Black-backed Gulls would enter the fringe of the base of the fog from below but, as observed from the ground, could be kept in sight all the time. This indicated that, at the same time, the birds themselves could see something of the ground over which they were flying. Here again there were simultaneous ground and aerial observations and, although birds were found to be flying in the basal fringe of the raised fog, none of them were ever seen to go up through the fog layers to emerge into the sunshine above and, at the same time, pass out of sight of the ground.

Many birds have been seen to approach similar masses of "lifted" fog and all passed beneath into the extent of good visibility between fog and ground. None of these approaching birds were seen to fly above the fog, which would have necessitated their passing out of sight of the ground. Some birds, including a Heron and several Rooks, have been seen flying towards "sandwiched" extents of good visibility like this, and at a height which would have taken them above the fog had they continued on their original course. All of them showed a very strong disinclination to lose sight of the ground by diving below the fog.

During the course of a coastal flight, near Seascale on the Cumberland coast, Rooks were seen to dive fairly steeply in order to pass below some lifted fog. Their dive was begun almost at the fringe of the fog but a Heron observed on the same occasion evidently made the decision to get below the fog when still some considerable distance away from it. The Heron's method of approach could better be described as a gradual descent rather than a dive. Its descent from approximately three hundred feet to fifty feet was made over a distance of about a mile. The average altitude of the Rooks when approaching the fog was

two hundred to three hundred feet and all of them dived almost to ground level in as many yards.

A somewhat similar descent was seen over Burgh Marsh on a June day in 1941 but on this occasion the Rooks, instead of diving in a straight line, lost their surplus height in a steep 360 degree diving turn before passing below the fog. The straight dive is the more commonly used method of entry.

BIRD FLIGHT MOVEMENTS IN RELATION TO TOPOGRAPHY AND TIDES.

Some most interesting notes of local flight movements relative to topographical features were made on the Solway concerning shore birds and the uncovering of sand- and mudflats by the ebbing of the tide. In this region the "fall" is so small that the tide advances and recedes very rapidly and large flats are covered and uncovered within a short space of time. On account of the unevenness of the levels of the sands and the mudflats in the Solway some isolated parts are uncovered before others as the tide recedes. Islands of freshly-bared ground appear and increase in size until eventually they join up with the surrounding stretches as the tide goes out. A series of observations on the movements of birds during ebb-tides was made and it was discovered that the birds displayed a striking knowledge of the geography of their surroundings with an understanding of the changes of the tide.

One stretch just to the north of Burgh Marsh regularly became uncovered as the tide ebbed appreciably earlier than the surrounding parts of the estuary there. Although it must have been well out of the range of sight of birds feeding to the north of Rockcliffe Marsh and on the Scottish side of the Solway, a regular movement to this feeding ground was noted at each tide. Waders and other sand- and mudflat feeding species arrived from the west and north sides of Rockcliffe Marsh and also from across the Solway as soon as the first part of the ground was exposed by the tide.

Another expanse which was regularly uncovered some appreciable time before the surrounding flats was about half a mile out into the Solway from the Scottish side, just south of the channel of the River Esk. At the times of several ebb-tides in 1941, movements of shore-birds towards this newly-uncovered ground were noticed as soon as the water receded from it. Now this ground being quite out of the sight of birds feeding on and near the southern shores of the Solway, aerial observations were made with the specific intention of discovering if any birds actually arrived from that direction. It was found that a large proportion did, in fact, come from the neighbourhood of Rockcliffe Marsh and south of it, and from the vicinity of Burgh Marsh, which ground they had presumably already worked.

A rather more important discovery was that birds arrived from the direction of Port Carlisle and from as far away as Bowness, that is from a seaward direction. Others arrived from a seaward direction on the Scottish side. Many were seen flying on an unerring course for the feeding ground over a distance of several miles and arriving punctually as it became uncovered. These aerial observations established that the birds were possessed of some prior knowledge of the accessibility of this desirable feeding ground at particular times, and that accurately timed movements towards it were made at each tide.

A further series of observations was made with the idea of ascertaining whether any "continuation" movements took place, and it was found that they did. It was seen on various occasions that there was a regular movement, as the tide receded further, to still more remote and more recently uncovered parts to seaward, often diagonally across the firth. A favourite second step from the first feeding ground was to a stretch of sand near Port Carlisle. This second place was yet again out of sight of any birds at ground level at the first, but still birds were seen to fly unerringly to it on accurate courses over the intervening stretches of water.

These inter-feeding ground flights were almost invariably performed at a low altitude, usually two to four feet above the water. On most occasions, on warm, sunny days, the heat haze and the refraction due to the convection at these low altitudes were quite strong, and it was thought that they alone would be sufficient to exclude any possibility of the birds being able to see the newly uncovered grounds from their original positions.

Similar movements were noted between successively uncovered places north and south of Rockcliffe Marsh. As the marsh itself was interposed, the movements reflected an excellent knowledge by the birds of local geography and of the tides. This knowledge assured an early arrival for the available food.

Observations of this kind can be made with ease from the air, except in bad visibility. It would be extremely difficult to make similar observations from the ground as the earth-bound observer has not the immense advantage of the comprehensive view obtained by the flying man. Given good climatic conditions, the latter can consider bird movements on a very extensive rather than a narrowly restricted scale. From the ground it is rarely possible to watch more than one flight of birds at a time, but from the air there is frequent opportunity to look down on and note identity, numbers and direction of two or more flights at the same time.

HEIGHTS AND SPEEDS OF BIRDS.

From the ground an observer can note the approximate height and direction, and estimate the speed of any birds he may see on passage or migration. The length of time such birds are

in view is usually very limited, depending as it does on the surrounding topographical features and the weather conditions. It is possible for the aerial observer to follow flocks of birds, meanwhile keeping sufficiently far away to avoid alarming them, and to plot their courses accurately over much greater distances. Any deviations from course can be noted and perhaps related to topographical features, weather conditions or other influences.

The height of birds can be very accurately recorded from the air. It is not necessary for the experienced pilot to fly alongside a bird to measure its height above ground level; he can fly level with it at a reasonable distance away and read off the height from his altimeter. This gives a roughly accurate result. Perfect accuracy may be obtained by noting from the map the height above sea level of the ground over which the bird was observed and making any adjustment necessary between that height and the height of the aerodrome at which the flight was begun and the altimeter set at zero. An alternative is to set the altimeter at the aerodrome to read the height of the aerodrome above sea level, and then the height of any bird encountered in flight can be noted on the instrument. The height of the ground over which the bird was flying subtracted from this reading gives the height above ground level. Minor final adjustments for instrument errors may be needed.

In this way many notes have been made over Lakeland of the height of birds in flight. Amongst these are some of birds flying at unusually great altitudes. In October 1941 a skein of fifteen Pink-footed Geese were observed flying in a westerly direction over Carlisle at a height of no less than 7000 feet. These same birds were seen by a number of observers on the ground, amongst them several very experienced pilots, who estimated the height of the geese variously between 2000 and 4500 feet.

During the summer months of 1941, Swifts—*Apus apus apus* (L.)—were seen over Carlisle at 2800, 2000, 1750 and 3400 feet, on various dates. Elsewhere, they were met near Sedbergh in summer 1938 at 3100 feet above ground level, at Hawkshead in 1939 at 2250 above ground level, and near Egremont in 1938 at 1950 feet. Swifts hawk insects at these heights on hot days. Also in 1941, they were encountered at 1800 feet near Cocker-mouth and, at the same height, above Langwathby. Other notes are 1300 feet at Sebergham, 1250 feet at Temple Sowerby and 1100 feet at Abbey Town.

The Curlew is often noted at surprising altitudes. It was seen in 1941 at Ainstable at 2500 feet, and at Caldbeck at 3700 feet. In the same year single birds were noted above Gilcrux at 2900 feet and above Skelton at 4200 feet. In 1938 a pair at Rosgill, near Shap, were at 2100 feet above ground level, or approximately 2900 feet above sea level. On other occasions, in 1939 and 1940, odd Curlews near Brough were at 1300 feet, and at Lazonby at 1150 feet. A party of nine Curlews on passage by way of the

Eden valley were seen at 850 feet, travelling south-east at Warcop, in September 1938.

The Common Terns of Rockcliffe Marsh often ascend to a good altitude and small parties were noted in June 1941 at 2800 and 3200 feet. On both occasions the weather was very fine with brilliant sunshine and excellent visibility, and no low or medium cloud. On other dates, at the same place, Common Terns were seen at 1200 and 650 feet. When disturbed from the marsh by people on foot they were noted as wheeling around at 300 to 400 feet, diving to about 150 feet, then ascending again.

The Redshank is another bird commonly met at some height about the Solway. In 1941 it was seen above Burgh Marsh at 1800 and 2300 feet, and at Kirkbampton at 1700 feet. At Newton Regny in 1938 it was seen at 1100 feet, and in August of the same year four Redshanks were observed flying south at a height of 600 feet at Cumwhitton. The Heron is easily seen in flight, and why birds of this species should ascend above a few hundred feet is a mystery. One was seen at Lyneside at 1800 feet in May 1941, and others, singly, at Milnthorpe in the south of Westmorland in April 1938 at 1300 feet, at Appleby also in April 1938 at 750 feet, and at Irthington in August 1941 at 700 feet. A solitary Heron flying west over Gilsland at 650 feet in September 1941 made a wide detour to the north to avoid flying through a rainstorm.

In the autumn and winter months ducks in small parties, mostly Mallard, are frequently to be seen flying high above the Solway region and North Cumberland. In October and November 1941 Mallard were seen on four occasions in the neighbourhood of Carlisle and the Solway at 2300, 3200, 3800 and 4000 feet, and on others at various heights between 1000 and 2000 feet. In September 1941 thirty to forty Mallard were seen flying south-westerly at Heatherhead in North Cumberland at a height of 1300 feet and were evidently just arriving in the area from the north-east by way of the Liddel valley. Wigeon arriving by the same route were seen in October 1941 at Liddelbank and near Penton Bridge at 650 and 400 feet respectively. In these two instances the weather was dull with cloud at 1600 feet in the district. Wigeon have also been seen, in small numbers, at heights between 500 and 950 feet above the Solway in October and November 1941.

At Broughton-in-Furness a large flock of Starlings were seen flying at 1400 feet, and another large flock at Thursby in the Cumberland plain were at 1100 feet. Smaller birds are not frequently seen flying at unusual heights, and six Pied Wagtails—*Motacilla alba yarrellii* Gould—at 750 feet above Great Broughton in West Cumberland, in October 1938, are worth recording.

In all instances, heights were read to the nearest fifty feet, greater accuracy than this being impossible with the altimeters used.

When movements of birds over appreciable distances are observed, say one mile or more, it is possible with the aid of a stopwatch to make accurate estimates of flight speeds. The pilot can ascertain the speed and direction of the wind prevailing at the time by one or other of several simple methods. This is necessary as the bird in flight is affected by the wind, and no accurate assessment of the bird's actual performance can be made without this information. It is better to do this than to rely on data provided by local meteorological offices which will be only approximate and may even be erroneous. Windspeed and direction vary with height, and a reading taken at ground level by normal methods will almost invariably be quite different from that at a hundred feet in both strength and direction. With accurate data on the wind at the height at which the bird is flying, very close estimates of its speed may be made. Amongst records of speeds noted in Lakeland are a number made by the above method, and others by the simple expedient of flying parallel with the birds and reading the speed from the airspeed indicator. This latter method is easy enough, but nearness of the aeroplane to the birds may have some effect on their speed unless great care is exercised. It is thus less likely to give such accurate results as the former method where birds can be timed between two points.

Records of the speed of the Mallard have been made more frequently than of any other species, mainly because this bird has been commonly met and easily identified in the Solway region, and it often flies on a straight course at a constant height for considerable distances. Four Mallard together were noted between Port Carlisle and Cardurnock flying at a true speed of forty-seven miles an hour, and a group of thirteen flying westward from Rockcliffe Marsh on the same day had a true speed of forty-nine miles an hour. About a hundred Mallard in a flock flew at an average speed of forty-two miles an hour between Oulton and Westnewton in West Cumberland, and a similar number together were flying at forty-three miles an hour true speed to the west of Rockcliffe Marsh on a day in November 1941. Several single ducks were checked for speeds and generally these were appreciably faster than most speeds achieved by large assemblies. A single Mallard near Penrith in December 1937 was flying at fifty-four miles an hour, and others at Dalton-in-Furness and near Whitehaven in January and May 1938 flew at forty-nine and fifty-one miles an hour respectively. Around the Solway on various dates in 1941, speeds of forty-seven, fifty and fifty-three miles an hour were noted for single Mallard.

Geese fly, on the average, faster than Mallard and a number of records of Pink-footed Geese were obtained about the Solway in 1941. Between thirty and forty flew a distance of some three miles into wind along the Solway at a speed of fifty-two miles an hour. On the same day another skein of fifty or sixty flew in a

similar direction at fifty miles an hour. Ten together, flying on a slightly different heading clocked fifty-six miles an hour. Wind speed appeared to have a slight bearing on flight speeds as other records from the same place of Pink-footed Geese travelling down wind show a lower rate. Between twenty and thirty flying down wind made forty-six miles an hour over two and a half miles, and a slightly larger skein forty-four miles an hour over three miles. Ten flying together did one and a half miles at forty-eight miles an hour down wind, and a further six together had a speed of forty-six miles an hour over two miles in the same direction. It appeared that, due to the assistance of the wind, the geese might have been making less effort when flying with it than when flying against it, the ground speed in each case still being slower into wind and faster down wind, but less appreciably so.

Along the Solway, the Sheld-Duck has been timed on a number of occasions and speeds of thirty-five and thirty-eight miles an hour noted at Rockcliffe Marsh and near Burnfoot. At Glas-son a Sheld-Duck flew at thirty-three miles an hour over a distance of almost a mile, and four together at Skinburness flew five-eighths of a mile at an average speed of almost thirty-six miles an hour.

Curlews have been timed in various parts of the area, the fastest being one near Milburn in the north-eastern corner of Westmorland in April 1939, doing forty-four miles an hour over a distance of a mile and a half. At Uldale, in 1941, a single Curlew flew a mile and a quarter at thirty-nine miles an hour, and another near Denton Fell in the same year flew a mile at thirty-seven miles an hour. Thirty-three miles an hour was the speed of a single Curlew over three miles near Sedbergh one day in 1937. A Common Heron, kept in view by circling movements during a flight between Hethersgill and Scaleby, was found to be making a speed of thirty-one miles an hour.

Wood-Pigeons fly more slowly than their quickly flapping wings might lead an observer to believe. Four carefully noted records taken in the area, just south of the Solway, gave speeds of thirty-four and thirty-six miles an hour at Great Orton, and thirty-two and thirty-seven at Wiggonby and near Dalston, all being over distances of not less than three-quarters of a mile. Cormorants on the Solway flew at very similar speeds to these. One timed coming from the west along the southern shore of the Solway, and between a point opposite Drumburgh railway station and Beaumont Marsh, did the distance at thirty-nine miles an hour true airspeed. A second, flying from the Scottish side opposite Dornock to the Eden mouth, had a speed of thirty-five miles an hour.

All the speeds given are "true airspeeds," or the speeds relative to the air. They must not be confused with "groundspeeds," or the speeds at which birds or aircraft pass over the ground, as

these are misleading and in no way commensurate with the energy expended.

MIGRATION ROUTES.

The mapping of migration routes is an interesting matter which frequently can be well done from the air. The aerial observer has the advantage of being in a position to follow birds over long distances, and the choice of routes as well as the deviations made according to topographical features, especially the obstructive high fells, can be studied. The initial visual "pick-up" of birds from the air, often very difficult, becomes easier with practice and the larger flocks of birds, particularly those on more or less direct routes during migration, often claim attention. For this reason notes on migration from the air are more commonly made than on any other aerial aspect of birds.

It was noticed in Lakeland that the vast majority of birds followed along the river valleys and the coastal plain during movements and migrations. This procedure was adopted even though the altitude at which they were flying was considerably higher than the highest points of the surrounding countryside. It seemed from most of the movements watched that the highest ground was avoided even at the expense of substantial detours.

Lakeland offers exceptionally good facilities for the study of migration from the air as the topographical lay-out is ideal. The extensive low ground of the Solway region and the Cumberland plain, lying to the north-east, east and south of the ornithologically rich and attractive Solway Firth, is hemmed in by the high barrier of the Pennines to the east and north-east and by the central fells to the South. Its height varies from sea level to between two hundred and three hundred feet over an average distance of twelve miles. This is an almost imperceptible rise for the greater part and nearly unnoticeable from the air, there being only a few sharp inclines here and there. On a clear day this region appears almost box-like from the air, with Rockcliffe as the centre of the box. The airman flying at 1000 feet above ground level—a common migration height—looks north-east, east, south and south-west and sees the high barriers of the fells rising steeply from the low plain land. The exits from this region, without which it would be necessary to ascend to a height sufficient to clear all fell tops, stand out clearly. To the south-west there is the low western coastal region; to the south the side-by-side valleys of the Petteril and Eden; to the east the Irthing and South Tyne valleys, and to the north the valleys of the Liddel and Esk. Entry from, or exit to the north-west can be made over the Border by way of the Annan valley, or from the west by the Solway itself. As seen from the air above the eastern end of the Solway, about the Eden and Esk estuaries, these routes radiate like spokes from a hub. Small wonder that the Solway is so

ornithologically rich, thrust as it is directly in the path of bird migration from so many quarters of the compass.

Not all migrants make a stop on the Solway, many crossing from the direction of the Annan valley, continuing over or near Carlisle, and thence along the Petteril or Eden valley. Many of the geese arrive by way of the Liddel, some stopping at the Solway, others continuing to the south-west and so to the southern estuaries of Lakeland by way of the coastal plain. Geese have also been noted arriving by way of the Irthing valley, passing between Carlisle and the Solway, and going on to the south-west by the coastal belt.

Clouds are very commonly at heights between one thousand and two thousand feet above ground level, and the latter height is perhaps more frequent than any other on those days when there is low stratus cloud. This sheet-like cloud often extends over the whole region and its mean height above ground level does not usually vary a great deal. On days when it is present, entry to or exit from the region by flight must of necessity be restricted to one or other of the routes already enumerated, if the birds are not to enter cloud and so lose sight of the ground. These very same routes are commonly followed by aircraft; airmen are usually routed by one or other of the valleys or passes, or by the coastal route, on days when cloud level will not allow a passage into or out of the region without losing sight of the ground. With the clouds at 2000 feet above sea level, a safe passage can be made while the surrounding fell tops are obscured but the rivers, lakes, woods and other outstanding landmarks remain in view.

The coastal region is especially attractive as a migration path to such shore feeding birds as the Turnstone—*Arenaria interpres interpres* (L.)—and the Knot—*Calidris canutus canutus* (L.)—and provides a very convenient route from the Solway to the southern estuaries. Some of the less common passage-migrants have been noted here and there along this route and one which seems to use it, the Purple Sandpiper—*Calidris maritima maritima* (Brunn.), has been seen at St Bees Head and also at Raven-glass. The latter is a very suitable additional or alternative stopping place to the Solway.

In October 1941 a skein of about twenty-four Grey Lag-Geese were noted following the coastal route, heading south between Maryport and Workington at a height of 1200 feet. Another sixteen Grey Lags were observed on the same occasion maintaining a steady southerly course just south of Abbey Town at a height of 1400 feet. They changed course to south-westerly near Baggrow, still at a height of 1400 feet. They then held course to skirt the high ground south of Plumbland, but altered to south again about Gilerux and continued so in the Eaglesfield direction. These geese would have passed comfortably above this elevated ground and in clear visibility even had they not altered course,

but if the cloud level had been down to 600 feet then such a deviation would have been quite necessary. The route chosen and the alterations of course made seem to indicate either some previous experience of the route in weather conditions requiring alterations of course, or a marked disinclination to fly over any elevated ground which may be comfortably flown round. Other movements of grey geese were seen in October and November 1941 in the Whitehaven district, and three separate skeins of about six, ten and fourteen birds were seen at one time near Wigton heading on parallel south-westerly courses and each separated by a distance of about half a mile.

A subsidiary inland branch from the coastal route follows the Derwent valley to Thirlmere and thence by Grasmere and Ambleside to Windermere and so to the southern estuaries. A number of Fieldfares were seen in October 1941 on this route heading south-east between Bassenthwaite and Keswick. The frequent appearance of the three species of Divers—*Colymbus*—on Windermere may be partly accounted to the use of this route, as may also the more regular appearances there of the Red-necked, Slavonian and Black-necked Grebes—*Podiceps griseigena griseigena* (Bodd.), *P. auritus* (L.) and *P. nigricollis nigricollis* Brehm—than on any other of the lakes.

To the south-east of the Cumberland plain, the Petteril valley is a much used migration route, branching from which the valley of the Eamont takes a proportion of the less common migrants to Ullswater, a lake for this reason almost as much favoured as Windermere by grebes and divers. Most birds continue by way of Penrith, Shap and the Lune valley, and there is another branch about Kirkby Lonsdale which provides the choice of either the Lancashire coastal route to the west, or the overland route to the south-east in the direction of Settle in Yorkshire. On this route a Great Snipe—*Capella media* (Lath.)—was obtained at Shap and another seen at Kirkby Lonsdale, and a Hoopoe—*Upupa epops epops* L.—seen near the former place.

Possibly a large proportion of migrants use the wider and almost parallel valley of the Eden. These again may branch either by Penrith and Shap and follow the same route as the Petteril valley migrants, or continue up the Eden valley to Brough where the majority filter south-westwards to the Lune valley. Near Brough some turn east and go over Stainmore to the eastern side of the Pennines and thus reach the Vale of York and the east coast.

Geese, most probably Pink-footed Geese, have been seen from the air on several occasions using this west to east route. In the course of a single flight, between Bowes and Brough, no less than six different lots of Golden Plover, varying in numbers from seven or eight to upwards of fifty birds, were seen on this flight track moving from west to east. Due to low cloud it was necessary on this occasion to fly the aircraft at four hundred feet above ground

level. Most of the migrants were flying about three hundred feet above ground level this being midway between ground and cloud base over most of the distance.

On an autumn day in 1938, a large number of Mallard at approximately the same height were seen moving up the Eden valley between Appleby and Brough, and when slightly south of Brough were seen to alter course east to pass over Stainmore. A number of other movements of flocks of unidentified smaller birds have been seen following this route, the height of passage depending upon the prevailing weather conditions, but being usually within 1000 feet of the ground, even on almost cloudless days. On these passages over high ground most flocks of birds have been seen to keep as nearly as possible above the centres of valleys where these have coincided with the lowest contours. The success of Hornby Castle duck decoy, near Bedale in North Yorkshire, was no doubt partly due to the presence of this west to east route, situated as it was a few miles to the south of the eastern exit from the Pennines.

From an aircraft flying up the Eden valley from Carlisle at a height of 1000 feet on a clear day, Kirkoswald can easily be distinguished, and from Kirkoswald the valley beyond Appleby can be picked out. On a cloudless day, with good visibility, the whole of the Solway region and the Cumberland plain and North Cumberland can be seen from a height of 3000 feet above Carlisle, and the coast from Silloth to Workington and beyond can also be surveyed. On days of this kind birds on migration, presumably with the same, or better, ability to see distant objectives, prefer to follow well-beaten aerial tracks and to make apparently meaningless detours and alterations of course which under the conditions of visibility seem to serve no useful purpose. They would, however, ensure safe and certain passage on less clear days.

The east to west and reverse route by way of the Irthing valley, with entry to North Cumberland between Gilsland and the Tindale Fells, is commonly used for coast to coast lateral movements. Parties of birds that have been seen from the air along this route were mostly shore-feeders. Bar-tailed Godwits—*Limosa lapponica lapponica* (L.)—which have been noted as passing over Carlisle from an easterly direction, during the hours of darkness in the months August to October, would have come directly by this way. A Black-tailed Godwit flushed by Abel Chapman near Brampton in September 1919 was on the direct line of this flight-path and had very probably just arrived from an easterly direction. A Great Snipe shot on Denton Fell in September 1933 by Dr E. S. Steward was also directly on this migration route and most likely lately arrived from an easterly or north-easterly direction.

During a flight in this region in late October 1941, a skein of some twenty Pink-footed Geese were seen passing westwards over

Talkin. About the same time, at Walton and near Naworth Castle and just south of Banks Fell, other skeins of Pink-feet varying in numbers between seven and fifty birds, were also seen flying westward towards the Solway. The last enumerated were flying at a height of 4100 feet above sea level. The skein of fifteen Pink-footed Geese seen flying over Carlisle on a westerly course, on 16 October 1941, at the amazing height of 7000 feet above ground level, were thought to have just arrived by this east to west route. They continued towards the west but, unfortunately, could not be followed. Possibly their first landing would be about the estuaries of Waver and Wampool, that is if they did not continue along the coastal route to the south of the Lakeland area.

Mallard seen in some considerable numbers flying west at Talkin, Milton, near Irthington and near Naworth Castle on various dates between early October and late November 1941, were either passage-migrants or winter-visitors most likely lately arrived on the north-east coasts of Britain.

An important migration flight-path is that which follows the Liddel valley, in the north-east of the area. This provides a more natural and direct route to the west coast and the Solway region for those migrants arriving on the north-eastern shores of these islands. Curlews arriving in late summer and autumn along the east coast are noted as crossing the country diagonally from north-east to south-west by this route.

It is thought likely that most of the Solway geese arrive from this direction. Many coming into the area this way do not stop but pass over or near the Eden or Esk estuaries and continue on along the western coastal route to the southern estuaries. Considerable numbers do, of course, stop to rest and feed on the Solway marshes for short periods before continuing. One of the numerous parties of grey geese seen arriving in northern Cumberland was sixty to seventy strong and first picked up between the Liddel and Green Rigg, flying strongly in the direction of Longtown at a height of 900 feet above ground level. Just south of Longtown the birds made a slight deviation westward, accompanied by a hundred foot loss of height, in order to pass over the estuary of the Esk, but the Solway marshes were crossed without a pause and the passage continued south-westerly in the direction of Oulton and Aspatria in West Cumberland. A small number of parties of grey geese have been seen from the air arriving down the valley of the Lyne, a few miles south of the Liddel.

Of slightly less importance as an entry to the area is that from the north-west about Lochmaben and the Nith estuary. This possibly provides an alternative to the previous route for southward movements when weather conditions demand. Considerable numbers of migrants do use this flight-path, many continuing, without a halt at the Solway, over the Carlisle district and on to the Eden or Petteril valley and so away to the south-east.

This has been seen more frequently on occasions when the east and north-eastern coastal districts have been under fog and the western side of Scotland and the west of Lakeland clearer. Subsidiary migrations and local movements are made over a number of less clearly defined routes in Lakeland and most of these follow the lines of valleys when not actually over the lowlands.

No doubt after the war, when civil aviation once again gets back to normal and the emergency restrictions are lifted, more and more air-minded ornithologists will combine their pleasure flying with bird observation. There is obviously tremendous scope for the study of birds from the air, especially in this most favourable area of Lakeland.

December 1944.

LAKELAND AND THE ICE AGE.

By T. W. K. SKELLY, L.C.P.

The Ice Age should be of special interest to Lakelanders, for it has largely contributed to the grandeur of the scenery which has made the land of the lakes so famous. The lakes, the sheer sides and combes of the mountains composed of the harder rocks, the truncated spurs of the hills, the moraines and the rounded and striated rocks within the heart of Lakeland, as well as the drumlins, kames, eskers, overflow channels and beds of ancient lakes, mostly in the surrounding district, are all attributable to the action of ice or of the water into which it passed when the climatic conditions were restored. Moreover, Lakeland is particularly rich in the evidence of a mighty ice sheet in motion clearing away the debris of, perhaps, millions of years of weathering, deepening the valleys, and so transforming the landscape. In fact, there is striking evidence of the Ice Age everywhere in Lakeland.

Although the Ice Age is, geologically speaking, of recent occurrence, no other epoch has given rise to more controversy. Its cause and duration, the direction of the flow of the ice and its power of erosion, as well as the number of interglacial periods, are still matters of discussion. However, in recent years much study has been given to present day conditions in Polar Regions, in Greenland, in Alaska and in other glaciated countries and this has led towards unanimity; but there is still much scope for exploration in a subject on which far from the last word has been spoken.

At the beginning of the nineteenth century, the surface deposits such as sands, gravels and boulder clay scattered far and wide over the British Isles and the northern part of the Continent were attributed to a universal deluge, and when Agassiz the Swiss geologist propounded, in 1837, the theory that they were the results of ice sheets his views were violently assailed. However, in the course of a few years, his views prevailed. In this country, Dean Buckland, who had been professor of geology at Oxford, was an early convert and after visiting Switzerland he, together with Agassiz, toured Britain, including the Lake District, and gave the results of his observations and his conclusions in a paper entitled, "On the Evidence of Glaciers in Scotland and the North of England." This was published in 1840.

The early glacialists attributed the then puzzling phenomena, such as the widespread distribution of boulders of Shap granite, to floating ice in a sea covering the land owing to a depression of

the surface of some 2000 feet. This view was accepted by such prominent geologists as D. Mackintosh and J. Clifton Ward, to whom Lake District geology owes so much. However, papers by R. H. Tiddeman in 1872, and J. G. Goodchild in 1875, convinced most geologists that land ice alone could account for the phenomena which had been attributed to floating ice.

J. D. Kendall, of Whitehaven, who made important contributions to local geology, especially of the West Cumberland mining district, remained a strong adherent of the old view, and as late as 1924 upheld it in a paper on "A Supposed Glacial Lake in West Cumberland." J. G. Goodchild's paper of 1875 which was entitled "The Glacial Phenomena of the Eden Valley" was in some respects epoch-making, and many of his views on the movements of the ice in the Eden valley are accepted to-day.

In 1902 P. F. Kendall's paper, "A System of Glacial Lakes in the Cleveland Hills," stimulated research into phenomena connected with the retreat of the ice at the close of the glacial period, but it was not until 1912 that the discovery of the site of a glacial lake in Lakeland was recorded by Dr Bernard Smith from the Wickham valley. In 1916 Professor Marr's *Geology of the Lake District* was published, and in it he emphasized the great effect the Ice Age had had on the topography of the district.

In 1920 H.M. Geological Survey commenced a re-survey of parts of the country bordering the Lake District. Geologists concerned with the northern part included Dr Bernard Smith, E. E. Dixon, T. Eastwood, Dr S. E. Hollingworth, and Dr F. M. Trotter. Special attention was given to glacial geology and many important discoveries were made in regard to the flow of the ice, the deposits and phenomena relating to the recession of the ice from the district. The results were published in a series of memoirs dealing respectively with the Carlisle district in 1924, the Maryport district in 1930, the Whitehaven district in 1931, the Brampton district in 1932 and the Gosforth district in 1937. The complete survey of Lakeland has not been carried out yet but other memoirs are in preparation. Dr F. M. Trotter in 1929 and Dr S. E. Hollingworth in 1931 published valuable papers in *The Quarterly Journal of the Geological Society*. It is largely from these publications as well as from the researches of Clifton Ward, Goodchild and Professor Marr that this account has been made.

The Ice Age did not arrive as a sudden catastrophe. For some sixty million years previous to the formation of the ice sheets the climate of Britain had been gradually becoming colder. In Eocene times plants, of which many living representatives are now found only in tropical and subtropical countries, flourished in the south of England; and generally throughout the succeeding periods—the Oligocene, the Miocene and the Pliocene—the plant fossils indicate successively colder conditions until finally,

just preceding the Ice Age, and as exemplified by the Cromer Plant Beds, a distinctly Arctic flora prevailed.

To what extent the elevation of the land surface immediately before the Ice Age differed from that which exists to-day is a matter of considerable doubt. W. B. Wright, relying on the evidence of ancient shore lines on both sides of the English Channel, the coast of Yorkshire and the south coast of Ireland, states that as far as Ireland and southern Britain are concerned the difference cannot have been more than twenty feet. The view formerly expressed by some students that, from a time previous to the Ice Age to one considerably later than that period, the British Isles and Europe had formed a continuous land surface must be given up.

facile Recent research, especially in regard to the terraces of such rivers, in the preglacial part of Europe, as the Thames, Somme, Danube, Rhone and Garonne; the buried channels of some rivers—of which that of the Somme is a good example—the high shore lines of the Mediterranean region, of the Atlantic coast of France, as well as those of America, Australia and South Africa, which can be correlated, have convinced most geologists that, during the Ice Age, there were successive periods of high and low sea level throughout the world with consequent inundation of low-lying land during high level periods, and retreat of the sea during periods of low level. It was during the latter periods that the British Isles were joined to the Continent, the course of the Rhine continuing along what is now the bed of the North Sea with the Thames as a tributary.

The entire cause of the alternations of high and low sea level during the Ice Age cannot be said to be fully established. An immense quantity of water locked up in the vast ice sheets, to be set free during interglacial periods when higher temperatures prevailed, and the depression of the land surface by the load of ice during periods of intense glaciation followed by elevation when the load was removed by the melting of the ice, are important factors.

In Scandinavia and around the Baltic there is definite evidence that the burden of ice caused a considerable depression of the land surface, particularly towards the close of the Glacial Period. In Scotland, shore lines dating from glacial times exist at 100 feet and 60 feet above present sea level, and there are marine clays containing shells of molluscs found living now only in Arctic and sub-Arctic seas.

No definite evidence of the land surface or of river terraces dating from glacial times has been recorded from Lakeland although, during the last geological survey of the Cumberland plain, traces of a fifty foot strand line were found, but as no marine shells were found it was impossible to say whether this line represented a sea level or the surface of a glacial lake existing in former times.

The Lakeland rivers of Mite, Esk, Duddon, Leven and Kent have sunken estuaries now filled with glacial drift, but these are attributed by Marr to preglacial times.

At the maximum of the glacial period, Ireland, Great Britain as far south as the Bristol Channel and the Thames estuary, Norway, Sweden, most of Holland, the northern half of Germany and Russia to within two hundred miles of the Black Sea were overlain with ice. The New World was equally affected as far south as a curved line joining Seattle in the west to New York in the east. In addition mountainous regions such as the Rockies in America and the Pyrenees and Alps in Europe were centres of ice sheets with glaciers extending into the plains. The chief centre which sustained the ice sheet in northern Europe was the Scandinavian plateau and the land to the east. From here ice spread in all directions. The stream of ice which took a south-western direction brought boulders to the east coast of England, erratics of Scandinavian origin being the commonest in the basement Boulder Clay along the coast of Yorkshire. In the British Isles, the most important centre was the Highlands of Scotland, other centres being the Southern Uplands of Scotland, the Lake District, the north and west of Ireland and the Welsh mountains. Glaciers proceeded from them on all sides and coalesced into a great sheet of ice. As the ice poured from these loci the various streams opposed one another with the result that the direction of flow was frequently changed and at times reversed.

The Scandinavian centre had established its full power at a comparatively early date in the Ice Age, but later the Scottish centres were able to fend off the Scandinavian ice from the shores of Britain and to establish a stream along the eastern shores and neighbouring coastal districts of England. W. B. Wright says: "It is a striking testimony of the Scottish ice that a great part of it found its way to the ocean in the very teeth of the Scandinavian ice sheet. That it was no sluggish stream that swept from west to east across the low lands of the central valley (of Scotland) is proved by the thick drift deposits and the intense erosion which characterised this much glaciated area. Anyone who has seen the great furrow which has been ploughed on the west side and on the flanks of the Castle Rock in Edinburgh and has followed the gently sloping tail of drift which lies away to the east of it, beneath the High Street, cannot fail to be impressed with the evidence of the powerful and vigorous action of the ice."

The vast bed of the Irish Sea became filled with ice from the Highlands of Scotland, from the Southern Uplands, from Ireland, from Wales and from the Lake District. The combined stream passed down the Irish Sea and over the plains of Lancashire and Cheshire. The pressure of the ice from Wales diverted part of this stream into the Midlands, where Lake District erratics are to be found. The main stream passed on its way to the Bristol

Channel. It is worthy of note that where the Irish Sea ice invaded the land, it frequently carried with it material, containing marine shells, from the bed of the sea. On a hill near the Menai Straits shells and Eskdale granite have been found at a height of 1350 feet above sea level. Pressure of ice from the Irish Sea caused ice from Galloway to invade Cumberland during three episodes of the glacial period and, besides glaciating the Cumberland plain and the Eden valley, had an important effect on the flow of the ice from the northern part of the Lake District.

It may be well, before dealing further with the movement of the ice in Lakeland, to refer to the deposits, collectively known as Drift, left by the ice after its recession. By far the most extensive is the Boulder Clay. As the name implies, it consists of an argillaceous matrix in which subangular stones varying in size from small pebbles to masses of some tons in weight are embedded. Boulder Clay covers the greater part of the less elevated ground of Lakeland, and in places reaches a great depth. At Kelsick Moss near Abbey Town, it attains a depth of a hundred and seventy-four feet below sea-level. Near Ribton Hall, a thickness of a hundred and sixty-four feet has been proved. Were it not for the drift a considerable part of Cumberland west of Carlisle and north of Workington would be under the sea. Boulder Clay is found in places as high up as the 2000 foot contour line as well as in the valleys of the Lake District. The amount within this, the heart of Lakeland, is, however, small compared with that on the surrounding plains.

Much of the upper part of the Boulder Clay has been moulded by the action of the moving ice into rounded ridges known as drumlins. Some have a length of about two miles and a height of eighty or ninety feet, while others may be mere undulations of the ground a few yards in length. Several good specimens of the large type may be seen in the Thursby district near Carlisle. Drumlins vary very much in shape; while some may be compared to a half cigar, cut lengthwise, and lying on its cut surface, others are "whale-backed" and others again nearly circular mounds. All are orientated in the direction of the flow of the ice at the time they were formed, and a typical drumlin has the end facing upstream steeper than the downstream end. As shall be shown later, drumlins are a valuable aid in determining the direction of the flow of the ice at certain periods of the Ice Age. Near Glasson on the Solway, owing to the erosive action of the sea, a fine section of a drumlin may be seen, and the internal structure examined. It is of Boulder Clay throughout, the contained boulders being entirely of Scottish origin.

As the mountains are composed of a great variety of rocks, it follows that the boulders which have been derived from them will show a similar variety. Many boulders have been carried far afield, some to the east coast of England, the Midlands and

North Wales, and it is at times by no means easy to trace the path by which they have reached their present situation. Owing to the pressure of ice from various centres, the direction of the ice and its contained boulders has repeatedly changed; besides, the ice of later phases of glaciation has incorporated the material left by former phases and so has added to the difficulty. The type of rock of which a boulder is composed largely determines its value as an index of movement. There are Palæozoic rocks in southern Scotland which are very similar to some in the Lake District and they, by themselves, would not be satisfactory evidence of the direction of flow in the Cumberland plain. On the other hand, in the Lake District, there are outcrops of rock confined to a single locality, and these enable the glacialist to trace the flow to distant parts. Amongst these rocks may be mentioned Shap granite, Armboth dyke, Sale Fell minette, Threlkeld microgranite, Carrock Fell gabbro, Eycott lava, Eskdale granite and Ennerdale granophyre. Similarly, there is Criffel granite by the Solway in Dumfriesshire.

Other elements of the Drift in Lakeland and elsewhere are extensive deposits of sand and gravel lying on or interbedded with layers of the Boulder Clay. It is clear that these deposits have been water-borne and must have been laid down either at the final melting of the ice or during intervals in the Ice Age when ameliorated climatic conditions had intervened. The most extensive of these deposits occurs in the Brampton district and will be referred to in some detail later. It is chiefly from the interposed beds that glacialists have inferred that the Ice Age was not a continuous period of intense cold but a series of such periods.

During the most recent geological survey of Lakeland it was established that at least three successive layers of Boulder Clay were deposited in the area. The successive deposits were often found to be separated by layers of sand and gravel. This is evidence that there were at least three episodes during which the ice sheet grew, reached a maximum of development and then waned. On the Continent, for example in the Alps and surrounding area, four major episodes respectively called the Gunz, Mendel, Riss and Würm, and a few minor ones of which that called the Buhl stadium is the most noteworthy, have been established chiefly by the researches of the Swiss glacialist Penck. It is highly probable that there were also four major episodes in Lakeland, as well as in other parts of Britain, but owing to the subsequent intense glaciation of this area the evidence of the early episodes would tend to become obliterated.

In a joint paper published in 1932, Dr Hollingworth and Dr Trotter say: "A boulder clay in the River Caldew has been found recently by one of us which differs from the deposits referred to above in yielding a suite of Lake District erratics that are in an advanced stage of decomposition. All possess deeply weathered skins and many are rotten throughout. This deposit is probably

older than the Early Scottish Glaciation." That is, older than the earliest discovered during the last geological survey.

In adopting the view that there were four major episodes in Lakeland, as on the Continent, it must be admitted that the evidence for any earlier than what is termed the third episode is very slender. However, the evidence for the third and fourth episodes, as well as for a minor episode known as the Scottish Re-advance Glaciation, correlated by Dr Trotter and Dr Hollingworth with the Buhlstadium recrudescence of the Würm Continental Episode, is quite definite.

EPISODES ONE AND TWO. The writer has adopted the numbering of the episodes as given in "The Glacial Sequence in the North of England" by Trotter and Hollingworth (*Geological Magazine*, August 1932). The various memoirs of the latest geological survey of Cumberland recognise the last three episodes. Consequently Episodes One, Two and Three of the memoirs correspond with Episodes Three, Four and Five of this paper.

It may well be imagined that at a very early period of the Ice Age glaciers would form in the valleys of the Lake District and would coalesce, on the lower ground, into an ice sheet. As there had previously been a prolonged period of denudation the ice would be heavily charged with debris which would be carried outward from the Lake District. Goodchild pictured great moraines being formed somewhere in the neighbourhood of Carlisle. If this ever happened the moraines have been completely obliterated by subsequent glaciation.

In Lakeland the only known relics—and they doubtful—of these two episodes are, firstly the much weathered boulder clay of the upper Caldew valley, and secondly a boulder clay discovered by E. E. L. Dixon in the shaft of Kelton Fell mine and of which the erratics "are deeply weathered and suggest comparison with those of various old weathered tills." Dr Hollingworth and Dr Trotter correlate the first episode with that of the Basement Boulder Clay of the east coasts of Northumberland, Durham and Yorkshire. This clay contains a large number of Scandinavian erratics showing that at this early stage of the glacial period Scandinavian ice actually invaded the east coast of northern England. The first two episodes of the Lakeland glaciation may also be correlated with those that produced the old weathered and highly dissected boulder clay of the Midlands and southern England, as well as with those associated with the lowest two boulder clays of East Anglia.

EPISODE THREE, sometimes called the Early Scottish Glaciation. Some twenty years ago Dr Trotter and Dr Hollingworth made exhaustive studies of the glaciation of the Eden valley and it is chiefly from their researches that this account of the sequence of events in this part of Lakeland during this episode and Episode Four is compiled.

Carbide Their view is that the glaciation of the Cumberland plain during Episode Three was due to ice proceeding from Galloway. Through pressure from the west and north-west a vast stream of Galloway ice invaded the Cumberland plain. It was of such power that it was able to push its way up the Eden valley and pass through the Stainmore depression. This is evidenced by the Scottish boulders found in the lower boulder clay at least as far as Brough-on-Stainmore. Further confirmation of this invasion of Scottish ice is to be had in the discovery by Dr Hollingworth of numerous Scottish boulders in the lower boulder clay in the banks of Gilcambon Beck, only a few miles to the east of Carrock Fell.

In time the climatic conditions changed, the ice melted and deposits of sand and gravel were formed. Whether Lakeland became completely free from ice or not, the local evidence is insufficient to decide. However, an ox molar has been found in gravel deposited at this period, near Appleby, and near the north-east coast of England other animal remains have been discovered in contemporaneous deposits.

The third glacial episode of Lakeland is correlated with the Riss Glaciation of the Alps neighbourhood, and in reference to the interglacial period following this and preceding the Würm Glaciation, W. B. Wright says: "On the principle of regarding denudation and weathering as a measure of time, the Riss-Würm Interglacial Period must have been considerably longer than the whole time which has elapsed since the Würm Ice Age." This period of time was perhaps 10,000 years.

EPISODE FOUR or the Main Glaciation. During this episode Lake District ice appears to have accumulated to a greater extent than in any other. Very few peaks of the Lake District, perhaps only Scawfell, stood out at the maximum of glaciation as nunataks above the ice. The summit of Crossfell within the Lakeland Pennines as well as the summits of Ingleborough, Penyghent and other hills further south, are thought to have remained above the general level of the ice sheet, and may even have harboured alpine plants which survived the rigours of the climatic conditions. Professor Marr and Professor Fearnside have pointed out that the more elevated parts of the Howgill Fells and the ground between Skiddaw and Carrock Fell do not show the erosive effects of intense glaciation. This may be due to the comparative immobility of the ice in these districts.

Clifton Ward recorded many erratics above the 2000 foot contour line and T. Hay has found perched blocks, probably left in their present position by the ice, near the tops of Crinkle Crag and Bow Fell at about 2800 feet above sea level. J. G. Goodchild estimated that the ice in the Eden valley must have stood at a height of 2400 or 2600 feet and this estimate is confirmed by Dr Trotter. The valleys of Lakeland were completely filled and while the lower layers moved down the valley floors, it frequently

happened that the topmost layers passed over the ridges separating the valleys. This is indicated both by the striae and the boulder distribution. As examples of this "welling over" mention may be made of ice passing from the Thirlmere valley into Borrowdale, from the latter into Newlands Vale and into the Vale of Lorton by way of Whinlatter Pass, from Buttermere valley into Ennerdale and from Ennerdale to the district on the south. Ice also passed over the Pennines into the South Tyne valley at a height of 2200 feet, but generally speaking, the direction of flow was that of the valleys radiating from the centre of the Lake District.

In the Derwent-Penrith gap, an ice shed seems to have developed somewhere in the neighbourhood of Keswick and streams of ice flowed to the east and to the west. The eastward moving stream after being joined by ice from the Thirlmere valley bifurcated, first passing some distance down the Caldew valley and then in a wide stream circling the northern boundary of the mountains, reached the lower ground of West Cumberland. It then proceeded southwards on a parallel course with ice from Scotland. The remainder passed on to the Eden valley where with ice from the Ullswater district it joined the Edenside glacier.

The record of events in the Eden valley, as deduced by Dr Trotter and Dr Hollingworth, make an interesting story of which only an outline can be given. Ice from Galloway again invaded the Cumberland plain but this time it was not able to force its way up the Eden valley, for it encountered the northward moving glacier in the district just south of Carlisle and was deflected eastwards. The Edenside glacier was divided. The eastern part passed side by side with Scottish ice through the Tyne Gap and over the northern shoulder of the Pennines. The western section of the glacier circled the northern part of the Cumberland mountains, being joined on its way by the ice stream which, as has already been mentioned, was proceeding from the direction of the upper Caldew valley. At this time the Irish Sea was completely filled with ice moving from Scotland, and the Lake District ice containing contributions from the Eden valley, Derwent valley, Ennerdale, Wastdale, Eskdale and the Duddon valley joined forces with it, forming a vast glacier reaching to the Bristol Channel. Some of the Lake District ice found its way into the Midlands, carrying with it local boulders. The glaciers of the Leven, Kent and Lune valleys moved directly southwards, the Kent valley stream being particularly charged with Shap Fell boulders.

At the maximum of the Main Glaciation, owing to the pressure of ice from Scotland, the influx of ice from the Pennines on the east, and from the Lake District on the west, as well as from the Howgill Fells on the south, the Eden valley became completely congested. An additional factor causing this congestion may have been an increased snowfall in the Eden valley when the surface level of the ice approached that of the Lake District

mountains. An ice shed was formed in the neighbourhood of a line running from a point immediately south of Crossfell through Appleby. The ice north of this line proceeded as has been indicated above. South of this line a joint stream of Edenside and Howgill Fell ice passed through the Stainmore depression carrying boulders, such as Shap Fell granite, into the Vale of York and to the east coast of England. A map drawn by Dr Hollingworth, and on which over a thousand drumlins are plotted, showing the directions in which they are aligned, supplies striking evidence of the correctness of his and Dr Trotter's views.

This episode of the Glacial Period must have lasted many thousands of years before the ice gradually melted. The progressive amelioration of the climate caused the ice front to recede stage by stage from its maximum extension. These stages in the retreat or recession of the ice have been worked out in some detail by interpreting the phenomena left by the retreating ice. Briefly it may be said that at certain stages valley glaciers, in the Pennines and along the western side of the Lake District, split off from the main ice sheet. From the Pennines the main ice sheet retreated towards the Lake District and towards the Southern Uplands. From the western side of the Lake District the retreat of the main ice sheet was into the Irish Sea basin and possibly eventually back to the Galloway mountains. The valley glaciers after their separation from the main ice sheet receded rapidly and their valleys became occupied by glacier lakes the waters of which were held back by the main ice sheet.

The phenomena of the retreat of the ice are nowhere in the British Isles better illustrated than in the Lake District and its surrounding country but within the limits of this paper it is only possible to refer to parts of this region. Ennerdale and the Brampton district have been chosen as they have features of special interest.

At a certain stage of the retreat of the ice the Ennerdale glacier separated from the mass of ice which covered the ground north of Dent and which extended into the North Sea basin. In the intervening space a lake was formed which, when at its highest level, had its surface at a height of at least 700 feet O.D., the overflow water escaping by the gorge behind Dent. This gorge had existed as a wind gap before the Ice Age but was greatly deepened by the escape waters and to-day presents an impressive sight. Deltas were formed in the lake by streams entering near Kelton Fell and Croasdale. Each of these deltas has three terraces, the uppermost terraces standing over 700 feet and the lowest at 600 feet O.D. The terraces indicate levels at each of which the glacial lake stood for a considerable interval of time at three periods of its existence. As the upper terraces were cut through by streams which built up the lowest it is clear that the deltas were formed in a lake of falling level.

Near Kirkland there is an interesting series of inter-connecting channels, some of them fully fifty feet deep, cut in Skiddaw Slate by water issuing from the ice sheet and running along its margin into the lake.

Close to Mockerkin Tarn, a very fine delta may be seen. The side of the deposit which was in contact with the sheet of ice from which the stream or streams issued to form the delta is very clearly marked and stands very steeply to a height of some thirty or forty feet.

To supplement this brief account of the glacial phenomena in the Ennerdale district the reader is referred to the accounts given by E. E. Dixon and Dr Hollingworth in the Whitehaven District Memoir of the Geological Survey.

The huge and apparently chaotic masses of sand and gravel existing in the Brampton district cannot fail to be noticed by even the most unobservant, but Dr Trotter has shown that the chaos is more apparent than real. He has demonstrated that these masses are usually aligned in such a way as to indicate melting places of the ice front on its westward retreat. He has mapped out over twenty of these between the Pennines and a north and south line running just east of Brampton.

Nearly all these masses were deposited in glacial lakes in contact with the front of the ice which held up the water against the high ground to the east. Many of the deposits are flat topped and are, in fact, deltas. Others, with rounded or irregular tops, are similar deposits on the floors of the lakes but whose tops did not reach the surface of the water and become rounded off. East and north-east of Talkin Tarn are four deltas which were formed in a lake whose surface stood at 500 feet O.D., and in the stretch of country extending from Boothby to Carlatten are at least eight deltas standing at 440 feet O.D. These were formed in a lake which occupied part of the Irthing valley to the west of Gilsland and covered land to the east of Brampton and extended into the Eden valley. The overflow was by way of the Tyne Gap the col of which, situated near Greenhead, stood at 440 feet above sea level.

A huge bank of sand and gravel standing about a hundred and thirty feet above the land on its western side is a conspicuous feature extending nearly one and a half miles from Brampton to near Boothby. This bank and its continuation south of Brampton by way of Townhead, near Hayton and Hornsby, marks the last ice front traceable with certainty in the westerly retreat of the ice sheet. It would appear that after this stage the lake, which ultimately extended westwards beyond Carlisle, found an outlet to the Irish Sea.

This fourth episode, the Main Glaciation, is correlated with the Würm Glaciation of the Continent and with that which produced the Hesse Boulder Clay of Yorkshire and Lincolnshire,

the Hunstanton Boulder Clay of East Anglia and corresponding deposits in Northumberland and Durham.

EPISODE FIVE. During the geological survey of the Carlisle, Longtown and Silloth district, the memoir of which was published in 1926, it was discovered that the surface Boulder Clay of the Cumberland plain, of which the continuation has been traced into Scotland, was a later deposit than that of most of Lakeland. This also applies to certain deposits of Boulder Clay along the coastal strip of West Cumberland and North Lancashire. In the Cumberland plain this Boulder Clay only extends eastward to just beyond Brampton and southward to about six miles beyond Carlisle. It does not cover any ground above the 500 foot contour and was formed by the last invasion of Scottish ice termed the Scottish Re-advance Glaciation. The extent of the Scottish Re-advance shows that it was comparatively feeble. However, the northern part of the Irish Sea was apparently filled with ice which encroached to some extent on the west coast of northern England. There is also evidence of this glaciation in Northern Ireland and probably in the Isle of Man. A lobe of Irish Sea ice seems to have passed up Ennerdale almost as far as the lake.

In this connection mention may be made of the presence, in Ennerdale Water, of the crustaceans *Limnocalanus macrurus* Sars and *Mysis relicta* (Lovén). The former, first reported by Dr Gurney in 1923, and the latter by D. J. Scourfield in 1941, have close affinities with the Arctic salt water species *L. grimaldii* de Guerne and *M. oculata* (Fabr.) respectively. It is considered that the lake species have been evolved from the Arctic marine species in response to the change of environment. Ennerdale Water is the only known British locality for these crustaceans although they are to be found in certain of the Irish loughs as well as in some of the lakes of North America, Finland, Russia and Germany which were all covered by the Quaternary ice sheet. How the ancestors of these crustaceans reached the lakes is an unsolved problem. As far as Ennerdale Water is concerned, it has been suggested that during the Scottish Re-advance Glaciation, or Episode Five, the lobe of Irish Sea ice, which left a moraine not far from the lake, impounded sea water, containing the crustaceans, and carried it forward into Ennerdale. If this be so, the salt water would become diluted, but there may have been time for mutations of the original crustaceans, adapted to freshwater conditions, to develop.

On the coast at St Bees in a section of glacial drift, Dr Bernard Smith discovered a thin layer of peat sandwiched between the boulder clays of the Main Glaciation and the Scottish Re-advance. This peat contains the seeds, fruits and pollen of many species of marsh plants and is the only evidence in Lakeland that the interval between the Second and Third Episodes was a true interglacial period.

At the close of the Scottish Re-advance episode, melt waters were impounded in the Cumberland plain by the ice front and high ground to the east of Carlisle. As the ice front retreated to the north-west the lake gradually spread until it reached westwards, at least as far as Highlaws in the Abbey Town district, where there is a huge mass of sand and gravel brought thither by an englacial river. The conspicuous mounds near Crofton have a similar origin. They appear to be linked up with a similar deposit at Ruthwell in Dumfriesshire. A chain of deposits at Dalston Hall, Sowerby Wood, Broomhills, Thurstonfield and Fingland is in line with one at Cummertrees, also in Dumfriesshire. These mark the courses of englacial rivers proceeding from the north-west. The history of the above mentioned lake is given in detail in the Geological Survey Memoir of the Carlisle District.

It may well be inquired what was taking place in that part of the area not affected by the Scottish Re-advance ice sheet. The answer must be that evidence on which a definite statement could be made has not been found. On this point, Dr Bernard Smith says: "If during this episode any glaciers were formed in the Lake District, they were confined to the upper ends of the valleys. Some corrie-moraines may mark the closing phase." It may be assumed that, with the Irish Sea as far north as the latitude of Barrow-in-Furness and the Cumberland plain filled with ice, the temperature conditions would be favourable for a glaciation of the Lake District, but it may be that for some meteorological reason the snowfall was too scanty for the formation of an ice sheet in this district.

Reference should be made to the numerous glacial channels by which the vast volumes of water formed from the melting ice found access to lower levels and ultimately to the sea. Some have been formed by the overflow of glacial lakes, others by water running along an ice front standing on sloping ground during a halt stage in the recession of the ice sheet, and others again may be deepened ravines down a mountain side. Often the glacial channels cut right across the present day drainage system and are quite dry or may contain a "misfit" stream. Frequently they are very impressive especially those cut deeply into solid rock, and help towards a realization of the great abrasive power of running water charged with grit and pebbles. Mention has already been made of some in the Ennerdale region. They are also numerous on the western slopes of the Pennines. The Whitehaven channel down which the road from the north runs into the town of Whitehaven will be familiar to many people. The Moor-thwaite channel near Thursby, the Wickham valley channel, one cut in granite across Muncaster Fell and several in the Bootle district are other examples.

The amount of erosion which occurred during the Ice Age, and the power of an ice sheet to modify the outlines of the hills

and deepen and straighten the valleys, are still a matter of controversy. However, when the immense quantity of Boulder Clay which overlies the lower ground, and the enormous amount of rock which must have been torn from such localities as Shap and Criffel, as is evidenced by the dispersal of boulders from these places, is taken into account, it seems clear that the moving ice must have had a very potent effect.

From the time of the last elevation of the Lake District until the advent of the Ice Age, an immense period of time had elapsed and Professor Marr considers it long enough for denudation to have brought the district into a condition of "low relief." He describes such a condition in these words: "The slopes become lessened, bare rock is gradually covered up with an accumulation of waste and the ridges and hill summits along these ridges lose their sharpness, become rounded and their rocks also become masked by a covering of waste material. A hill tract of this type is spoken of as one of 'low relief'." If this description applies to the Lake District before the advent of the Ice Age, then it is obvious that the glaciation must have had a profound effect and the grandeur of the scenery as presented to-day must, in large measure, be attributed to ice action.

There is a form of erosion the importance of which has been recognised only in comparatively recent times. It might be described as the plucking action of ice. At the head of a valley glacier, the snow and partly formed ice is frozen to the rock but, a short distance away, a crevasse is formed which reaches downwards to the valley wall. In 1904 W. D. Johnston of the U.S.A. Geological Survey had himself lowered down one of these crevasses to the point where the crevasse reached the valley wall. He found the rock much disjointed and large blocks were actually leaning against the ice. Some were embedded in it. It being summer time, he found the cracks in the rock full of water—ideal conditions for disintegration by alternate freezing and thawing. During the winter, loosened blocks would become frozen to the ice of the glacier and would be plucked from their situation when the glacier moved forward. Such action is responsible for the steep rock faces of the higher parts of many of the mountains and of the valley heads as well as the combes on the mountain sides. The important part played by this form of erosion in producing wild and rugged scenery can be realised almost anywhere in the Lake District where the mountains are composed of the hard rocks of the Borrowdale Volcanic Series.

In connection with this form of erosion, mention may be made of *roches moutonnées*. The end facing the direction of the flow of the ice, as well as the top and sides, is smooth and rounded while the downstream end is often jagged. Examination will show that the roughness has been caused through pieces of rock being torn off at the joints, no doubt by a plucking action of the ice similar to what has just been described.

Assuming that the Lake District had been reduced to an advanced stage of low relief before the Ice Age, the main valleys of that period may be pictured as being wide in relation to their depth with the spurs of the hills projecting into them, the streams winding, and the side valleys joining the main valleys at a gentle slope. The effect of glacial action was to deepen the valleys, cut back the obtruding spurs, remove the accumulation of debris resulting from the long period of denudation, and straighten the courses of the streams. As the vertical erosion was greatest in the main valleys the subsidiary valleys were not deepened to the same extent, and often they are now seen to join the main valleys, either at a steep angle, or high up in the walls of the latter. These are termed hanging valleys. In Borrowdale there is a series of them including Watendlath, Styhead Gill, Gillercombe, Greenhope Gill and Combe Gill. Others enter the Thirlmere valley from the Helvellyn range while the Buttermere valley, Eskdale, the Coniston neighbourhood and other parts of the Lake District afford numerous additional examples.

Towards the head of many of the valleys there are mounds of sand, gravel and boulders which mark the halting places of the ends of the valley glaciers as they finally retreated after the last phase of the glaciation of Lakeland. These are terminal moraines. They are frequently crescent shaped, the concave side being towards the head of the valley. Where they have been cut through by streams it is possible to see their structure. They are unstratified and are merely masses of sand and stones of various sizes together with a variable amount of clay. The stones are more angular than those of the Boulder Clay as might be expected from their not having travelled so far. In the Derwent valley below Cockermouth there is a series of mounds which, from their situation and appearance, might easily be mistaken for the moraines of a glacier retreating eastwards, but examination by T. Eastwood of the Geological Survey has shown that they are water deposits of glacial streams. Moraines are widely scattered over the Lake District. There are two at Rosthwaite, one laid down by a glacier from the Seathwaite valley and the other by the joint Langstrath and Greenhope Gill glaciers. These and one in Greenhope Gill have some interesting features which have been fully described by T. Hay in *The Geographical Journal* for March 1944. A few of the localities where there are moraines in the Lake District are the head of Langstrath valley, head of Greenhope Gill, Grain Gill, Wythburn, Dunmail Raise, head of Ennerdale, Patterdale, Keppel Cove Tarn, Wolf Crag, head of Wastdale, Rosset Gill and the Coniston district.

There has been much controversy in the past over the origin of lakes but it is now generally agreed that in such mountainous regions as those in Switzerland, the Highlands of Scotland, South-west Ireland, Scandinavia, Finland and the Lake District, ice in motion has been the cause of their formation. Most of our larger

lakes appear to be situated in rock basins, and this applies to the lakes in the above mentioned lands as well as to the fiords of Norway the deepest parts of which are usually near the head. Neither earth movements nor any form of erosion except that caused by ice in motion can adequately account for the situation of the rock basins in the mountain valleys, and it is almost universally conceded that glaciers under favourable circumstances can scoop out hollows in their valley floors even if the latter are composed of hard rock. The depth of rock basins is very small compared with the thickness of the glaciers to the action of which they are due. This may be gathered from a consideration of our larger lakes, the names of which follow with their greatest depth in feet:—Ullswater 205, Hawes Water 105, Windermere 219, Derwent Water 72, Buttermere 94, Crummock Water 144, Ennerdale Water 148, West Water 258, Conistone Water 144. Even if it be granted that many, if not all, of the principal lakes occupy rock basins, it is obvious that some of them, for example Windermere and Bassenthwaite, would not be so deep were it not for the glacial deposits at their lower ends.

The islands which add so much charm to the lakes may be either ridges of rock which have resisted the drastic erosive action of the glaciers, or deposits in the form of drumlins or moraines left when the ice disappeared.

Among the most conspicuous effects of the glaciation of the Lake District have been the steepening of the valley walls, the cutting back of the spurs of the hills, and the conversion of the V-shaped section of the valleys of preglacial days into one comparable to the letter U. The familiar view of Blencathra or Saddleback from the Druids' Circle near Keswick affords an excellent illustration of the effect of the glaciation on the spurs of a mountain; but this feature, as well as others already mentioned, may be observed in almost all of the principal valleys of the Lake District.

The retreat of the ice must have been a very gradual process. There is good evidence of this in the marginal and overflow channels, many of them cut in solid rock, of western Lakeland and the Eden valley. These could only have been cut and maintained in use while and so long as a more or less stationary wall of ice held up the melt waters at a sufficiently high level. Even if it is assumed that the grit-charged escaping waters had a maximum of abrasive power, it must have taken a long period to excavate these channels. The Moresby-Whitehaven channel illustrates this very well. It could only have been cut and have functioned while, firstly, there was access to the sea at Whitehaven, and secondly, while a wall of ice about a mile farther along the coast to the north held up the Distington valley lake the overflow water of which formed the channel. The ice, then, had retreated only this short distance while this very deep channel was

being formed. De Geer, who was famous for his study of retreat phenomena, estimated that in the neighbourhood of Stockholm the rate of retreat was about two hundred and twenty-five yards a year. On the assumption of this rate for the retreat of the ice in Cumberland it required at least a hundred years to uncover the Cumberland plain after the last glacial episode.

While the ice was slowly retreating northwards from the southern limit of glaciation the land was gradually becoming restocked with animals and plants. Tundra species first occupied the ground freed from the ice. These species and others in their wake had, perforce, to follow the ice in its retreat unless they could find the particular climatic conditions necessary for their existence by ascending to higher ground. This, in part accounts for Arctic, Sub-Arctic and what are called Highland plants existing to-day on the mountains of Lakeland, isolated from their fellows in other mountainous areas. Other factors have no doubt contributed to the spread of species peculiar to mountainous regions. Many of the plants have very small seeds which could be wind borne great distances or dispersed through the agency of birds. The researches of Ostenfeld, Sandford, Seward and others on the flora of Greenland have demonstrated that flowering plants can exist under the most adverse conditions. In *Plant Life through the Ages*, 1931, Professor Seward states that the Danish Expedition of 1916-18 to the north coast of Greenland found seventy species of flowering plants. Of these a *Thalictrum*, *Silene acaulis* L., *Saxifraga oppositifolia* L., *Polygonum viviparum* L. and Cottonsedge are represented in Lakeland. Another of the plants, *Dryas*, is one only lately thought to have become extinct in the area. Ostenfeld found a few flowering plants on nunataks situated about eighty degrees North Latitude and remarks: "One must be careful in asserting that any country, under conditions answering to an Ice Age, is completely destitute of flowering plants." This suggests that places such as the Cleveland Hills and parts of the Pennines, which are considered to have remained uncovered during the Ice Age, may have harboured plants which would be able to spread to other high ground as the ice disappeared. Dr Raistrick remarks in the *Proceedings of the Geologists' Association*, October 1933, "There is some evidence that the summits of Ingleborough and Pen-y-ghent, as well as Buckden Pike and a few other peaks above 2000 feet O.D., were nunataks at the maximum glaciation and that the present flora of these peaks preserves some residual elements of considerable interest."

Investigation of the deeper layers of peat mosses, particularly of the pollen content of these layers, and of the deposits on the beds of lakes will undoubtedly furnish useful information of the spread of plant and animal life immediately after the ground had been cleared of ice.

At present, at the station of the Freshwater Biological Association, Wray Castle, Westmorland, under the direction of Dr E.

B. Worthington, an investigation of the post-glacial history of the Windermere district is being undertaken. Some account has already been given in the reports of the Association for 1944 and 1945.

A valuable and interesting paper by Winifred Tutin entitled "Lake Sediments: The Bottom Deposits of the North Basin of Lake Windermere" appears in *The New Phytologist*, Vol. 42, No. 1, 1943. By means of a core-sampler the glacial floor of Windermere was reached and on it was found a layer of laminated clay having a thickness in places of some six or seven feet. This laminated clay almost certainly was deposited before the ice had completely disappeared and, as there are at least a thousand laminations or varves, each of which may be considered to be a year's deposit, a period of at least a thousand years is represented. The actual laminated clay contains very few organic remains but within this deposit occurs a layer of grey detritus silt of which, in the *Report of the Freshwater Biological Association*, 1945, Mrs Tutin writes: "The layer of grey detritus silt within the laminated clay (which was shown last year to be correlated with a late-glacial climatic amelioration widespread in N.W. Europe and called the Allerød oscillation, from the type locality in Denmark) is only present at the margins of the lake, and consists of material apparently derived mainly from shore erosion, plus remains of land and water plants. In some places the unsorted character of the deposits of this layer suggests that solifluction may have taken place during the colder periods at the beginning and end of the amelioration. The plants identified from the middle of this layer include: *Myriophyllum* (leaves), very abundant: *Betula pubescens* and probably *B. verrucosa* (fruits, catkin scales and leaf fragments), abundant: *Populus tremula* (catkin scale), rare: *Rubus saxatilis*, *Menyanthes trifoliata* (seeds), rare: *Thalictrum minus* (fruits), *Viola palustris* (seeds), occasional: *Rumex acetosa* (fruit and perianth), occasional to frequent, and *Andromeda polifolia* (leaf fragments), rare. This list confirms the evidence from pollen analysis that during this late-glacial period the climate was cold, the dominant vegetation of the region surrounding the lake was birchwood, and it shows that there was a luxuriant growth of *Myriophyllum* in the littoral region. The evidence for increasing cold at the end of this period has been strengthened by the identification of the Arctic-Alpine species *Polytrichum alpinum* (leaves), frequent, and *Oxyria digyna* (fruit and perianth), rare, from the deposits transitional between the detritus silt and overlying Upper Laminated Clay."

The Ice Age in general, and its effect on Lakeland in particular, is a subject very far from exhausted. No doubt new inferences will be drawn from already known facts and, as data increase, theories will be modified or abandoned. This only heightens the interest to the naturalist and student, and many will subscribe to the words of Gilbert, the American glacialist:

“When the work of the geologist is finished and his comprehensive report written, the longest and most important chapter will be upon the latest and shortest geologic period.”—That is, upon the Ice Age.

June 1945.

BIBLIOGRAPHY.

- BOSWELL, P. G. H.: The Ice Age and Early Man, *Rep. Brit. Assoc.*, 1932.
- BUCKLAND, W.: Evidences of Glaciers in Scotland, etc., *Proc. Geol. Soc.*, Vol. iii, 1840.
- DE GEER, G.: A Geochronology of the last 12,000 Years, *Geol. Congress*, 1910.
- DIXON, E. E. L.: Glaciation of Ennerdale, “Summary of Progress for 1921” (*Mem. Geol. Surv.*), 1922.
- GOODCHILD, J. G.: Glacial Phenomena of Eden Valley, *Quart. Journ. Geol. Soc.*, Vol. xxxi, 1875.
- Ice Work in Edenside, *Trans. Cumb. and Westm. Assoc.*, No. xi, 1887.
- HAY, T.: Rosthwaite Moraines, etc., *Geog. Journ.*, Vol. ciii, No. 3, 1944.
- HOLLINGWORTH, S. E.: Glaciation of Western Edenside, *Quart. Journ. Geol. Soc.*, Vol. lxxxvii, 1931.
- HOLLINGWORTH, S. E., and TROTTER, F. M.: The Glacial Sequence in the N. of England, *Geol. Mag.*, August 1932.
- KENDALL, J. D.: The Distribution of Boulders in W. Cumberland, *Trans. Cumb. and Westm. Assoc.*, No. v, 1879-80.
- The Glacial Deposits of W. Cumberland, *Trans. Cumb. and Westm. Assoc.*, No. vii, 1881-82.
- A Supposed Glacier Lake in W. Cumberland, *Geol. Mag.*, 1924.
- KENDALL, P. F.: A System of Glacier Lakes in the Cleveland Hills, *Quart. Journ. Geol. Soc.*, Vol. lviii, 1902.
- MARR, J. E.: *The Geology of the Lake District*, 1916.
- MARR, J. E., and FEARNSIDES, W. G.: The Howgill Fells and their Topography, *Quart. Journ. Geol. Soc.*, Vol. lxvi, 1909.
- MEMOIRS OF THE GEOLOGICAL SURVEY OF GREAT BRITAIN: Carlisle District, 1924; Maryport District, 1930; Whitehaven District, 1931; Brampton District, 1932; Gosforth District, 1937.
- RAISTRICK, A.: Glaciation of Wensleydale, etc., *Proc. Yorks. Geol. Soc.*, Vol. xx, 1926.
- SCOURFIELD, D. J.: *Mysis relicta* in Ennerdale, letter, *Nature*, August 1941.
- SEWARD, A. C.: *Plant Life through the Ages*, 1933.
- SMITH, B.: Glaciation of Black Combe District, *Quart. Journ. Geol. Soc.*, Vol. lxviii, 1912.
- Glacier Lakes of Eskdale, etc., *Quart. Journ. Geol. Soc.*, Vol. lxxxviii, 1932.
- TIDDEMAN, R. A.: Evidence of the Ice-sheet in North Lancs., *Quart. Journ. Geol. Soc.*, Vol. xxviii, 1872.
- TROTTER, F. M.: Glaciation of Eastern Edenside, *Quart. Journ. Geol. Soc.*, Vol. lxxxv, 1929.

TUTIN, WINIFRED : Lake Sediments, etc., Windermere, *New Phytologist*, Vol. xlii, No. 1, 1943.

Lake Deposits, *Rep. Freshwater Biol. Assoc.*, 1945.

WARD, J. CLIFTON : Geology of the Northern Part of the Lake District, *Mem. Geol. Surv.*, 1876.

WRIGHT, W. R. : *The Quaternary Ice Age*, 1937.

ZEUNER, F. E. : The Pleistocene Period, Ray Society Publication, 1945.

WINTER BIRDS ON WINDERMERE.

A RETROSPECT TOGETHER WITH A LIST OF THE
WATER-FOWL, WADERS AND GULLS OF THE LAKE.

By MARJORY GARNETT.

Windermere, ten and a half miles long and rather less than a mile across at the widest part, is almost as much like a stretch of some great quiet river as a lake. There is in fact a definite though imperceptible drift from the northern end where the two main feeders, the Rothay and the Brathay, enter together at Waterhead, to the southern tip where the Leven flows out—or rather where, below Lakeside, the lake gradually narrows and merges into the river. The long narrow southern portion of the lake lies nearly north and south, but the shorter and broader northern end swings round more to the north-west, with the widest part just at the bend, where Millerground Bay forms a shallow elbow in the eastern shore. South of this turn a double row of islands are strung diagonally across the lake from near Rayrigg Bay on the eastern to the Ferry on the western shore.

Belle Isle, very much the largest, is inhabited and partly cultivated; it is narrow but nearly three-quarters of a mile long and has its northern end opposite Bowness Bay. Between it and the western shore lie Tommy Holme, the next in size, and three or four smaller islands, with Crow Holme to the south and Hen Holme, Lady Holme and Rough Holme to the north, in a line towards Rayrigg Bay. All are wooded and rather stoney, but there is a tussocky marsh at the northern end of Tommy Holme. The other islands, except Ramp Holme, south of Ferry Nab, are all small, and situated close to the shore along the southern part of the lake. The mountains stand closer round the northern end, but nowhere very near, and except where Claife Heights rise almost straight from the shore between Wray and the Ferry, and at the southern end where the eastern shore rises through steep woods to Gummer's Howe and Cartmel Fell, most of the land bordering the lake is undulating woodland and pasture with alluvial flats at Waterhead and Cunsey, at the back of some of the bays, and particularly at Calgarth where there is a wide alluvial meadow between the Troutbeck Mouth and White Cross Bay.

From the bird watching point of view Windermere falls into three parts; the northern and southern stretches of open water, and the central island portion. By rowing boat, starting as I used to do from either Bowness or Rayrigg Bay, the northern end and islands could easily be worked in a day, but the long

southern end was seldom visited further down than Silver Holme, or not so far if one went round the islands on the way. It will be seen therefore, that it was never possible to make a complete count of the ducks or other birds in any one day, though one might have a fairly good idea, based on previous experience in similar wind and weather.

When we were children we were much on the lake, but usually in summer, and it was not until about 1911 or 1912 that my brother, D. G. Garnett, and I began to go on later in the year, in search of the diving ducks and other winter-visitors. After that time, up to about 1933, no year passed when I did not spend many days on the lake at that season, especially in hard weather, when there was always the chance of coming across some rarity. The following account of the winter birds of Windermere is based mainly on my field notes for those twenty odd years, but I never attempted any systematic watching and though I saw much of interest the notes remain desultory and disconnected, and all I have tried to do here is to give a general picture of the waterfowl and their life on the lake from autumn, through the winter months, until their departure in late spring.

I am indebted to my brother for his notes of the earlier years, up to 1918, and to Dr M. S. Wood for various notes of his own and for permitting me to use those of the late J. F. Peters, whose knowledge of the lake birds from about 1910 to 1927 was unrivalled. Thanks are due also to the staff of the Freshwater Biological Association at Wray Castle for valuable assistance in naming the water plants and animals, for information on the winter habits of fish and eels, and for some bird notes; and to James Nicholson for help with the descriptions of the lake floor.

For all its size Windermere cannot be called a favoured resort of wildfowl; it never attracts many surface-feeding duck, and in open winters the diving-duck population may remain small throughout the season. Yet it is a fascinating lake in winter, and in spite of many days when one saw only a few Tufted Duck or Goldeneye there was always the chance that the next bay might hold something quite unexpected—a Velvet-Scoter or a party of Goldeneye—and apart from this there was the perpetual interest of the small bird life along the shore, the gulls and hawks flying over, owls and Wood-Pigeons about the islands.

One very noticeable effect of the north and south alignment of the lake and its position between Morecambe Bay and the central fells is that it forms part of a regular migration highway to and from the southern estuaries of Lakeland and the Solway, and is followed in spring by many small birds making for the passes through the hills, and in the winter months very noticeably by geese. These, though they seldom alight on the lake, are seen flying over as they change their ground from north to south and vice versa, which may happen several times between

autumn and spring, according to the weather. Other valleys to the east and west, running in the same direction, are used in the same way; and geese certainly, probably gulls and other birds as well, take at times a line roughly east and west from the northern part of the lake via Staveley to the Gilpin and Kent valleys; or further south they sometimes branch off into the valley of the Winster—all these joining in the Kent estuary between Grange and Arnside. Curlews also, when coming down from the hills in late summer, sometimes leave the lake south of the Ferry on a line that would take them to the Leven estuary by way of Rusland Pool. The Cartmel valley which leads directly south from the southern tip of the lake, seems to be much less often followed, at any rate by geese.

The bird life of the southern portion of the lake differs in some ways from that of the northern part, partly no doubt on account of its proximity to the estuaries of the Kent and Leven, which run far inland from the northern shores of Morecambe, but also I believe to a great degree because there is a large expanse of shallow water extending south from the islands past the Ferry and Ramp Holme as far as Storrs Point on the eastern side, while the whole of the middle of the lake north of the islands is very deep.

Unless they are much disturbed, the different kinds of duck can usually be found in certain places where the depth of water or kind of bottom are to their liking, or where they are sheltered from the prevailing wind. Nearly all the bays are favourite haunts, especially the deep indentations with reed beds—*Arundo Phragmites* L.—at the back and where the bottom is of sand or mud with patches of weeds, or covered with the short grassy tufts of Shore Weed—*Littorella lacustris* L.—and Water Lobelia—*Lobelia Dortmanna* L. There are several of these on the northern part of the lake; Rayrigg and White Cross bay on the eastern side, the small bay at the inner end of the wide High Wray Bay; and near the head of the lake, Pull Wyke which is a large bay with smaller indentations within it, and two or three smaller bays near Waterhead.

The island portion, where the water is all comparatively shallow, was always a favourite place, especially for Goldeneye, in the wide bay at the back of Bell Isle and round the islands near the western shore. The bottom is "grassy" here, that is covered with a dense growth of Shore Weed, but Goldeneye also frequent the water along the western shore to the north of the islands, where the bottom is stoney near in and only becomes "grassy" further out. South of the islands the promontory on which the Ferry Hotel stands juts out from the western shore, and Ferry Nab from the eastern, reducing the width of the lake at this point to little more than a quarter of a mile, and Parsonage Bay, well sheltered between Cockshott Point and Ferry Nab, with a rather muddy and weedy bottom and thick reed bed at

the back, is the best of all the bays for Tufted Duck and often holds Goldeneye and Pochard as well. All the eastern shore from Ferry Nab to Storrs Point is good, particularly in the bays and over the shallows south of Ramp Holme, where the winter Coot flock had their headquarters. South of Storrs the eastern shore becomes straighter, the bottom more stoney and quickly shelving, and what ducks there are on this part of the lake usually keep to the western side, where the bay below Cunsey, the narrow Lazy Bay south of Rawlinson Nab and several smaller bays further south can offer food and shelter. Probably the best bay at the southern end is Parkhead Wyke, north of Lakeside, but it is so far down that it was seldom visited.

Before the end of July the lake begins to turn towards autumn. Most of the Common Sandpipers that have made the shores and islands lively since their arrival in the middle of April leave during the month, and the few that remain until mid-August are solitary and silent. Curlews, going down from the hills where they have nested, fly over on their way to the estuaries, and most of these also will have gone by the first week in August. In former years, when the reed beds were much thicker and more extensive than they are now, they became at this time of the year the scene of much activity, especially towards dusk, when Swallows and countless Starlings gathered to roost there, and when they were alive with young Coots and Moorhens and often sheltered a brood or two of Mallard and their temporarily flightless parents. Mallard are the only duck resident on the lake throughout the year; a certain number nest round the shores and on the islands, and later seek the shelter of the reed beds during the day. Teal do not so far as I know nest anywhere very near the lake, and are not usually seen until later in the season; while the other common surface-feeding duck, the Sheld-Duck, is essentially a summer-visitor, leaving the lake after nesting.

One of the most interesting changes that has taken place in the years covered by these notes, though not properly part of the tale of winter birds, has been the colonization of the lake by the Sheld-Duck as a breeding species. Mr Peters found a nest, the first of which I have any record, near the eastern shore below Gummer's Howe in 1918, and by 1930 Sheld-Duck had come to breed freely in rabbit holes and among rocks in the woods on either side of the lake as far up as Rawlinson Nab. They were still very rarely seen north of the islands, but have continued to extend their range and now nest also in some places round the northern shores of the lake. I have never seen one in winter, though they do occasionally visit the lake at that season. Most of the breeding birds return in March and April and are an attractive sight as they swim along close inshore or rest on the little rocky islets.

Tufted Duck, though suspected of nesting on Esthwaite as long ago as 1911, and known to have nested on smaller tarns to the east of Windermere since 1914, have never been more than rare visitors to the lake in summer, and though Pochard also have nested in Lakeland since 1927 and non-breeding birds or early migrants certainly move about the area in late summer, the earliest date I know for a Pochard on the lake is 5 October 1914. It is probable that these duck find the smaller sheets of water more congenial and less disturbed by boats during the summer months.

The first of the winter birds to arrive is usually the Common Gull, which often does not leave the lake until the middle of May, and reappears early in August. In August, too, Snipe drop in to the marshy places behind the reed beds, while among casual visitors, Oyster-catchers, though they have occurred, usually singly but sometimes in pairs, at every season of the year, have been noted more often in August than any other month. Common Terns also are sometimes seen in August and September; the late A. Astley thought they appeared more frequently than earlier in the year, when they occasionally visit the lake on spring passage in April or May. I know of only one record of Black Terns on the lake—the two that J. F. Peters saw hawking near Tommy Holme on 5 August 1912. The same observer saw two Little Terns on 8 September 1918, and Dr M. S. Wood has an August record of this species.

About the end of September or beginning of October most of the Lesser Black-backed Gulls which have spent the summer on the lake take their departure. The majority of those that have been present since early spring, though they may be in pairs, are either non-breeding birds or not fully adult, but their numbers are increased in late summer by the addition of young and old birds from neighbouring gulleries. Black-headed Gulls which are about the lake all the year round, but less numerous in summer, also increase after the breeding season, and Herring-Gulls, rarely seen in summer, return a little later. Great Black-backed Gulls, though they used to nest at Finsthwaite, and now again nest among the Lesser Black-backs at Foulshaw, are only irregular and infrequent visitors to the lake.

As the days shorten and the reed beds bleach to gold, more of the winter birds appear; sometimes Tufted Duck are the earliest arrivals, but often the first are a few young Goldeneye, solitary or in small parties which, if undisturbed, can be found day after day diving in some favourite place. These arrive sometimes in October—11 October is my earliest date for the lake—sometimes not until nearly the end of November, and the same is true for Tufted Duck, though it may happen that both are seen on Esthwaite before they appear on the lake.

The first Cormorant I ever saw on Windermere was flying down past Rawlinson Nab in October 1911. A rare sight then,

but soon to become common enough, though it was not until the winter of 1917-18 that Cormorants were more than irregular visitors to the lake. Then as now they were seen occasionally at any season, but since that time, when a few stayed on and off all through the winter, increasing numbers have remained on the lake from autumn to late spring. Their two main roosts in the early years were Silver Holme, far down the lake near the western shore, and Rough Holme, where three or four were often to be seen sitting in the tops of the oak trees. Most of the Cormorants of course feed as well as roost on the lake, but one shot on Silver Holme in January 1921 had evidently just flown up from the estuary, as it was full of small Plaice—*Pleuronectes platessa* L.—and Flounders—*P. flesus* Day—and a piece of Sea Trout—*Salmo trutta* L. All the others I have examined were shot in December or January and contained Eels—*Anguilla vulgaris* Day—or Perch—*Perca fluviatilis* L.—or both, but bones of *Salmonidæ* have been found in some, and I once saw one swallowing a good-sized Trout. A point of interest is the depth to which Cormorants must dive to reach these fish in the winter months. The probable maximum diving depth given in *The Handbook of British Birds* is thirty-one feet. At the Freshwater Biological Association's station at Wray Castle, however, investigations on Perch and Eels indicate that during the winter these fish live well below this depth, and in winter netting operations in February 1945 a Cormorant was taken in a gill net set at 12-13 metres (39-43 feet). Cormorants sometimes have a disturbing effect on other water birds. I have seen a small flock of Tufted Tuck fly off grunting loudly when a Cormorant came up near them, and again, in February 1929, when the Cormorant flock alighted near some Tufted Duck, the latter swam together in alarm.

About the end of November the Coots that winter on the lake begin to arrive and take up their quarters on their favourite feeding grounds. In earlier years, when the reeds, particularly in White Cross and Parsonage Bays, were thick enough to give them good cover, some Coots used to nest round the lake, but since the reed beds have shrunk in size and become more and more scanty, it is doubtful whether any do so now. The native birds usually stayed near the shores in the places where they were bred for some time after the winter flocks were formed, and in spring were seen again in pairs near the nesting places before the winter birds had left. The latter at that time kept almost entirely to the shallows south of Ramp Holme, where I believe they were attracted partly by the "meakins"—*Potamogeton prælongus* Wulf.—and/or *P. perfoliatus* L.—which grow there, and which I have seen pulled up where the Coots have been feeding. Coots nest in suitable places round many of the smaller lakes and moorland tarns, but though all the high-lying haunts are deserted in winter it seems almost certain from their num-

bers that at least some of the migrants come from further afield. They do not arrive all at once, and the full strength of one to two hundred or more birds are sometimes not seen until after the turn of the year. In 1917 the large flock did not appear until 2 February, when after about ten days of hard frost the lake was beginning to freeze over. It was in this year and, I believe, because the shallows off Storrs were frozen over for a time, that the Coots began to change their feeding grounds. Many of them came up to south of Rough Holme where there are rocky shallows not so extensive as those south of Ramp Holme, and they also began to frequent Rayrigg Bay and across from the northern shore of Bowness Bay to Belle Isle. Except during the hard weather of February-March 1929, when the whole of the southern and island portions of the lake were frozen, there was never so large and compact a flock in these localities; in ordinary seasons many birds still clung to the old place. On the northern part of the lake there were usually a few Coots in winter off the shore north of Wray, round Pull Wyke and the other large bays, and sometimes half a dozen with the Mallard in the middle of the lake, but never very many, so it is interesting to note that this season, 1944-45, A. Dixon has observed a large flock spending the winter off Calgarth flat and the Troutbeck Mouth.

Like the Coots the wintering Mallard are usually first seen in November, but unlike the Coots they spend the day resting on the deep water of the northern end of the lake. The main flock, which might number seventy to a hundred birds, could usually be found between Rough Holme and Barkhouse or further north towards Wray, and sometimes there was a smaller flock in the middle of the lake off Lowwood. These would be nearly all wild birds, as great trouble was taken to prevent Mallard, hand-reared near by, from joining the flock. There were always other Mallard to be found scattered round the shore in various places, though I never saw them in any numbers except in Parkhead Wyke near the southern end of the lake. Towards dusk the main flock would break up and duck would fly or swim in to feed round the shores and islands, especially at such favourite places as the Lily Holmes between Belle Isle and the western shore, and the marshy southern shore of White Cross Bay. There is no proper flight either to or from the lake, though no doubt some duck which spend the day there visit the inland fields and marshes to feed at night, and in more recent years Mallard have been attracted to flight to a small tarn near Calgarth.

Small numbers of Teal frequent the lake from late autumn to spring; usually single birds or at most two or three together, which spend the day sitting among the stones and rough grass near the water's edge. One of their favourite haunts is the Calgarth shore where one can often flush a pair in early spring. Large flocks are quite exceptional, but J. F. Peters saw one on

7 December 1913, and on 13 March 1917 about thirty Teal spent the day on the open water north of Rough Holme.

Of the two remaining surface-feeding ducks that visit the lake, I have seen Shovelers only twice—a drake on shore in Lazy Bay in May 1909, and a duck which rose from the southern point of White Cross Bay in December 1927—and Wigeon come very seldom as for some reason the lake is apparently not suited to their needs. J. F. Peters saw a large flock of Wigeon in December 1913, on the same day that he saw the flock of Teal; but usually they appear in small parties of from three to eight and they do not stay long. It should be noted that “Wigeon” is one of the local names for Goldeneye; the Wigeon was styled the “proper Wigeon” by the few gunners who knew it.

Twice in November I was lucky enough to come across Velvet-Scoters. The first time, 25 November 1921, there were two, an adult drake and another, with six Tufted Duck, in the middle of the lake between Rough Holme and Barkhouse. The Scoters flew when we were some way off, and when the Tufted Duck also rose they all went off up the lake. Soon, however, the Scoters came back alone, and by going very slowly indeed I got close enough to have a good look at them, and to see the yellow on the bill of the drake and the dark beak of his companion. They frequently put up their heads with beaks pointed sky-wards, usually one after the other, and sometimes one would raise its body out of the water with neck stretched up, as Common Scoters do. When put up again they settled off Rayrigg Bay, but came swimming back to their first place, which they were evidently loath to leave. Floating on the surface, where they had been with the Tufted Duck, was Shore Weed which looked as if it had been pulled up, or rather bitten off, by ducks, but the lake here is so deep that the probability is that it had drifted down from off the Calgarth shore. The following year, on 22 November, three diving ducks were feeding at the back of White Cross Bay, and when they flew, one, larger than the others and with a conspicuous white wing-bar, proved to be a Velvet-Scoter. Next day as I rounded the point to the south of the bay, three young Goldeneye flew out followed by the Velvet-Scoter and its two satellites, which were probably Tufted Duck. This was a female or immature bird, with a conspicuous light mark well behind the eye, and under parts rather lighter brown than the back. It stayed at least until 2 December when I found it by itself in Ecclerigg Bay just north of White Cross.

An earlier November record is of a young drake Velvet-Scoter shot on 14 November 1918 by T. Battersby, who first sighted it behind Belle Isle; and in the years under review there have been two February records—two drakes shot by A. Dixon in 1923, and a duck or immature that I saw flying past Troutbeck Mouth against a strong wind on 3 February 1933—and like the Common Scoter, which is an irregular but not uncommon visitor

to the lake, the Velvet-Scoter has also occurred in summer. J. F. Peters saw four on 22 May 1920, and a duck or young drake flew from up the lake to alight near Haws Holme on 7 July 1928. It is probable that both scoters migrate overland from Morecambe Bay to the Solway by way of the lake, but interesting to note that though the Common Scoter is quite as often seen on the southern half, and the Velvet-Scoter was recorded several times from the Sampool estuary by the Rev. E. U. Savage, all the above records refer to the northern part of the lake.

Of the three regular winter diving ducks Tufted Duck and Goldeneye rarely reach their maximum numbers before the turn of the year, but Pochard, much less common than either, are just as likely to be seen in November and December as later in the season. About 1910 they were considered rather scarce, though probably even then a few came nearly every winter. Single drakes were most often seen, or small parties of three or four, usually in company with Tufted Duck, sometimes with Coots, and often asleep while the other birds were diving. Rayrigg and Parsonage Bays have always attracted them and one of their favourite places is a bay about half way between Ferry Nab and Storrs Point which has a narrow fringe of reeds and a bottom of mud and sand with patches of Shore Weed and American Pond Weed—*Elodea*. I have never seen them diving over a stoney bottom, but when on feed by day they are rather fond of going close inshore among tall dead reeds. When there is a small party with a flock of Tufted Duck, the Pochard usually keep together but among the other birds, unlike Goldeneye which are more often well apart and rather further off shore. Small lots of Pochard sometimes spend the day resting over the deep water north of Rough Holme, where in November I saw an unusually large flock of twenty-two, nearly all drakes, with twenty or thirty other "divers," probably Tufted Duck. These were most likely birds of passage, for even since they became more common, flocks of over a dozen Pochard are seldom seen on the lake.

At one time the Tufted Duck was the commonest of the winter diving ducks, then between about 1917 and 1922 the Goldeneye became the more numerous and remained so for several years, until the Tufted Duck again drew level. I think, in spite of the great fluctuations from one season to another, that both increased in the twenty years of which I am writing.

The main Tufted Duck flock, which might number twenty to thirty or even fifty birds, had its headquarters in Parsonage Bay or on the shallows off Storrs and round the islands, with smaller parties in Rayrigg and White Cross Bays, Pull Wyke and other bays both up and down the lake. In some years, particularly in the winter of 1922-23, drakes greatly outnumbered the ducks, at other times there were rather more ducks, but usually the sexes were about equal. Tufted Duck feed by day, on both animal and vegetable matter, and I have seen the lake littered with tufts

of Shore Weed where they had been feeding, some bitten off, some pulled up by the roots, perhaps in search of small mollusca or water insects. One shot in December 1917 had a caddis-fly larva, a freshwater shrimp—*Gammarus*, weed and grit in its gizzard. They have also been known to feed on bloodworms—*Chironomus*, and on acorns fallen from trees overhanging the water. Towards evening Tufted Duck very often become restless and either move out of the bays or change their ground without being disturbed, perhaps going out to roost on the open water. In December 1915 my brother heard some Tufted Duck, as they swam out of Rayrigg Bay at dusk, calling with a harsh croak rather like Carrion-Crows. Usually they are silent on the water, but like Goldeneye the birds in small flocks often grunt to one another as they fly up and down the lake.

All through the winter Goldeneye, even when present in good numbers, keep in small parties of from three to five, rarely more than eight or ten together, until March or April, when they tend to join up, and flocks of twenty or more are sometimes seen. Adult drakes are by no means rare on the lake, though in some years they seem to arrive rather later than the others. They are I think the most attractive of the diving duck and the most interesting to watch. It is not difficult with practice to distinguish the young drakes in the mixed flocks by their size even before the white face spot begins to show, and in a good light the adult ducks have rather more reddish heads and yellow ringed bills. There is no doubt that the majority of those on the lake are first winter birds; adult ducks probably do not greatly outnumber the old drakes. One of these latter will often be seen in company with a few young birds, sometimes with a single adult duck, and, though rather quarrelsome, occasionally two or three old drakes will stay together.

Goldeneye feed almost entirely by day, and unlike the other diving ducks are rarely seen asleep. When in the same bay with Tufted Duck or Pochard they usually keep apart from the others, diving over rather deeper water, or occasionally among sparse reeds; and though in some of their favourite haunts the bottom is covered with *Littorella* they also frequent places where it is stoney close inshore and where the other "divers" are seldom found. Most of those I have examined contained caddis larvae, but one old drake was full of Char ova of which they probably take good toll when the Char—*Salvelinus willoughbii* (Günther)—are spawning on the shallow redds in November and December.

The first time I saw the courtship display was in March 1919, when an old drake with two young birds swam leisurely past where I sat by the shore north of Cunsey. The drake was preening himself vigorously when suddenly he rose half out of the water with neck stretched up, threw his head back between his shoulders and as he sank down again kicked up tiny jets of water with his feet. Afterwards I found that old drakes in company

with other Goldeneye in the big bay at the back of Belle Isle, or round the islands, often did portions of their display from January onwards. Sometimes if there were two or three of them, or if newcomers joined the flock, one or more of the drakes would become excited and swim about jerking his head suddenly up and back, sometimes with breast lifted clear and with beak nearly touching his tail, or, with head and neck stretched flat on the water, would swim towards or round one of the grey birds, perhaps a duck, which however took no notice of him.

The loud and sustained singing whistle of the wings is made almost exclusively by the adult drakes; I have never heard it from a flock that did not contain one or more of them, and only once from a dark bird flying alone. Twice I came across old drakes that flew silently after rising.

December, January and February are the best of the winter months on the lake, and best of all are the days of hard frost and black calm when the first flakes of snow drift down and ghostly fingers of mist rise from the water of the bays. Then, driven by hard weather from abroad and by the freezing of the smaller sheets of water, the numbers of Tufted Duck and Goldeneye increase and the more exciting big divers and grebes are to be expected.

Before so many oaks were felled towards the end of the 1914-18 war much larger numbers of Wood-Pigeons used to come to the district to feed on acorns and beech mast on the islands and in the woods, and their trailing flocks could be seen early on winter afternoons returning across the lake to roost on Claife Heights. Another familiar winter sight was the Barn-Owl (usually one but sometimes two) which hunted constantly by day on Belle Isle and which I have seen crossing from the island to work the marshes near Ferry Nab, Rayrigg and Calgarth. There is a rookery close to the lake at Storrs and Rooks and Jackdaws, feeding in the ploughed fields at Cunsey, cross and recross the lake many times a day. Buzzards and Ravens occasionally fly over, the latter as a rule on regular lines of flight from one fell group to another; Sparrow-Hawks, singly or in pairs, hunt the wooded shores and islands, and Merlins sometimes visit the lake in winter; a young cock shot in mistake for a Wood-Pigeon as it came into the oak trees on Rough Holme in December 1915 fell into the water with a Blue Tit in its claws. There were never many Herons, sometimes only one, sometimes three or four, would be seen in a day, standing solitary at the water's edge, and often two at Calgarth near the Beckmouth. This was a favourite place for many birds; Magpies and Carrion-Crows were usually to be seen there, the latter gathering towards evening to roost in a nearby wood, and on a lucky day one might see a Great Spotted Woodpecker working the oak trees near the shore.

A few pairs of Kingfishers nest near the lake, but the number seen in winter fluctuates very considerably from season to season, and it may be that in a long cold spell they tend to leave the lake for the coast and estuaries. In February-March 1929 I never saw one, and they were noticeably scarce for two or three years after the hard winter of 1916-17. Dippers on the other hand seem to enjoy hard weather; most of them leave the becks then and appear on the lake shores, where they are more than usually lively and quarrelsome, dashing in and out of the water in furious chases. Sometimes, more peacefully, one will be seen like a minute duck, floating and diving in shallow water.

There are very few waders on the lake in winter. A. Astley told me that he rarely saw Lapwings at Ambleside at that time of the year, but there was usually a flock at Cunsey and a few near the Beckmouth at Calgarth, even during the hard frost. Common Snipe are flushed sometimes from the lake shores and marshy fields round the bays; Grass Holme, a very small reedy island, with at that time a few bushes and saplings on it, which lies just off the western shore north of Lazy Bay, was particularly attractive and I have known two Jacks and a Common Snipe shot there in different years. I have never seen a Curlew on the lake in winter, that is between the time they leave their nesting haunts at the end of summer until they return, the earliest spring migrants, at the end of February. Redshanks on the other hand do occasionally winter on the lake; there were three all through the hard weather of 1916-17, and I saw one in January 1929. There are also two records of Common Sandpipers in winter. A bird in juvenile plumage was shot by J. F. Peters on 1 January 1924 on the snow-covered shore between Cockshott and Parsonage Bay, where it had been seen two days before, and another was seen by P. Robinson on 13 February 1929. Dunlin appear rarely in small flocks in hard weather. One that I shot from a flock of six, accompanied by a larger bird, on 21 December 1927, proved to be of the northern form, and there was a flock of small waders, probably Dunlin, at Millerground at the beginning of the hard weather in February 1929. Besides these and a few other winter records of single birds, there is one summer record of two seen by J. F. Peters on 17 July 1913. Golden Plover very rarely visit the lake. I have never seen them myself, but J. F. Peters told me that he had seen flocks occasionally in winter, and Dr Wood saw eight with some Lapwings just north of the Troutbeck Mouth on 4 March 1935. It is fairly certain, however, that their main flight lines lie to the east of the Lake District proper, through the valleys of Lune and Eden, and this may apply to other species such as Greenshank and Green Sandpiper, for I have never heard of a Greenshank on the lake and the only record of Green Sandpipers is of two seen by A. Dixon near Ambleside on 1 November 1934.

In the middle of the lake south of Wray a great concourse of gulls used to roost on the open water all winter. Those that fed to the east of Windermere arrived in small parties from early afternoon onwards on a regular line that brought them to the lake near Millerground, and they often stayed for a time between Millerground and Barkhouse before moving on to the gathering place. Herring-Gulls were usually the most numerous, with varying proportions of Black-headed and Common Gulls, and in some years the main flock would number one to two hundred birds. I do not know of any similar roost on the southern part of the lake, and the straggling flocks of Herring and other gulls that were sometimes seen in November and December flying south past the islands before sunset may have carried on to roost on the estuaries.

In 1916-17, the first really hard winter in the years covered by these notes, there were very few diving ducks on the lake up to Christmas and none of the larger grebes were seen; but all through December and until the lake froze at the end of January there were from one to three Great Northern Divers, usually to be found north of the islands between Rough Holme and Wray. One of them, a young male, was shot on 5 January, and on the same day D. G. Garnett saw seven or eight small grey geese, probably Pink-feet, off Calgarth. They circled when put up, and finally made off to the north, flying at a good height. In spite of the numbers that pass over this was the only definite record I had in these years of geese alighting on the lake, except for a single bird, also probably a Pink-foot, which frequented some seed-grass fields by the shore just north of Rawlinson Nab for a few days in March 1920 and was seen there by J. G. Gordon and J. F. Peters.

When the cold spell started in the middle of January 1917 Tufted Duck and Goldeneye began to come in, and a few Scaup also appeared. These last are real hard weather birds and seldom visit the lake except during a severe frost, coming then in small parties or sometimes pairs or single birds, the black and silver drakes and the ducks with their white faces and rich brown colouring looking very handsome among the more sober Tufted Duck. When on the lake Scaup probably feed partly at night, for by day they are almost as sleepy as Pochard. An adult duck shot in February 1919 contained the short cylindrical leaves of *Littorella* or Water Lobelia. In 1915 and again in 1929, when Scaup visited Windermere in some numbers, a few stayed late into March, but in 1917, perhaps because the lake was for a time completely frozen except at the ends, only one or two were seen after the thaw in the middle of February, though large flocks of Tufted Duck returned.

This winter of 1916-17 was remarkable for the number of Water-Rails in the reed beds and marshy places round the lake. Several were seen in December, and when the cold weather lasted

into March they were driven to forage boldly by day behind the reeds in Parsonage Bay and south of Ferry Nab. It is probable that their numbers were considerably reduced by the cold and lack of food, as Moorhens certainly suffered badly and were scarce for some time after.

A cold spell in January and February 1922 again brought many interesting birds to the lake. On 5 February there were about twenty Tufted Duck in Cunsey Bay, and nine Goosanders, two of them adult drakes, the largest flock I ever saw on Windermere. Although these fine birds have increased in recent years on the tarns of East Westmorland there does not seem to have been any corresponding rise in the numbers that visit the lake, where they are irregular but not uncommon visitors, appearing in small numbers in most winters. Nearly all are in grey plumage, and they are very wild, sometimes flying right off the lake when disturbed. Small lots of two to six are sometimes found in the rocky bays between Pull Wyke and Wray and I have seen them flying both to and from the direction of Blelham Tarn just north of Wray. An adult duck and drake, shot in Millerground Bay on 20 February 1923, both contained Three-spined Sticklebacks—*Gasterosteus aculeatus* L., the drake seventeen, the duck nine, and a Minnow—*Phoxinus phoxinus* (L.), besides the remains of others.

February 1922 was also a great time for grebes and divers. An adult Red-throated Diver had been shot in January and two more were seen by J. F. Peters on 6 February, while on the 10th and 11th, in severe cold, there were several big divers on the lake as well as an unusual number of grebes. On the 10th J. F. Peters, on the southern half, saw three and shot two Black-throated Divers. I went round the northern end, and besides twenty or more Tufted Duck and about the same number of Goldeneye, Mallard in various places, and a small flock of Dabchicks in White Cross Bay, there was a Great Northern Diver in the middle of the lake off Wray, where the gulls were collecting to roost, three Great Crested Grebes in Pull Wyke, at least seven "black and white" grebes, six in Wray Bay and one in Pull Wyke, and an unidentified large grebe off Millerground. The Great Northern Diver, or another of the same species, shot the next day, contained two trout about six ounce size.

Great Crested Grebes, which have nested on Esthwaite since 1908, and which sometimes nest on Blelham and other tarns in the neighbourhood, visit the lake either singly or in small numbers at almost any time of the year, and Little Grebes, though they rarely if ever nest on the lake, are common in winter. Single birds bob up anywhere round the shores, and small flocks, perhaps family parties, varying much in plumage, frequent some of the bays. These little flocks of six to eight or more birds keep well together when feeding, and are often very lively, "skittering" over the surface, chasing and playing together; sometimes

when disturbed they all swim out into the open water instead of diving to shelter at once.

Although a few of the rarer grebes probably occur nearly every winter, especially in hard weather, they are always very difficult to identify in the field, and often so wild that it is impossible even to make a guess at what they are. I have never met with the Red-necked, but a female was shot from a party of four in Millerground Bay in January 1907 and another in Pull Wyke in February 1912 by E. B. Dunlop, and J. F. Peters saw one on 14 November 1914. The "black and white" grebes, Slavonian and Black-necked, appear more often; probably most are Slavonian, as, though usually indistinguishable in the field, all but two of the definite records refer to this species. A few have been shot flying in mistake for diving ducks, and I had a fine view of one in February 1929 as it swam slowly about, preening itself, just north of Rayrigg Bay. When disturbed it went out into the lake, and after coming up once near two Great Northern Divers that were swimming there, it took flight, showing both when flying and on the water, the very clean-cut black cap and white cheeks characteristic of the species.

The first Black-necked Grebe to be recorded from Windermere was shot by D. G. Garnett on 8 January 1918. A female, and probably a bird of the year, it was feeding busily just outside the thin reeds on the north side of Rayrigg Bay, on a brilliant morning of hard frost and strong north wind. Sitting, when on the surface, with its upper tail coverts and rump feathers raised and fluffed out in Dabchick fashion, it looked, from behind, all white except for the darting snakey head with dark crown and patch round the eye and a narrow black line down the back of its neck. It was taking long (time) dives and proved to have been feeding on *Notonecta*, freshwater shrimps and a few caddis larvae. A second Black-necked Grebe was shot on 18 December 1920 by J. F. Peters. It was an adult male and when first seen was off the shore just north of Rayrigg Bay.

Like the rarer grebes a few of the big divers—*Colymbæ*—visit the lake nearly every winter, and like them are extremely difficult to identify in the field. The Red-throated Diver used to be considered the commonest and may have been so at one time, but I am certain that between say 1915 and 1930 more Black-throats than Red-throats came to the lake. Of the divers I saw in the flesh or was able to identify for certain on the lake during that time, seven or eight were Great Northerns, ten or more Black-throated Divers, and only three Red-throats, one of which was shot earlier, in 1910. The only one of the last named I ever saw in the field to be sure of was a bird that stayed from 2 to 23 March 1922 and spent much of its time ashore on a shingly point north of the Ferry, where it was first seen by J. F. Peters. It may have been slightly oil-clogged, as was one shot in January of the same year.

All through the hard weather of February and March 1929 there were divers of one sort or another on the lake. The first to appear were two Great Northerns on 14 February, but these did not stay, and all those identified later were Black-throated Divers. On 15 February a Black-throat flew into Millerground Bay just before sunset and swam slowly along inshore, dipping its head now and then to look under water, and passing close to three Scaup drakes, an unusual and lovely sight.

One diver seen several times between Calgarth and Lowwood was so wild that I never got near enough to be sure of its species, but a Black-throat that could usually be found off Rayrigg Bay or just north of the islands, after its companion had been shot on 21 February, became very tame and stayed at least until 8 March. On 1 March it came swimming and diving through a lane of open water in the ice north of Belle Isle, so close that I could see every detail of its markings. There is something strangely pleasing about divers; the smooth contours of head and neck give them a sleek and well fed appearance, the shining white of throat and flanks is beautiful against the dark water, and no other water bird I know can touch them for ease and suppleness of movement. A second Black-throated Diver appeared off Rayrigg Bay on 5 March, but went away up the lake, and on the 8th, besides the tame bird, which was diving and probably feeding close inshore near the sand wharfe south of Rayrigg Bay, I saw two others of the same kind in Millerground Bay and a single bird north of Calgarth. This last was not easy to approach and may in fact have been the wild diver seen earlier. There was still one Black-throat left on 13 March, swimming slowly and preening itself just off the Troutbeck Mouth.

The food of these divers on the lake is of some interest as *The Handbook of British Birds* mentions only animal food. The birds have a habit when feeding of diving close inshore and coming up again near the same place, and though the female shot in February 1929 contained a trout of about six inches and the bones of another fish about the same size, one shot on 6 January 1920 had grit and small fish bones, all stained green, in its gizzard and a dead leaf in its gullet, while one got on 9 January 1915 contained only woody reed stems, leaves and some water weed, with a few pebbles.

In 1929 when there was skating on the lake for the first time after 1917, the cold weather did not begin until the middle of February. Then one or two springlike days were followed by grey skies, hard frost and a bitter easterly wind, which broke up the ice on the northern half of the lake and kept open water from just north of the islands nearly to Waterhead. Except for a short thaw from 20 to 25 February, when the ice became mushy, the frost lasted from 11 February to the middle of March, and even then, with sun all day and no wind, the frosts were hard

enough to put a skimming of ice each night over the deep water which had not been frozen before. By that time the birds were leaving, but for nearly a month, with all the other fresh water in the district frozen, the north end of the lake had harboured an amazing collection of waterfowl.

Some of the most interesting birds which came in the first few days did not stay long on the lake. Among these were the Great Northern Divers and Slavonian Grebe already mentioned. I saw an unidentified "black and white" grebe on 16 February, after when there were only Dabchicks and a few solitary Great Crested Grebes. On 15 February a Red-breasted Merganser duck rose from the back of Rayrigg Bay and I flushed a Smew, female or young, twice from the Calgarth shore—both rare birds on the lake. The only other Smew I ever saw, probably a young one, swam out of Wray Bay in November 1925. Red-breasted Mergansers have occurred rather more often; J. F. Peters saw three on the 19th and seven on 21 February 1921, and in this year, 1929, another or perhaps the same duck was swimming near the Coot flock off Rough Holme on 8 March. There were several Scaup in twos and threes on the lake by 14 February, and some of them, alone or in company with the Tufted Duck and Pochard, stayed until the end of the hard weather. The last I saw were a drake and two ducks with the remains of the Coot flock, three Pochard and a single Tufted drake, on 27 March.

There were large numbers of Goldeneye at first, scattered in small parties round the lake shores, but they decreased as time went on, and by 5 March there were only about twenty-four altogether, including one old drake. Large flocks of Tufted Duck on the other hand stayed throughout the hard weather, as did the Pochard, of which there were only a few at first, and then from 18 February onwards a flock of forty or more, usually at White Cross or Calgarth or near Rough Holme. On 5 March they were scattered asleep off the Calgarth shore with some Tufted Duck and a large flock of Mallard, most of which were busily feeding, up-ended in the shallow water.

In the coldest weather at the end of February the Cormorants, of which there were usually twelve to fifteen to be seen near Rough Holme, kept more together than usual, swimming about in a strange looking long-necked fleet.

The Coot flock spent most of their time just off the shore between Fallbarrow Point and Millbeck Mouth, coming up sometimes towards Rough Holme and Rayrigg Bay, and when the Tufted Duck and Pochards were there as well, with a white cluster of gulls on the point, Cormorants, a few Scaup and Goldeneye, and perhaps a Black-throated Diver or pair of Whoopers, and the sun shining on blue water in the windless cold, the lake was a truly wonderful sight. When the water west of Rough Holme was frozen in early March some of the Coots took to landing on the ice, and gulls, mainly Black-headed, roosted there for

a time. After the thaw the Coots moved down near the south end of Tommy Holme—not one of their usual haunts—and there were still thirty or forty there on 27 March.

Many Mute Swans from neighbouring waters gathered on the lake during the frost to join the resident birds, and on 16 February there were a pair of adult Whoopers feeding just north of Rayrigg Bay. They were not very wild, and would have liked to be friendly with two Mute Swans in the bay, but the latter did not respond. I saw the Whoopers again on the 18th and 28th; on the last day they came flying from up the lake and after feeding for a time at Millerground went on to the south where all was frozen. There is little doubt that they were the same birds each time, as they showed the same individual mannerisms.

Whoopers had not then begun to winter regularly on Elterwater and other nearby tarns, and were looked on as rather uncommon visitors, though flocks were seen flying over from time to time. I saw twenty-two flying down the lake at no great height and calling in chorus, on 24 March 1922. A very much bog-stained adult was grazing by the shore on the south side of Rayrigg Bay on 30 April 1927. This bird, though alert and wary enough in its bearing, had evidently been used at some time to being fed, and came in near the landing for bread that we threw for it.

As far as I know, Bewick's Swans have only once visited the lake. On 21 February 1919 J. F. Peters saw two with two Mute cygnets in the bay on Storrs where Pochard and Tufted Duck are often found. He saw one of them again off Lowwood the next day, and on the 26th they were in Rayrigg Bay, but their favourite place was Storrs where they stayed until 8 March. Though much lighter in colour than the yearling Mutes, the Bewick's Swans were not fully adult, only a few white feathers showed on their backs and the light patches on their beaks were pale pinkish yellow. The two birds used quite different call notes, one a sort of hiss, the other a soft bark, neither at all loud. They seemed to like the company of the Mutes, though the latter sometimes bullied and chased them, but they usually fed closer inshore than the larger birds, only submerging their heads and necks in the shallow water.

March sees the departure of many of the winter birds and the return of some migrants. Curlews and Lesser Black-backed Gulls are the earliest, and the arrival of Curlews towards the end of February is usually the first sign of approaching spring. Even in the coldest weather of 1929 the first Curlew and the first Lesser Black-back were seen on 28 February. In March there is often, near the Troutbeck Mouth, a flock of Curlews which gradually disperse to nesting places in the hills, but the birds that nest on the fells above Belle Grange on the other side of the lake, come to feed at Calgarth all through the summer. Reed-Buntings return in March or earlier to their nesting places on some of the

islands and in marshy places round the shores, which have been deserted since the previous autumn. Rarely an odd bird is seen on Tommy Holme or Grass Holme in December or January. The two or three pairs of Redshanks, which nest in the big field at Calgarth and usually leave the lake in late summer, also come back in March, shortly after the Curlews, though as already mentioned Redshanks do exceptionally stay in winter.

Most of the non-breeding Lesser Black-backed Gulls that spend the summer on the lake return in March and April, and it is at this season that one occasionally sees very dark backed birds, possibly of the Scandinavian form on passage; for besides the return of the summer-residents and nesting birds there is the northward stream of passage-migrants which begins in March and continues through April and early May. Most of these pass over unseen, but there have been notable exceptions, among them a Great Northern Diver in full breeding plumage seen at Waterhead by A. Astley on 30 March 1916; and in two years Whimbrel have visited the lake in spring. In 1908 E. B. Dunlop saw four flying over on 17 May, and in 1915 D. G. Garnett saw one at Cunsey on 28 April, and J. F. Peters four on 12 May. There can be little doubt that some of the divers and ducks seen late in the season are also in fact on passage.

Towards the end of March the Coot flock breaks up. On 23 March 1917 I actually saw one Coot leave the flock south of Rough Holme and fly off the lake at a good height over the fells in the direction of Esthwaite. Mallard disperse about the same time, but until the ducks begin to sit, small parties of paired birds often spend the day together, half asleep at the water's edge. There was usually a nest among the tussocks on the north end of Tommy Holme, unless, in a wet season, the marsh was under water. At the end of March 1929 a duck and two drake Mallard were skirmishing there, but ten days later I found no nest, only the bones of one of the drakes, neatly picked by Otters. There are usually some of these beasts about the lake and during the hard weather earlier in the year they had been coming nightly into the boathouse in Rayrigg Bay till the place reeked of their fishy smell. After the ice went they had changed their quarters to Haws Holme, just north of Tommy Holme where, though fish scales were scattered about, much of the foil contained feathers.

Those diving duck that nest nearest to the lake are the first to depart; I have no notes of either Tufted Duck or Pochard after the end of March. One of the latest Pochard records is rather curious. On 23 March 1923 a flock of eight, seven ducks and a drake, were resting all afternoon in the middle of the lake north of White Cross Bay. When I rowed towards them they started ducking and bathing, and two of them dived and stayed down what seemed a considerable time, though the lake here is over two hundred feet deep. Several of them raised their closed

wings over their backs, but not until I rowed faster would they take flight.

By the end of March and in April most of the Goldeneye, in larger flocks now, are to be found between Belle Isle and the western shore, or close inshore north of the Garden House; but after the fishing season starts at the beginning of March, they are constantly disturbed by boats and kept on the move from one place to another. Usually the last of them are seen about the middle of April, when the Common Sandpipers are arriving and the lake is springlike with new green in the reed beds and gay with daffodils and marsh marigolds along the shore. Apart from wounded birds there are two May records of Goldeneye. D. G. Garnett saw seven behind Belle Isle on 2 May 1927, and I saw thirteen, one of them an old drake, near the same place on 9 May 1930.

Finally, to round off this rambling account of winter birds and others on Windermere, there are two unusual May records: the first of a fine duck and drake Scaup put up twice off Barkhouse on 1 May 1927, the day before one of the late Goldeneye flocks was seen, and the other of a party of nine Common Scoters which Dr Wood watched playing together off the Calgarth shore on several days in May 1929.

May 1945.

A LIST OF THE WATER-FOWL, WADERS AND GULLS OF WINDERMERE.

WHITE STORK—*Ciconia ciconia ciconia* (L.)—One shot on Windermere early in 1867 (*Birds of Lakeland*).

COMMON HERON—*Ardea cinerea cinerea* L.

BITTERN—*Botaurus stellaris stellaris* (L.)—One shot on the Calgarth shore in December 1921, and one seen 11 August 1933 (*Birds of Lakeland*).

WHOOPEE SWAN—*Cygnus cygnus* (L.).

BEWICK'S SWAN—*Cygnus bewickii bewickii* Yarr.—Two cygnets on the lake from 21 February till after 8 March 1919. J. F. Peters and M. Garnett (*Birds of Lakeland*).

MUTE SWAN—*Cygnus olor* (Gm.).

WILD GEESSE (? spp.). Macpherson (*Fauna of Lakeland*) mentions Bean-Geese as probably visiting Windermere. In more recent times Pink-foot and Grey Lag have probably alighted very occasionally.

BARNACLE-GOOSE—*Branta leucopsis* (Bechst.)—Two, one shot, on Windermere in the winter of 1889-90 (*Fauna of Lakeland*).

SHELD-DUCK—*Tadorna tadorna* (L.).

MALLARD—*Anas platyrhynchos platyrhynchos* L.

TEAL—*Anas crecca crecca* L.

WIGEON—*Anas penelope* L.

SHOVELER—*Spatula clypeata* (L.).

COMMON POCHARD—*Aythya ferina* (L.).

TUFTED DUCK—*Aythya fuligula* (L.).

- SCAUP-DUCK—*Aythya marila marila* (L.).
 GOLDENEYE—*Bucephala clangula clangula* (L.).
 LONG-TAILED DUCK—*Clangula hyemalis* (L.).—Adult male and female shot, Ambleside, 13 January 1908, by W. Hardy. Female seen same place, 10 November 1922, A. Astley (*Birds of Lakeland*).
 COMMON SCOTER—*Melanitta nigra nigra* (L.).
 VELVET-SCOTER—*Melanitta fusca fusca* (L.).
 GOOSANDER—*Mergus merganser merganser* L.
 RED-BREASTED MERGANSER—*Mergus serrator* L.
 SMEW—*Mergus albellus* L.
 CORMORANT—*Phalacrocorax carbo carbo* (L.).
 SHAG—*Phalacrocorax aristotelis aristotelis* (L.).—One shot on the lake 1 December 1927 (*Birds of Lakeland*).
 GANNET—*Sula bassana* (L.).—One fishing in deep water 7 June 1914, J. F. Peters (*Birds of Lakeland*).
 STORM-PETREL—*Hydrobates pelagicus* (L.).—One seen, 8 November 1913; lake calm with slight east wind, J. F. Peters (*Birds of Lakeland*).
 GREAT CRESTED GREBE—*Podiceps cristatus cristatus* (L.).
 RED-NECKED GREBE—*Podiceps griseigena griseigena* (Bodd.).—One shot, 4 January 1907, and one, 5 February 1912, E. B. Dunlop. One seen, 22 November 1914, J. F. Peters (*Birds of Lakeland*).
 SLAVONIAN GREBE—*Podiceps auritus* (L.).
 BLACK-NECKED GREBE—*Podiceps nigricollis nigricollis* Brehm.—Female shot, 8 January 1918, D. G. Garnett. Male shot, 18 December 1920, J. F. Peters (*Birds of Lakeland*).
 LITTLE GREBE OR DABCHICK—*Podiceps ruficollis ruficollis* (Pall.).
 GREAT NORTHERN DIVER—*Colymbus immer* Brunn.
 BLACK-THROATED DIVER—*Colymbus arcticus arcticus* L.
 RED-THROATED DIVER—*Colymbus stellatus* Pontopp.
 COMMON CURLEW—*Numenius arquata arquata* (L.).
 WHIMBREL—*Numenius phaeopus phaeopus* (L.).—Four seen, 17 May 1908, E. B. Dunlop. In 1915 one seen, Cunsey, 28 April, by D. G. Garnett and four by J. F. Peters on 12 May (*Birds of Lakeland*).
 WOODCOCK—*Scolopax rusticola* L.
 COMMON SNIPE—*Capella gallinago gallinago* (L.).
 JACK SNIPE—*Limnocryptes minimus* (Brunn.).
 GREY PHALAROPE—*Phalaropus fulicarius* (L.).—One shot, Fallbarrow Point, 10 November 1891, by H. E. Rawson (*Birds of Lakeland*).
 DUNLIN—*Calidris alpina* (L.).
 COMMON SANDPIPER—*Actitis hypoleucos* (L.).
 GREEN SANDPIPER—*Tringa ochropus* L.—One shot on the lake, April 1892 or 1893. Two seen near Ambleside, 1 November 1934, by A. Dixon (*Birds of Lakeland*).
 REDSHANK—*Tringa totanus* (L.).
 GOLDEN PLOVER—*Pluvialis apricaria* (L.).
 LAPWING—*Vanellus vanellus* (L.).
 BRITISH OYSTER-CATCHER—*Haematopus ostralegus occidentalis* Neum.
 BLACK TERN—*Chlidonias niger niger* (L.).—Two seen, 5 August 1912; strong south-west wind, J. F. Peters.

COMMON TERN—*Sterna hirundo hirundo* L.—Some of those seen may be Arctic Terns—*S. macrura* Naumann—but that species has not been satisfactorily identified on the lake.

LITTLE TERN—*Sterna albifrons albifrons* Pall.—Two seen, 8 September 1918, J. F. Peters (*Birds of Lakeland*). One, Troutbeck Mouth in August, M. S. Wood.

BLACK-HEADED GULL—*Larus ridibundus ridibundus* L.

COMMON GULL—*Larus canus canus* L.

HERRING-GULL—*Larus argentatus argentatus* Pont.

BRITISH LESSER BLACK-BACKED GULL—*Larus fuscus gruellsii* Brehm—A few birds of the Scandinavian form—*L. fuscus fuscus* L.—also probably visit the lake from time to time on migration.

GREAT BLACK-BACKED GULL—*Larus marinus* L.

GLAUCOUS GULL—*Larus hyperboreus* Gunn.—Not actually seen on the lake, but an immature that visited a fish tip near Windermere between 30 January and 4 February 1922, came in the mornings with the regular flight of Herring-Gulls from the direction of the roost south of Wray, J. F. Peters and M. Garnett (*Birds of Lakeland*).

KITTWAKE—*Rissa tridactyla tridactyla* (L.)—One picked up dead at Ambleside in March 1903; record confirmed by Miss Armitt (*Birds of Lakeland*).

BRITISH RAZORBILL—*Alca torda britannica* Ticehurst—One shot on the lake, 6 October 1926, by T. Battersby (*Birds of Lakeland*).

GUILLEMOT—*Uria aalge* (Pont.)—One shot at Ambleside, 26 December 1919, by W. Hardy. This and the Razorbill were seen in the flesh by M. Garnett.

LITTLE AUK—*Alle alle alle* (L.)—One killed at Waterhead in November 1908, J. Hardy. One seen by J. F. Peters, 25 November 1916. One caught at Ambleside, 20 November 1920, A. Astley. Another same place as last, 5 May 1927, A. Dixon (*Birds of Lakeland*).

CORN-CRAKE—*Crex crex* (L.)—Has probably nested on Belle Isle. One calling there in May 1921.

WATER-RAIL—*Rallus aquaticus aquaticus* L.

MOORHEN—*Gallinula chloropus chloropus* (L.).

COOT—*Fulica atra atra* L.





ERNEST BLEZARD.

CREeping LADY'S TRESSES AT BROADFIELD, CUMBERLAND.

CREEPING LADY'S TRESSES IN CUMBERLAND.

By DOROTHY BLEZARD.

One result of the recent clearing of woodlands in Cumberland has been the wholesale disappearance of the orchid, Creeping Lady's Tresses—*Goodyera repens* Br.—within a few years of its having become strongly established in several stations. The felling of Scots Pines—*Pinus sylvestris* L.—with which it grows in association has brought extinction to all but one of the later known colonies.

In *The Comital Flora of the British Isles* by George Claridge Druce, published in 1932, *Goodyera* is represented as having been recorded from six vice-counties of England. These are East Norfolk (27), West Norfolk (28), South-east Yorkshire (61), Northumberland South (67), Cheviotland or Northumberland North (68) and Cumberland (70).

Between the periods of the 1914-18 and the present war Cumberland had six definitely known stations for *Goodyera*, all close and to the south of Carlisle. There are records referring to the Eden valley and neighbourhood in earlier years.

A Flora of the English Lake District by J. G. Baker, published in 1885, gives the statement, "In a fir plantation near the Eden at Armathwaite between Penrith and Carlisle (Dr F. A. Lees)," but in William Hodgson's *Flora of Cumberland*, published in 1898, any mention of the species or reference to the earlier record by Dr Lees is entirely omitted.

T. Scott Johnstone in a paper read to the Carlisle Natural History Society in March 1911, says that in June 1908 Mr Platt had found *Goodyera* at Faugh, near Heads Nook, where it was apparently well established, and that Mr Dickenson had again found it at Armathwaite, in July last. The Carlisle Museum herbarium has in it a specimen of *Goodyera* collected by Mr Dickenson at Armathwaite in July 1910, and in the manuscript flora of the Rev. W. W. Mayson, sometime Vicar of Melmerby, the plant is recorded as found by him at Armathwaite in 1914.

Five of the later colonies have vanished because the pine wood habitats have been completely felled. As a humus plant peculiar to conifer woods, *Goodyera* does not seem to find the remaining humus sufficient for its growth once the woods have been felled, the shelter and nourishment from living trees apparently being necessary requirements. Furthermore, it is reasonable that the particular fungal mycelia, the threads of which unite with the roots of the orchid, and are responsible for conveying some amount of nourishment to the plant, only subsist in the humus so long as it is continually receiving additions.

The strongest station of all was at Longrigg, Broadfield, about five miles south of Carlisle. Here, from 1925 onwards, *Goodyera* increased till it carpeted a considerable part of the floor of a wood which was roughly thirty acres in extent. It covered the needle-strewn spaces between the pines in association with Common Speedwell—*Veronica officinalis* L.—and sparse grass but was absent from the lush, grassy rides where Lesser Butterfly Orchis—*Habenaria bifolia* Br.—grew. Creeping Lady's Tresses ceased to exist here after the autumn of 1936 when the whole of the wood was felled. As so frequently happens on woodland clearings, the site became closely overgrown with Rose-bay Willow-Herb—*Epilobium angustifolium* L.

Until it was felled in 1931, part of Tarn Wood, one of the Red Cat Woods at Durdar, some three miles south of Carlisle, had its floor thickly covered with *Goodyera*. The remainder of the wood stood till the winter of 1933-34 and during the interval the plant struggled to exist on the outer hedgebank of the wood in company with the fern, *Polypodium vulgare* L., before finally disappearing.

Less than a mile away lay another of the Red Cat Woods, on Seuggar House land, the haunt of two other orchids, Broad-leaved Helleborine—*Epipactis latifolia* All.—and Lesser Twayblade—*Listera cordata* Br. It was during a visit to these other plants in June 1932 that I found a single pat of *Goodyera* towards the outside of the wood, on ground bare except for a sprinkling of the cushion-like moss, *Leucobryum glaucum* Schp. Small patches eventually appeared but this colony was short-lived as felling was begun in August 1940 and completed by the winter of 1941. A tangle of bramble, rush and willow-herb then developed on the site.

In June 1935, my husband came upon a fair colony of *Goodyera* under old pines at Burthwaite, within sight and to the south of the last two mentioned stations. Here the wood stood on high, windswept ground with the trees rather widely set, and the ground beneath rough and partly bramble-grown. The history of this station also was very brief as the felling of all the trees was begun in the following winter.

In *The Naturalist*, Vol. 19, p. 46, F. H. Day records a colony of *Goodyera*, first known to him in 1916, and established under some tall, old pines within four miles of Carlisle. Incidentally, the locality Corby mentioned in this note can be taken as identical with Faugh. When I later saw the colony having a history dating back to 1916, the plants were flourishing under the largest trees among a ground flora of stunted Blaeberry—*Vaccinium Myrtillus* L., Ling—*Calluna vulgaris* L.—and Hair Moss—*Polypodium commune* L. Here also Broad-leaved Helleborine grew in close proximity, and it is still to be found in the shelter of young birches. By 1933 the Creeping Lady's Tresses had appeared across the way in a mixed wood separated by a footpath.

At first springing among *Polytrichum* under Silver Birches—*Betula alba* L.—it was, however, without doubt nourished by drifted pine humus. Very fortunate it was that the *Goodyera* had spread away from the old pines as these were felled in the winter of 1941-42 and the original colony then died out.

The trees in the mixed wood are largely birch and oak but there are many Scots Pines and all together they cover a plot of about twenty acres on which formerly stood a pine wood, long since felled. From its starting place near the path, where *Polytrichum* and Heath Bedstraw—*Galium saxatile* L.—tend to smother it, *Goodyera* has proceeded to colonize the ground under the scattered pines where it is unhampered by sparse grass. By 1943 vigorous growths were dotted across the wood to pines right at the farther side. How long this sole remaining colony survives may depend upon the demand for home-grown timber.

In February and March 1931 an attempt was made by my husband and myself to establish colonies in the Castletown woods at Rockcliffe and in a pine plantation at Aglionby by transplanting healthy clumps of plants. A visit to these places in the following season failed to show any sign of the plants, probably either because rabbits had eaten them or a dry spell had prevented them from establishing good root systems. All the plants had, however, mature spikes of fruits on them and if at any time the species does crop up in these districts the possible origin is fairly certain. That rabbits have a taste for the orchid seemed evident by the often nibbled condition, especially of the flower stems, in woods where the plant was abundant.

There is the likelihood that one or other of the older and vanished colonies originated from seed or plants introduced with seedling pines from Scotland where the orchid is a native type. The establishment of *Goodyera* in Norfolk has been stated to have come about in this way. In the case of the short-lived Red Cat colony and of the one at present surviving it can be stated surely that the plants were self-sown, the dust-like seed being carried and distributed by the wind. Colonization has been noted to proceed by the formation of small dispersed pats in the direction of the prevailing wind. These small pats of a plant or two then seem to increase largely by vegetative reproduction. Incidentally, five of the six Cumberland stations, in relation to the prevailing and often forceful south-westerly wind, were more or less downwind of Longrigg, the strongest station.

Bentham and Hooker's *Flora*, Seventh Edition, 1924, states of *Goodyera*, "In Britain confined to Cumberland and several counties of Scotland where it is rare and local." G. C. Druce has shown it to have a wider distribution in Britain. The days of *Goodyera* in Cumberland would almost appear to be numbered were it not that one suitable haunt succeeds another. New plantations of conifers, some of them extensive, are springing

up in different parts of the county, and so remains the possibility that Creeping Lady's Tresses will continue to be included in the flora of Cumberland. (Cf. *North Western Naturalist*, Vol. 11, p. 361.)

January 1945.

THE GREY LAG-GOOSE IN LAKELAND.

By TOM L. JOHNSTON.

HISTORICAL.

Since the beginning of the present century the Grey Lag-Goose—*Anser anser anser* (L.)—has progressed from being an uncommon bird in Lakeland to a numerous passage-migrant and winter-visitor.

Macpherson in his *Vertebrate Fauna of Lakeland*, 1892, gives the Grey Lag as a bird that did not appear to have been common at any time and one for which any early evidence of its nesting in the area was lacking. In the Naworth Household Accounts there were no records which might be referred to breeding or home-bred wild geese, only occasional entries of autumn birds, as one in September 1620 and one in September and two in October 1634. These were as likely to have been Pink-footed Geese—*Anser fabalis brachyrhynchus* Baillon—as Grey Lags.

The Rev. W. Richardson, a native of Ullswater district, had said in his paper on the fauna of that district, 1793, that the geese that used to visit Ullswater seldom stayed longer than a day or two except during severe frost.

Dr John Heysham (1753-1834) in his *Catalogue of Cumberland Animals*, 1796-7, had stated that the grey goose was seen in the county only in winter but that it bred in many of the fens of England.

It was evident that neither of these naturalists had any knowledge of Grey Lags breeding in their own districts although local tradition had it, and perhaps rightly, that a few used to breed in the wild country about the headwaters of the Eden in Westmorland.

Under Bean-Goose—*Anser fabalis fabalis* (Lath.)—Yarrell had written in the first edition of his *British Birds*, 1843, that a few pairs were said to breed annually in Sunbiggin Tarn, near Orton, in Westmorland. This statement should have referred to the Grey Lag-Goose as the only British nesting species. In 1861, Dr Thomas Gough of Kendal, Westmorland, had included the Grey Lag as an occasional winter-visitor to his district.

T. C. Heysham (1791-1857) had considered the Grey Lag a rare bird in Cumberland and Macpherson adds that since Heysham's time the Grey Lag had continued to be the rarest of the grey geese to visit Lakeland.

To this day the lonely Sunbiggin Tarn, lying in the moorland connecting the Pennines and the Lake Fells, is a calling place

for grey geese, between autumn and spring. If the Grey Lag formerly nested in the wilds of Westmorland, it seems as likely that it should have bred in the Solway region. Here, the present mosses, flows and bogs of Bowness, Wedholme, Biglands and elsewhere, although together covering hundreds of acres, are only a remnant of what was previous to the enclosures in the late eighteenth and early nineteenth century a great wild waste reaching at one point to the outskirts of Carlisle. It was on the fringe of this land, on Newtown Common, now a built-up part of the city of Carlisle, that Dr Heysham had as many as three nests of the Hen-Harrier—*Circus cyaneus cyaneus* (L.)—under observation in 1783 and again in 1785. These facts suggest the possibilities of what there might have been in the way of other bird life in the more remote parts, then difficult of access. Divided as they now are by roads and encroached upon by farm land, the remaining peat mosses are at certain times favourite haunts of the Grey Lags resorting to the Solway. They still bear a resemblance to some of the present breeding haunts of the species in Scotland, and in what is now Bowness Moss there was formerly a sheet of water, Anthorn Lough, to lend attraction.

The seventeenth century evidence for the breeding of wild geese in the Scottish Solway region might be taken in favour. The places referred to are Loch Urr on the boundary between Dumfries and Kirkcudbright and Mochrum Loch in Wigtown. In the light of this evidence, H. S. Gladstone in his *Birds of Dumfriesshire*, 1910, says that it is not impossible that in these early days the Grey Lag may have nested at Loch Urr.

CHANGES IN HABITAT.

During the period under survey, the Cumberland Solway salt marshes principally favoured by wild geese have gradually and very considerably grown in size. There has been a succession of new and choice feeding grounds in the process. Newly formed marsh with its young growth of grass has a much superior attraction to old marsh where, especially on stretches colonized by Black-headed Gulls—*Larus ridibundus ridibundus* L.—and Lesser Black-backed Gulls—*Larus fuscus graellsii* Brehm—the herbage becomes too long and coarse to suit the taste of geese.

Rockcliffe Marsh, lying between the mouths of the rivers Eden and Esk, which used to be cut in two by "the gulf," a deep channel from one river to the other, is now, except for the usual winding creeks, one continuous stretch with many acres added to the side towards Esk. This gain has been made while Burgh Marsh, separated from it by Eden, has lost ground.

The additions to Longnewton Marsh, flanked by the estuaries of Wampool and Waver in Moricambe Bay, have been relatively

greater. What was once an island sandbank in Wampool at the upper end is now grassland raised high above the bed of the channel and indistinct from the main body of the marsh. It is still "the island" to the local people just as the outer end of the marsh which has stretched so much farther into the bay continues to be "yon end."

As the seaward end of Skinburness Marsh became much eroded, sand was carried up to widen the adjoining Border Marsh which lies on the opposite side of Waver to Longnewton Marsh. Something of the process of marsh formation may be described from this neighbourhood. As the sand gets piled up above the normal level of the channel but is still continually tide swept and inclined to be muddy, it becomes dotted with Glasswort—*Salicornia herbacea* L. The newer parts of Border Marsh at this stage were particularly attractive to Curlew-Sandpipers—*Calidris testacea* (Pall.)—and Little Stints—*Calidris minuta* (Leisl.). When the accumulating sand becomes higher and firmer there next appears Creeping Sea Meadow-grass—*Puccinellia maritima* (Huds.) Parl.—as determined from specimens submitted to the Royal Botanic Gardens, Kew. In its early stages this grass commonly forms hollow rings which then fill in with growth and spread one to another so binding the ground in preparation for the establishment of various other grasses. In this way the typical Solway salt marshes become solid grassland raised well above low water mark and submerged only by the highest tides. Good pasturage, they are used from May until October for the grazing of large numbers of cattle, sheep and horses.

There have also been changes more favourable to wild geese in Morecambe Bay and neighbourhood since the time that Macpherson could mention the Grey Lag as only rare there. Here the difference of only one vowel might be remarked in the two place names Moricambe Bay and Morecambe Bay.

Leighton Moss, two to three miles inland from Morecambe Bay, although outside the limits of the Lakeland faunal area, has come to have an important bearing on its wild geese and ducks. At the end of the war of 1914-18 the system by which it had been drained fell into disuse and there resulted an expanse of wet pasture, swamp and standing water of some five hundred acres. Extensive beds of Common Reed—*Phragmites communis* Trin.—developed as did lush growths of Reedmace—*Typha*, Horsetail—*Equisetum*, Iris, Rush, Sedge and Meadow Sweet—*Spiræa Ulmaria* L. Willows and Alders add to the scene.

In *The Naturalist* for September 1941, Sydney Moorhouse points out that the gradual withdrawal of the tide in Morecambe Bay has perhaps had a great deal to do with the establishment of wild geese. New resting and feeding grounds have been provided on the verge of the bay where the ousting of sand by mud has been followed by a covering of Glasswort and grass.

WILDFOWLERS.

It is fitting that this account should include mention of the wildfowler-fishermen of the Solway, observers unexcelled, so much of whose lives has been concerned with wild geese. Great hearted, remarkable for both their hardihood and longevity and full of that wisdom gained only by direct contact with Nature, they are now almost all gone. Behind their descriptions of the behaviour or action of any creature lay always the ability to give a very shrewd reason born of close acquaintance with wild life and the elements. With two of them, William Nichol of Skinburness and James Storey of Anthorn, I have shared friendship and experiences for nearly fifty years.

William Nichol (1854-1934), who carefully recorded as well as keenly observed, and who was so sensible to Nature in all her moods, would run his slender gunning punt out into the open Solway just to enjoy the charm of the moonlight on the waters and the music of the wildfowl in the firth. A remark of his, "I love flowers, but I hate botany," on an occasion when I described a visiting companion as a botanist, expressed the simple, unalloyed pleasure he derived from Nature.

James Storey, or Jim Storey, as he is widely known and esteemed, although now an octogenarian, still has zest for his fowling and fishing. Deeply absorbed in the ways of many creatures, he is as happy in telling of the occurrences of Clouded Yellow Butterflies—*Colias edusa* Fb.—or of the colony of Leaf-cutter Bees—*Megachyle*—in his garden wall, as of recounting exploits in his gunning punt. Kindly and generous by nature, he could yet reprove a too ardent shore-shooter with "Six days a week are plenty to shoot in."

Thomas Peal of Burgh-by-Sands, who passed on in 1937 in his ninety-second year, retained a remarkable vigour long beyond the allotted span. During the day and night in which he made a record bag of twenty-two Barnacle-Geese to his shoulder gun, on Longnewton Marsh, the weather conditions were just as bad as the Solway could ever show. Jim Storey, speaking of the time, said "It wasn't fit for a dog to be out." This from Jim to whom a wild winter's day was a day to be out and doing, meant a lot.

Two other outstanding veterans were James Bryson of Glasson, another to pass his ninth decade, and James Smith of Drumburgh who lived by the Solway for more than eighty years. It was specimens obtained by these men, the first two in particular, that went far towards enabling Macpherson and other donors to build up a large part of the fine bird collection in the Carlisle Museum. The younger generation, not following their fathers, prefer steady employment with the result that there are now only two gunning punts operating on the English side of the Solway.

RECENT AND PRESENT STATUS.

The references to the Solway Firth include notes of my own dating back to the early part of the century and drawn from a record of many days and nights spent observing and fowling, especially on the marshes of Skinburness and Longnewton. Invaluable as notes are, none can adequately convey the attendant glamour peculiar to wild geese and all the fascination of their haunts under moonlight. Nor can they tell of the thrill of listening to their varied calls over the saltings in the night time when the different kinds are to be recognised only by their voices as are the ducks and waders all around and perhaps fleeting migrants overhead.

The few occurrences detailed by Macpherson begin with two Grey Lags shot at Allonby prior to 1883. One of a couple was shot in March 1889 at Langwathby in the Eden valley where, as stated, several others were seen during the early part of the summer. In the winter of 1888-89 Alexander S. Smith observed a gaggle of six frequenting Rockcliffe Marsh and, in the following December, he shot one bird out of two there. February 1891 brought a gaggle of seven to Longnewton Marsh, one of the birds being shot by Bob Law who took it along for Nichol to examine. This was the first Grey Lag to be seen in the flesh by Nichol although he had previously brought down White-fronted, Pink-footed and Bean-Geese. Next year, the year in which the *Fauna* was published, rather more Grey Lags visited Longnewton to which marsh and those adjacent they have since been regular visitors but, for the first few years, in similar small numbers.

On Rockcliffe Marsh a marked increase in Grey Lags was recorded by Miss S. Mounsey-Heysham for 1906. In varying numbers they have continued to resort to this marsh and for 1943-44 T. Pattison describes them as only limited which, is to be taken in relation to those of the Pink-feet. Late in the autumn of 1943 about a hundred geese one night landed in a pasture across the river from Rockcliffe. Four of these geese were shot and they proved to be Grey Lags.

There is constant travel to and fro between Rockcliffe Marsh and the Moricambe Bay marshes of Longnewton, Skinburness and Border where recording is easier because the Grey Lag is not so much associated with the Pink-foot which, since 1898, has displaced the Bean-Goose as the common grey goose of the Solway. Between 1900 and 1909, on the three marshes last named, the winter numbers of Grey Lags were constant at between thirty and fifty. On 4 March 1910, three gaggles numbering twenty-five, thirty and sixty were reported, then on 21 November 1911, about one hundred and fifty Grey Lags were seen on Longnewton Marsh by Nichol who, in March 1914, said that the numbers frequenting the neighbourhood had risen to between three hundred and five hundred. This was in the period when the Grey Lag rivalled the now greatly outnumbering Pink-foot as successor to the Bean-

Goose which has become an uncommon, if not irregular, visitor. The first Grey Lags to arrive in 1913 were thirty on 20 September.

During the night of 1 January 1914, which I spent on Longnewton Marsh, many Grey Lags passed over on their way to rest on the exposed sandbanks. At dawn they returned to their feed in a succession of small skeins until, on this marsh alone, there were more than two hundred and fifty, which I reduced by two. Five early arrivals in the autumn of 1914 came on 5 September, one I shot out of them confirming identity.

The high numbers remarked early in 1914 continued during the first world war period and, in 1918-19, Nichol in shooting thirty-five made his largest bag of Grey Lags for any one season. On 15 November 1919, upon a sudden change after hard frost and snow, there were Grey Lags on every part of Longnewton Marsh where the grass had been cleared by the thaw and the tide. Here again, on 29 March 1921, I counted on to three hundred and fifty which, with about two hundred and fifty Barnacle-Geese—*Branta leucopsis* (Bechst.)—were scattered over the grass and the sands. Some of the birds were busily feeding, others washing and preening in the shallow pools of water.

In 1934-35, Jim Storey observed that, as in 1919-20, numbers approached five hundred for the Longnewton, Skinburness and Border Marshes. He saw the greatest gathering he had ever seen in March 1935. There was a decline between these two seasons. A strong arrival in the autumn of 1922 had become considerably reduced by the beginning of November although, on 23 February 1923, one hundred and fifty Grey Lags together with three hundred Barnacle-Geese and a small gaggle of Pink-footed Geese were brought up at high water on to Cardnock Point at the opposite side of the bay to Skinburness. Two hundred and fifty Grey Lags in a body were seen in this neighbourhood on 28 February 1926 and two hundred at different times during the winter 1932-33. Somewhere near these numbers were seen flying across to the Scottish side of the Solway by William Storey, son of Jim, on 28 April 1927.

One day during the last peak season, 26 December 1934, when Ernest Blezard, Ernest Glaister and I were on Longnewton Marsh, the Grey Lags were in an unsettled state. We estimated the total number, seen in the air and out on the sands, at four hundred. Afterwards Jim Storey noted numbers steadily decline here until, in 1943-44, all the Grey Lags that wintered were two gaggles, one of nine, the other of sixteen.

Arrivals were in good time in 1944, skeins numbering nineteen, twelve and nine birds being noted in the two days 24 and 25 September. All of them were last seen heading towards Rockcliffe.

The Grey Lag is now not only the predominating wild goose in Morecambe Bay but also perhaps more numerous there than on the Cumberland side of the Solway. Referring to the period up to 1914, F. W. Smalley told me that wild geese had never been

plentiful in Morecambe Bay and that those shot were chiefly White-fronted Geese—*Anser albifrons albifrons* (Scop.)—with an occasional Pink-foot. Grey Lags appeared in 1920 by when Leighton Moss had more or less reverted to its wet condition and, in 1922-23, S. Moorhouse states that they were in large numbers. The Lakeland haunts affected are principally the estuaries of the Kent, mainly in Westmorland, the Leven in North Lancashire and the Duddon between North Lancashire and Cumberland. The Kent is the most favoured and the geese flight between this estuary and Leighton where Dr E. S. Steward, in his experience, has always found them in the afternoon, not in the morning, and resorting either to an open sheet of water or three damp meadows at the eastern end of the moss.

In his contributions to *The Birds of Lakeland*, 1943, J. A. G. Barnes, who has also supplied all the later notes from the Kent, estimates two hundred as a fair average number of Grey Lags wintering in that estuary in 1939. There were then three hundred and twenty-five together in March 1940 and about three hundred in the following December and in March 1942. Beyond the largest count of three hundred and forty for a single gaggle in 1942-43, there were one time that season perhaps nearly six hundred Grey Lags seen in flight. Still increasing numbers gave a single count of four hundred and five on 2 December 1943 and one of about six hundred and sixty at the beginning of November 1944.

Perhaps due to more shooting, the geese in the Kent seem to be changing their habits. From spending much of the day on Meathop Moss or the salt marshes or Leighton Moss, they now remain all day on the mud or water of the estuary and flight in to Meathop Moss—in 1944 partly oat stubble—at dusk. The first hundred or so in 1944 arrived on 19 October although smaller skeins had passed over earlier, some in September. For two years back, Mr Barnes has not seen or heard any other species of goose on the Kent but Grey Lag.

The presence of Grey Lag-Geese in the interior of Lakeland has become much less extraordinary than it used to be. Beyond the now occasional visitors to Windermere and other lakes and tarns, small gaggles have regularly wintered at Bassenthwaite Lake for the past seven or eight years. The birds feed in adjacent pastures and are said to stay the night and not flight to and from the coast. During the winter of 1943-44, M. G. Robinson and W. F. Davidson counted nine there in December, fifteen in January, twenty-six in February and fifteen in March.

In the east of Cumberland, Major W. J. M. Gubbins observed small gaggles feeding on the site of Tarn Wadling during the winter of 1937-38. There was one of five birds in the January of that season. The tarn was drained in the year 1858. Geese which came by night to a park pond in Carlisle in 1942-43 were believed to be Grey Lags as were other recent night time visitors to fields

not far from the city. A gaggle of about twenty geese, very likely the same kind, were flushed from Whins Tarn also in East Cumberland, on 26 October 1944. The Lyth Mosses in South Westmorland have for several years been a great inland feeding place of Grey Lags, about eighty being seen there by Miss M. Garnett in February and forty in March 1938.

MOVEMENTS AND HABITS.

Between the times of autumn arrival and spring departure there are continual movements of grey geese through and within the Lakeland area. The normal period of arrival for Grey Lags is from late September to late October. Some flocks appear to come from a north-easterly direction without touching the Solway and, in this bearing, Grey Lags have been recognised by George Bolam as they were travelling south-westerly over Alston in the Pennines. After reaching the Solway, and while broadly Pinkfeet continue in a south-easterly direction, Grey Lags travel southerly or south-westerly heading towards Morecambe Bay where flocks reach its Westmorland shores generally in the third week of October.

Their inland routes, although following roughly the main valleys, are complicated and not necessarily in direct lines. In October 1936, when good numbers of Grey Lags arrived in Morecambe Bay, quickly to dwindle, skeins were seen going southerly over Raughtonhead by H. S. Glaister, and over Wigton by C. F. A. Ritson on the same day. These two places are eight miles apart, east to west. Dr E. S. Steward frequently sees Grey Lags passing over Windermere, to or from Morecambe Bay. Skeins, presumably of Grey Lags, seen travelling through central Lakeland by Alan F. Airey were one of thirty going south over Elterwater in September, one of thirty north over Rydal Water in January and one of a hundred and fifty north over Dunmail Raise in March.

Near Staveley, Westmorland, grey geese thought to be Grey Lags, are not infrequently seen flying east to west, apparently crossing over from one regular north and south line to another. Similar movements in Cumberland, and especially of birds flying in to the Solway from the east, observed by E. Blezard, may be associated with visitors to such haunts as Tarn Wadling and Whins Tarn.

Irregular winter movements between the Solway and Morecambe Bay, from Morecambe southward, and also between the English and Scottish sides of the Solway, are influenced by weather conditions. The geese go south at the signs of prolonged frost and return with milder conditions. Movements from one marsh to another, and to inland feeding haunts, are affected by tides and human disturbance as well as by the weather.

Beginning in late February, there is a general northward return by way of the Solway. This usually ends in April but sometimes continues into May, late lingering birds having been seen in the middle of May. On 2 May 1923 I saw a flock of some hundred and fifty Grey Lags pass over Great Orton from the south and head in the direction of Rockcliffe Marsh. During this return period, particularly in March and April, numbers increase to equal those of autumn, rising far above the total of the wintering stock. Many of the birds rest for only a few days and William Storey has often seen them passing over to the Scottish side of the firth, generally in April.

A survey of the present distribution of wild geese on the English side of the Solway must precede some account of the habits of the Grey Lag as observed there. Rockcliffe Marsh and the marshes of Moricambe Bay are similar in formation and in regard to grazing qualities yet differ in their appeal to geese. Thousands of Pink-feet, comparatively small numbers of Grey Lags and an occasional few White-fronts visit Rockcliffe. On the other marshes, Longnewton, Skinburness and Border, the Grey Lag predominates over the other grey geese and there are only an occasional few each of Pink-feet and White-fronts. Since 1900, until which year Rockcliffe was most favoured, these three marshes have almost entirely claimed the Barnacle-Geese wintering on the English side. These geese lately declined until in 1943-44 there were none at all but in December 1944 they were back in something like their old numbers. In any case the total numbers of geese here are only a fraction of those to visit Rockcliffe which has a greater individual expanse to offer the hordes of Pink-feet.

Grey Lags may be fighting to or from their feeding grounds at all hours as they feed both during the day and at night. For some places early morning is a good time, for others a moonlight night, with allowances for tides, weather conditions and disturbance and whatever is the attraction in the way of grass, grain or other food. While some graze on the salt marshes others, especially in early mornings, fly to fields and pastures, sometimes a considerable distance inland, and others again to the coastal mosses. Birds not feeding usually rest out on the open sand banks and flats when these are not covered by the tide. Between midnight and dawn they are often fighting over the marshes from all directions to their resting places on the sands. Except for an occasional low "ga-ga" they are then remarkably silent, unlike the Barnacle-Geese which proclaim their night movements by loud and continuous calling. Incoming birds on reaching the sands are greeted by earlier arrivals and the "talking," as wild-fowlers term the vocal medley, is intensified as the gathering grows. This "talking" continues throughout the night and develops into a loud chorus at the approach of dawn. For several

seasons one particular goose was recognised on the same resting ground by a peculiar inflexion in its extra loud voice.

Morning flight to feeding grounds begins soon after dawn and, travelling in small skeins, the birds now call loudly and frequently in contrast to their behaviour when fighting at night. Their notes are almost indistinguishable from those of domestic geese and I have frequently heard farmyard geese responding to Grey Lags in both the day and the night time.

On returning from feeding, geese will fly over the sands until they locate a shallow pool left by the tide where they can exercise their fondness for washing and preening. If no pools are available they will go to the edge of the channel. During the rest period some birds lie on one side with the opposite wing and leg outstretched, others on their bellies with head tucked under scapulars, but always a few stand erect and on the alert.

Grey Lags, although resorting to the same ground as other kinds of geese, appear to be somewhat exclusive and do not mix with them or, for that matter, any other birds. Or, it may be, the others do not mix with the Grey Lags. They are gregarious enough amongst themselves and a solitary bird is usually a wounded one. On 1 January 1920, after three hours of watching a crowd of feeding Grey Lags, I distinguished a group of five geese which kept well apart from any of the others. These five gradually worked towards the creek in which I was hidden and when one of them fell to my gun it proved to be a Bean-Goose.

On the marshes Grey Lags are given to grazing at the one chosen spot until much of the choice herbage is soon consumed and the place fouled with droppings. This necessitates a continual change of ground although high tides have a cleansing effect and a new growth of grass is not long in showing. The birds prefer to feed where water is handy as they are constantly sipping between grazing. They are also partial to damp places where the lower and more succulent parts of the grasses are easily obtainable. When high tides leave the water in the creeks and pools, or "flosches," too salty for their liking they go to drink where the water from the land flows out of drainage cuts and over the glacial scours.

Frost or snow will cause them to desert a regular feeding ground only to return at the first signs of thaw. I recall one hard frosty night spent with a friend on Longnewton Marsh where up till then Grey Lags had been feeding in numbers. All we either saw or heard were the four we shot.

Grey Lags quickly settle in domesticity and will breed with their farmyard kin. A goose winged by H. Russell of Newton Holme Farm on the adjoining marsh paired with a tame gander and laid eggs in the first year of her captivity. This laying turned out to be unfertile but in the following year, 1924, she reared a family of eight which were often to be seen flying like true wild birds over the farm land and the marsh.

ANECDOTES.

The lure of wildfowling gives rise to many amusing and curious incidents out on the wide marshes and sands, especially in the quest for geese under the light of the moon.

One distant November night, after two of us had cycled the fifteen miles from Carlisle to Anthorn, we arranged with Jim Storey that, while he should go along to Cardurnock Point, we would take ourselves on to Longnewton Marsh. This was done with the idea of keeping the geese on the move. Punting across the river and leaving the craft anchored on the sand, we made for the place then being frequented by the geese and hid ourselves to await events. The moon, just past first quarter, early became clouded over and heavy sleet and snow soon followed. Conditions becoming worse, we sought the shelter of a deep creek and then, as there was neither sight nor sound of geese to detain us, we would have made our return only to find that the incoming tide had cut us off from our punt.

It now meant a lengthy wait until the tide was well on the ebb so we decided to head for a known refuge in the form of an old stranded fishing boat. Once inside through the poop hole we had a snug, dry shelter but, while my friend was soon sound asleep, I could find no comfort in the hard, uneven boards. After a couple of hours I climbed out to find that the storm was nearly over and that Barnacle-Geese, evidenced by their calls, were on some not easily determinable part of the marsh. Getting back into the boat, I took my gun and fired a shot through our way of entry to rouse and locate the geese. This brought the realisation that not only were the geese fairly near but also that my friend was a good deal nearer. Yells broke from him even as the report was still ringing in our confined quarters, the rude awakening having caused him to spring up with such abandon as to bring his head into violent contact with the underside of the deck covering. He developed a wonderfully large swelling in quick time.

When at last we did reach the punt we paddled back over the river to find that Jim had long been enjoying the warmth of his fireside. He, not having to contend with the tide, had made his way home during the snowfall. My friend's swelling had so increased that in all truth his head was too big for his cap and he did look comical in his now ill-fitting headgear. He gained some relief in condemning me as the cause of the trouble as we told the tale before bedding down in the cottage for the remainder of the night.

Next morning the swelling was less troublesome but not so the snow which had thickly covered the roads. Our cycle run home was much more toil than pleasure as we had frequently to dismount and remove from the mudguards accumulations which effectively braked the wheels. So went a typical wild-geese chase.

It was on the same marsh that John Strong, the local postman, had an interesting little experience during rough weather, but in daylight. He was out after Grey Lags when a biting north-westerly wind brought a sudden storm of hail which was more than he cared to face. He too took shelter in a deep creek and, under the lee side, covered himself with his oilskin coat. Before long he was surprised to see five of the birds he sought pitch into the same creek within twenty yards of him and follow his example by crouching under the same bank. Sportsmanlike, he did not disturb them but when the storm cleared and he raised himself those five Grey Lags were decidedly startled to find that they had so closely shared shelter with a man.

CONCLUSION.

The increase and spread of the Grey Lag-Goose as a passage-migrant and winter-visitor in Lakeland has taken place since 1900 and over a time in which various haunts have become more attractive to wild geese. This development, however, may well be a secondary consideration to a general southward trend of the species.

Grey Lags arrived in large numbers on the Scottish side of the Solway before they did on the English side. Under "Zoological Notes for Solway," Robert Service wrote of the winter 1900-01 that Grey Lags had been in large flocks and the geese shot by gunners all Grey Lags. It was hard to give an explanation of the curious change in relative numbers for in the recent years all the geese had been Bean-Geese and the Grey Lag seldom got. (*Annals of Scottish Natural History*, April 1901.)

During a period of decline, 1920 to 1934, on the English side, very large numbers were one year present on the Blackshaw Bank between the estuaries of the Lochar and the Nith in Dumfriesshire. Well on towards two thousand Grey Lags were seen there by E. Blezard on 15 October 1925. Four days later, only about three hundred were in evidence, the others perhaps having gone on southward, some of them possibly by way of Rockcliffe Marsh, a calling place for grey geese in thousands, mainly but not all Pink-feet.

For a while up to 1918, and before being enormously outnumbered by the Pink-foot on the Solway, the Grey Lag had displaced the Bean-Goose as the commonest Lakeland goose. Then, in 1920, began a southward drift coinciding with the reversion of Leighton Moss and affecting Morecambe Bay where numbers have increased and new ground is being formed. The Grey Lag in Lakeland has now changed its principal quarters from the northern shores on the Solway to the southern shores in Morecambe Bay.

Although numbers had begun to fall away on the Solway in 1935, the poor showing in recent years may in some measure be due to war-time activities. There is here a feeling of loss in the near abandonment of a once favoured place by this most sensible and wary of wildfowl and a hope that it will return in its former strength. After many memorable days and nights of all weathers in quest on the marshes and sands, I must add that the expression, "Silly as a goose," can in no way refer to a Grey Lag.

December 1944.

THE BADGER IN CUMBERLAND.

By RITSON GRAHAM, M.B.O.U.

In this brief survey of the history and attempted assessment of the present status and distribution of the Badger—*Meles meles meles* Linn.—in Cumberland many factors are disclosed which are similar to those encountered in a study of the Roe Deer—*Capreolus capreolus thotti* Lönnberg—in the same county printed in the Transactions of the Carlisle Natural History Society, Vol. 5, 1933.

The neglect and the lack of information by our early naturalists concerning these two native mammals of ancient lineage are features common to both. The Badger and the Roe Deer were formerly regarded as being extremely scarce throughout the whole of Lakeland and their final extinction was widely accepted. In recent times, however, the once precarious pair have considerably increased, and they have also received a greater degree of attention from field naturalists. As these shy and retiring creatures increased, so did the knowledge concerning them, a coincidence which cannot be overlooked when we come to consider their exceptional progress from scarcity to comparative abundance.

Upon investigation we frequently discover these two quite unrelated mammals to be very closely associated in the vicissitudes of their destiny. This remarkable similarity of ways continues. There are to-day few Roe Deer haunts without a Badger earth somewhere on the wooded slopes or in the scrubby glens, and often the locality is new to both of the animals, for though the two differ considerably in habit, they do not differ greatly in their choice of habitat. Thus the connection between the two could not reasonably be omitted.

The great antiquity of the Badger in Britain is established beyond doubt, and there are cave bones and numerous place names to prove its existence in Lakeland at a very early period. Professor Owen in his *History of Fossil Mammals and Birds*, 1846, claims that, subject to the authenticity of a skull found in Miocene formation in Suffolk, the Badger will prove to be "the oldest known species of mammal now living on the face of the earth." Concerning the prehistoric existence of the Badger in the Faunal Area of Lakeland, there are the jaw bones and teeth found in the Helsfell deposits by John Beecham, in about 1880, and which are preserved in the Kendal Museum. Macpherson in his *Fauna of Lakeland*, 1892, fails to include these Badger remains in the list of animal bones found in the Helsfell caverns and I am indebted to A. Wainwright of the Kendal Museum Committee for the information.

In addition to this evidence from the only suitable Lakeland locality where such has been sought, there is ample proof of the early existence of the Badger in our faunal area in the frequent occurrence on the map of the place names Brock, Grey, Bawson and Pate. The familiar place name of Brock alone ranges the country from the lower reaches of the River Eden to a number of crags extending up to 2000 feet in altitude in the Lakeland fells, whilst the many farm, field and fell names of which Brockle-wath, Brockholes, Brocklands and Brocklebank are typical examples, all testify to the prevalence and wide distribution of the Badger in former times.

In the middle of the seventeenth century the hitherto unmolested Badger became an object of persecution in Lakeland, particularly in those districts where it was most numerous and where its depredations, real or imaginary, were calculated to cause most harm or concern. These were chiefly the fell and moorland districts. The parish registers of certain parts of Cumberland, Westmorland and North Lancashire contain entries showing that head money was paid out of the parish funds for the destruction of Badgers, the earliest being one from Penrith dated 1658. The name there used for the Badger is Payte and the fee one shilling a head.

The term Brock was, however, already in use elsewhere and it remained the common name for the Badger until almost the end of the seventeenth century. The modern name of Badger first appears in the parish books in 1695, though Dacre in Cumberland and Barton in Westmorland continued to use the old name for many more years.

With unremitting zeal this paid persecution of the Badger prevailed in the hill parishes of the three counties for almost a hundred years, the first payment recorded being the one from Penrith dated 1658 and the last from Ulverston in 1741. During this period the payment varied from a shilling to sixpence a head and, in a few instances to fourpence.

The parishes of Penrith, Kendal, Dacre, Barton, Kirkby Lonsdale, Orton and Ulverston are all mentioned as having paid head money for the killing of Badgers, and Kendal heads the list with seventy-three Badgers paid for within a period of eight years. Detailed information on this sordid sidelight on the Badger in Lakeland is to be found in *The Fauna of Lakeland*, pp. 40-42.

During this period the Badger was undoubtedly equally as numerous in suitable districts in the low country as it was about the fells and subject to a similar, if unrecognised and unrewarded, persecution. The wholesale destruction had its effect as is evidenced by the fact that the entries in the parish registers gradually become fewer before they finally come to an end.

By the beginning of the nineteenth century the Badger had definitely decreased, and its position worsened as the century ad-

vanced. The early naturalists Richardson and Heysham, and later Macpherson, all record the scarcity of the Badger even to the extent of its verging on extinction. Dickinson in his *Cumbria*, p. 172, states: "Badgers are now (1875) extinct in the wild state in Cumberland but were not scarce until about the end of the eighteenth century." Reporting the capture of a Badger near Grasmere in 1863, *The Westmorland Gazette* adds that, "the old hunters say that the last Badger caught in Westmorland was in 1823"; whilst in Dumfries, the Scottish county adjoining Cumberland, Robert Service writes: "The general opinion is that the last of the native Badgers met their fate about 1860." The scant accounts in local literature of this period confirm the decline and the extreme scarcity of the Badger.

Dr John Heysham's account of the Badger in his "Catalogue of Animals" in Hutchinson's *History of Cumberland*, 1794, is typical of the period. "The Badger," he writes, "is an indolent animal, burrows underground where it sleeps the whole day, feeds only at night. It lives upon roots, fruits, grass and insects. Badger bating is a common diversion in the north of England."

Macpherson in his *Fauna* expresses a doubt as to total extinction in: "Whether the Badger really became quite extinct in Lakeland within the limits of the eighteenth century is a difficult point to settle. On the whole the balance of evidence seems to favour the belief that this species lingered on the fells of Cartmell and Windermere for at any rate the first thirty years of our own century." Nine years later, in 1901, in *The Victoria History of Cumberland*, the same writer expresses some improvement as well as a similar doubt thus: "Formerly Badger earths were to be found in most parts of the county, from the shores of the Solway Firth to the borders of Westmorland. Some years ago it appeared probable that the old race of Badgers had become extinct, but of late years Badgers have reasserted their rights of domicile in some of our larger covers. Whether these animals had escaped from confinement is difficult to determine but as wild Badgers certainly exist in Westmorland, it is possible that though the number of Badgers in Cumberland dwindled to very small proportions the original stock never became entirely extinct."

Harry Britten in his "Mammals of the Eden Valley" (*Trans. Carlisle Nat. Hist. Soc.*, Vol. 1, 1909) writes of the Badger: "I have only one record of the occurrence of this animal. This was on Skirwith Abbey estate near to Langwathby (Cumberland) where one was trapped by my father about 1888."

The generally recognised scarcity of the Badger towards the end of the nineteenth century, whilst certainly real, would probably not be so great as the various writers imagined. The nocturnal habit of the Badger and its exceptionally unobtrusive way of life render it at all times a much under-rated inhabitant of the more remote parts of the countryside, and to-day, when this mammal is much more numerous throughout practically the whole

of the county, these characteristics greatly obscure its real strength.

There is a conspicuous hiatus in local Badger information during the first decade of the present century, an occasional newspaper account of one being trapped being about all that I can discover.

Before entering into the period of my own experience and investigation, the vexed question of the introduction of Badgers into certain parts of Cumberland must be referred to.

It is widely claimed that Arthur Lawson liberated Badgers, which he obtained from Ireland, in the Hesket-Newmarket district. Referring to this event the local press of April 1929 states that "several years ago the above named gentleman liberated two Badgers, a boar and a sow, and there is no doubt that from these have sprung a good number of the Badgers which are now about the countryside." The same account also refers to Badgers having been introduced on the Naworth Castle estate in: "On the Naworth estate about 100 years ago, four Badgers were liberated by the then owner near Irthing and established themselves in a fox's earth."

Macpherson mentions two instances of Badger introduction, one at Edenhall and the other at Castlesteads. It is also frequently stated that Canon Rawnsley had Badgers introduced into Gowbarrow Park, a National Trust property in Lakeland which he did so much to acquire. I can, however, find no reference to this in any of his many books on the Lake District. There is an early reference to the Badger in Gowbarrow which cannot be associated with this reputed introduction. It is by William Hodgson, the Cumberland botanist, who resided at Watermillock, which is less than two miles from Gowbarrow, and reads: "The Badger has for many years been regarded as extinct in Cumberland. Quite recently, however, "brock" has reappeared amongst us; stray specimens continue to be reported from different quarters; . . . During the summer of 1885, John Greenhow, the gamekeeper at Gowbarrow Lodge, informed me that a solitary Badger had taken up his quarters among the rocks on the adjoining fell. After an unmolested sojourn of several months, the animal had not long ago disappeared." (*Trans. Cumb. and Westm. Assoc.*, No. xi.)

Whatever these introductions of the Badger into various parts of Cumberland may have amounted to, or whatever their success, it is nevertheless a fact that all but the last named locality are notable Badger haunts to-day. But then so are many other localities which are far removed from the sites reputed to have been artificially colonized.

The period now reached is that following the war of 1914-18 and the beginning of my own interest in the Badger population of Cumberland.

Before giving any special attention to the Badger, I had a knowledge of only about half-a-dozen earths or setts, and this despite many years of outdoor observation in most parts of the county; such is the unobtrusive nature of the Badger and the obscurity of its haunts. None of these early earths were ancient, or even old, and two of them had not existed before 1914. As soon as particular attention was directed to the Badger and its haunts, two prominent facts emerged, one being the surprisingly large number of strongholds and the other the very considerable age of many of them. Regarding the first, I find that my first year's list of earths visited rose from seven to twenty-seven, and that two years later the number had increased to fifty-two. Though the increase has been less remarkable during the succeeding years it has nevertheless continued, and new haunts continue to come to my notice at a greater rate than my limited time allows for their inspection.

In considering the haunts of the Badger in Cumberland, as distinct from its distribution, I find that they can only be described as varied, yet they demand more than a word. Many, probably the majority, of the earths I have examined are situated on the banks of streams, and in this general statement I include every kind of waterworn defile, from the narrow ravine to the wide river valley, a particular type of physical feature abounding in Cumberland. Within this broad classification of haunt there exist many types of site and a variety of substance, the latter ranging from bare rock to the finest sand, and the earth varying accordingly from a clean crevice in rock to an extensive series of large dumps and holes in a bank of sand.

The position of the sett in the broad valley or the narrow gill is as varied as the site itself; it may be almost at water level or on the brink of the bank, at the head of the water which feeds the gill or down by the broad sweep of the river. The majority of these valley earths are sheltered and more or less concealed by trees or bushes; exceptionally they are in the open, though this is often due to subsequent felling of the trees or clearing of brushwood.

The next most common type of haunt is the tree, scrub or bracken covered bank, and these together with the banks of streams, also often tree clad, certainly constitute the majority of our Badger haunts. Yet there are many exceptions, and it would be incorrect to state that the Badger is purely a woodland dweller.

There are many Badger haunts in comparatively open country, and many earths in treeless localities. As examples of the treeless or otherwise exceptional site, we find Badgers established in abandoned quarries and old coal drifts, in thick hedgerows and disused sandpits, and in bare hillsides. Thus, whilst the bank is preferred and some cover desirable, the Badger is adaptable and can secure a home in almost any kind of country. A feature of the Badger's haunt is the evident desire of the owner for peace,

and thereby security, the earth being invariably situated in a quiet place, though not necessarily far removed from human habitation. Most earths are well away from busy roads and from towns and villages, yet the Badger can live quite near a solitary dwelling providing its own home is not disturbed or does not become too popular. Many isolated Cumberland farms have a Badger stronghold situated no more than a field's length from the house, yet so unfrequented is the haunt that the householders are often unaware of its existence.

Though the site of the Badger's stronghold is usually hidden and obscure, the earth itself is often quite the reverse. Bare and fresh soil is prominent and noticeable in an environment of green vegetation, be it a narrow gill or a broad wood, and the work of the Badger is more extensive than that of the Rabbit, or of the Fox which does little digging. It is the Badger's habit of constantly cleaning out and gradually enlarging its earth than accounts for both its exposure and its distinctiveness.

Fronting each large mouth of the stronghold is a more or less well-defined mound, a dump which is constantly being enlarged with each cleaning out of the old bedding and loose earth. These mounds resemble in miniature the tipplings of our modern excavators and refuse disposers. The top of the dump is flat and firm, and the rejected material is shot over the continually receding edge, the whole forming a rounded mound on a level with the mouth of the earth. Where circumstances permit, as for instance on the top of a steep bank, the outer rim of the dump can be very high with the spoil spilling down to the beck or valley below; or where a tree blocks the path of the deposited material, the soil, sand or gravel is piled up against the trunk. In districts where reddish-brown soil prevails, I have seen trees in the vicinity of the earth smeared and stained to a height of five feet by the material carried out by the Badger.

The debris as well as the original material of the earth is carried and not scratched out and thrown back by the feet as is the case with the Rabbit, and this accounts for the difference in form and structure of the exterior of the two kinds of workings. Where the earth is dug in stiff and wet clay, this tenacious material is brought out in the form of crudely fashioned nodules and, on the outer edge of the dump, they set into hard fist-sized lumps. The dumps vary in size according to the age of the earth and to the nature of the material. Invariably the mound, however small, contains a quantity of dead and damp grass and leaves mixed with the more solid material, whatever its nature.

Underground obstacles in the form of large stones, fragments of rock, or slate, are removed and carried out to the dump. Stones of the average cobble size are frequently to be found on the mounds and, at an earth near Greystoke, I found several angular stones, each larger than a building brick, which had been removed

and carried out. In addition to the more or less obvious signs and indications as to whether an earth be occupied, it is almost always possible to find odd hairs adhering to the damp soil of a tunnel of recent use. These cast hairs are quite distinctive, being whitish at the base, black in the middle and pale brown at the tip, and they possess a characteristic crinkle.

Amongst the material excavated by the Badger I have occasionally found skulls and other bones of previous occupants, but not of any other mammal. At one earth of recent construction, a very old, if not actually ancient, skull of a Badger was found on the dump, which suggested that the site had been occupied by a race of Badgers long before the time of the present owners. A long-lost steel trap, in sprung condition, had on one occasion been dragged or carried out during a period of cleaning, and once I picked up a piece of cheap jewellery, a necklet, at the mouth of a Badger earth. This last find remains a mystery.

Before concluding this note on the exterior of the typical Badger earth, mention must be made of an example of the animal's desire for cleanliness in addition to that exhibited by its constant changing of its bedding. At many of the dumps I find, either about the sides or at the foot, shallow holes scratched in the loose material in which the excrement is deposited. Often several of these pockets in the soft soil are quite close together, and others may be found by disturbing the soil at likely places. At some well-established earths with substantial mounds and well-trodden paths none of these latrines are in existence, though similar deposits are occasionally to be found at some distance from the earth.

Next in prominence and distinctiveness to the mounds are the well-trodden paths which lead to and from the earth. These, though often few in number, are unmistakable. Where a river or other obstacle bars the way on one side, a single path leads at right angles in the opposite direction, otherwise the earth is usually served by two or three equally used highways. The tracks seldom radiate in several directions, nor do they usually branch into subsidiary tracks, but lead as main roads to the nearest fence or point of emergence from the site. When they reach open country they peter out. The only divergence from the general arrangement is where the entrances to the earth are far apart and at varying angles, in which case each hole has its own direct lead-in.

From well inside the hole to a distance of many yards along the paths there is strewn a quantity of bedding such as grass, moss, leaves and bracken. I find these scatterings most noticeable during the early months of the year, in February and March. Not every entrance to the earth possesses this evidence of occupation, nor does every dump have an equal amount of the spent bedding in its make-up, as evidently only the path and entrance leading to the sleeping quarters and the lying-in chamber of the

sow are provided with this material. Occasionally quantities of fresh grass, rolled into balls as big as a Hedgehog, are found both on the paths and elsewhere in the vicinity of the earth, gatherings lost or abandoned by the carrier, whilst the stripped banks and woodland floors tell where the material had been obtained.

Where fallen trunks or growing trees are in direct contact with the main paths or the entrances to the earths, they are often rubbed smooth or clawed bare by the passing Badgers, betraying an indulgence very characteristic of the creature.

In its excavations the Badger throws minor sidelights on local geology. The many drumlins and eskers, relics of a glacial age, prevailing in various parts of the county provide excellent material for the purpose of this mammal and in more than one instance its diggings have exposed a hitherto unsuspected ridge or hillock to be of glacial origin. In a glacial overflow channel illustrated in the Geological Survey Memoir of Carlisle, Longtown and Silloth District, 1926, it is interesting to note that old and extensive Badger workings exist at two points on the sandy margin of this ancient inland channel where, in the clean sand brought out by the Badgers, I have picked up very old and pure white molluscan shells.

A small stream valley, worn deep through a ridge of the New Red Sandstone, was always disregarded as a Badger haunt in consequence of the absence of suitable and sufficient sub-soil yet Badger earths were eventually found at two sites in this ravine. The earths were situated in a thin layer of fine sand which was inconspicuously bedded between the sandstone and the top sod, and of which I had not previously suspected the existence.

Apart from the rich brown earth which the Badgers occasionally expose in localities where the surface ordinarily betrays no trace, I have found deep diggings into very ferruginous soil which stains the Badgers a permanent rufous shade and dyes the trees and the vegetation about the earths in vivid contrast to all that is green above ground. Incidentally, many Badgers are stained a hue which is usually described as "ginger," the white parts of the animal in particular being coloured some shade of brown or tawny, a condition which sometimes give rise to the belief that a red or genuine erythristic Badger has occurred. On only two occasions have I seen examples of this rare dimorphism in the Badger in Cumberland, and in both instances it was the preserved skin that I examined. A Badger mounted in the form of a footstool was shown to me in a farmhouse in Bewcastle, in which district the animal had been obtained. It was a perfect example of erythrism, the normally white parts being coloured deep red, the shade naturally deep and not imposed by the preserver. The other was a skin serving as a bedroom rug in a boarding house near Silloth, the Badger having been obtained many years ago in the Castle Sowerby district and the skin preserved by the owner. In neither instance was the possessor aware of the abnormality of the trophy.

The friendly, or at least tolerant, relationship which normally prevails between the Badger and the Fox is well known though in point of fact the very occasional use of a Badger earth by a Fox, or *vice versa*, is seldom a permanent arrangement. Where the two co-exist it is frequently due to a recent disturbance or dislodgment of one or the other from its rightful home, and their living together is a matter of temporary convenience, a mutual expedient. More often the two are found occupying a large series of workings, though they are not necessarily actually living together. In almost all these dual occupations of an earth it is the Fox that is the interloper. I have on several occasions found Fox cubs being reared in a Badger earth and both the Fox and the Badger using the same entrance, though the Badger's quarters underground were not necessarily shared by the Fox. On the other hand the Fox frequently takes possession of a vacant Badger earth as soon as it is deserted by the original owners, but even this is only for the purpose of rearing cubs. Unlike the Fox, the Badger is almost strictly subterranean in its home life, and the former can only be regarded as a temporary lodger.

Despite the fact that the young of rabbits often constitute the staple food of the Badger, these prolific rodents do not hesitate to burrow into the dump and live in the outer ramifications of the Badger's earth generally, and they do so apparently unmolested. Many Badger earths are literally surrounded by rabbit burrows and occasionally the Badger lives in the centre of a strong rabbit warren. In such localities, particularly where the workable soil is shallow and the rabbits have their nests near the surface, I have found dozens of these rabbit nests dug out and their contents devoured by the Badgers. This kind of work was most noticeable, on an occasion early one May, in a locality where the steep sandstone bank of a stream abounded in rabbits and possessed no less than three Badger earths in a distance of little more than a mile. For about three miles along the valley the exposed and disordered nests of grass and fur appeared at very frequent intervals, this evidence of destruction by the Badgers continuing right up to the respective earths.

Though it is generally agreed that the food of the Badger is very varied, direct evidence of the creature's daily diet is difficult to procure. In this connection I can give only some of the more prominent items of food which I have found to be normally consumed by the Badger. Shallow, rabbit-like scratchings in the woods tell where the Badger has been seeking the bulbs of the Wild Hyacinth—*Scilla non-scripta* H. & L., and where these plants are rank the cup-shaped hollows are proportionately numerous. These delvings are made by the Badger's strong snout, and they are perhaps grubblings rather than scratchings. Badgers certainly forage about the corn stacks, especially in autumn and winter, husks of oats being prominent in their excrement at these times of year. The rabbit-catcher's heap of entrails is readily cleaned

up by the prowling Badger, and trapped rabbits are frequently taken from traps when these are left out overnight. An unmistakable indication of the creature's nocturnal peregrinations is provided by the overturned cakes of dry cow dung occasionally found in the fields and lanes. The object of this novel industry is to secure the many beetles and other insects that are to be found under the dung. On only one occasion have I found a wasps' nest ravaged by the Badger, although wasp grubs are regarded as common fare.

It is evident that the Badger subsists on an abundance of pickings rather than a limited range and bulky form of food. It has also the ability to fast for long periods and, as often occurs in such cases, the tendency to feast when occasion offers. It is well known that during the worst of winter's weather the Badger will be denned up for weeks on end without securing a meal, but what may not be generally recognised is the fact that, after being subject to disturbance or attack, at any season, the creature will stay in the earth for as long as three weeks together without attempting to seek food. This ultra-cautious and extremely sensitive behaviour of the Badger is a constant and strong characteristic and is in direct keeping with its unobtrusive and unsuspicious nature generally. Normally indifferent and devoid of an excess of care and regard for its welfare, the unconcerned and clumsy Badger reverts to the opposite extreme once it is given the slightest cause. The moment interference of any kind is imagined or experienced the otherwise neglectful creature becomes extremely guarded and vigilant.

Though the present distribution of the Badger is fairly general throughout the county, it is nevertheless patchy; there are parts of comparative density and others of relative scarcity. As the creature increases, the extent of its range, its territory, grows proportionally, thus the geographical distribution of the Badger is constantly and progressively changing. This is perhaps most marked in the central lake and fell region, a historic Badger country, but now practically unoccupied by either the old or the new Badger population.

It is appropriate here to remark in passing that the Cumberland hill Badger did not adopt the cairn-dwelling habit that is practised by the Badger on many of the Scottish mountains and, except for the occasional occupation of an old mining drift, there is no evidence of mountain-top dwelling by the Badgers of either the central fells or the Pennines. The hard and elevated core of central Lakeland is now, however, in process of being penetrated. In addition to the increasing number of Badgers being encountered on the Lakeland mountains by the fell packs of foxhounds during hunts, I have recent notes on earths from Thirlmere, the Skiddaw Group and Ullswater and, in Westmorland, from Martin-dale and Mardale. The Badger is undoubtedly climbing back to the mountain strongholds of its ancestors.

In North Cumberland, the valleys of the rivers Lyne, King, Irthing and Cambeck are all excellent Badger haunts and there are many earths elsewhere in this wild and sparingly-peopled district.

A similar condition prevails in the Pennine region. The comparatively short valleys of the rivers Gelt, Croglin and Raven, as well as those on the Westmorland side of the Crossfell escarpment, all have their Badger haunts, whilst the main valley of the River Eden is liberally occupied throughout its whole length in Cumberland. In the sand and light soil of the mid-reaches of this broad valley, from Lazonby to Wetheral, the Badger can be regarded as being fairly common and, here as elsewhere, the earths are not restricted to the main river valley.

In the Cumberland plain, the stream sides are again the chief haunts, yet there are many earths established away from the narrow and often wooded valleys. The limestone country about Greystoke and the red earth around Penrith contain many Badger strongholds. Sowerby Row and Middlesceugh are localities in this region where really old haunts exist, whilst others of equally historic interest are situated in the neighbourhood of Wigton and Westward.

In the Solway region the Badger is established in all but the actual coastal strip and its extension in this direction is of comparative recent origin.

Inland from the industrial belt of West Cumberland, the wooded and stream-intersected zone between the central region and the sea is fairly well occupied by the Badger. There are many earths in a wide district round Cockermouth, including the Lorton and Derwent valleys. In all these districts there is a sprinkling of very old, and maybe ancient, Badger earths as well as a few traditional haunts not now occupied. The majority, however, in all localities, are of fairly recent origin, the outcome of the last twenty-five years of increase in the species, an increase which continues though perhaps, during recent years, less rapidly than hitherto.

Two items of interest, which I have not been able to fit into the general account, refer to the fairly frequent fatalities among Badgers caused by road and rail traffic, and to the existence here and there of mounted specimens of late nineteenth century Badgers in private ownership. Regarding the first, I have many records of Badgers having been killed by railway trains and motor vehicles, particularly by the heavier types of the latter which are now increasingly travelling our roads. The mishaps generally occur after sunset or during the early morning, and they relate to all the railways radiating from Carlisle with the possible exception of the Carlisle-Penrith section. The bus services on the Solway, North Cumberland and Brampton-Carlisle routes have from time to time been responsible for Badger fatalities. The local press invariably announces the road deaths, whilst the drivers of the

railway locomotives concerned usually report such incidents to me. Of the few examples of the old race of Badger available for inspection, I have notes on specimens from Bassenthwaite, Sowerby Row, Bewcastle and Scaleby, all obtained in the latter half of the nineteenth century, though little further information concerning them is now to be had.

In concluding this brief sketch of the Badger in Cumberland I am conscious of much that has been omitted, of much that is not adequately dealt with, and of information that is scanty. The natural history aspect, rather than the economic, has been the object of this paper. The Badger's relationship to man, the conflict of interests between the two, the hunting and sporting sides, past and present, have not been considered. Such observations as are available to a field naturalist on this elusive and strictly nocturnal mammal are here offered in the hope that they may stimulate a wider interest, and thus increase the knowledge and understanding which is so urgently necessary of the much maligned and misrepresented Badger.

August 1946.

THE LAKELAND PENNINES AND THEIR BIRDS.

By ERNEST BLEZARD, F.Z.S., M.B.O.U.

The groundwork of this local sketch is that part of the Pennine Uplift belonging to the counties of Cumberland and Westmorland, and extending from the Tyne Gap in the north to the far end of Mallerstang Common in the south. This common covers the upper, narrow part of the Eden valley, the river entering it by a sharp bend shortly after leaving its source beyond the Westmorland boundary. The Eden valley, or Vale of Eden, separates the Pennine region for nearly all its length from the rest of Lakeland. A little over forty miles is the length from north to south and about fourteen the greatest breadth from the county boundary on the east to the River Eden on the west. Much of the breadth is less by half or more and in the scope of this account is further reduced to about the 500 foot contour. In Mallerstang the entire breadth narrows to no more than one mile. The region in general presents a high, steep escarpment to the Eden valley with tableland surmounted by flattened summits above and long, downward-sweeping moorlands to the east. Much of it is more than 2000 feet above sea level, and the several tops over 2500 feet include Crossfell, the highest in all the Pennines and now calculated to be 2979 feet. The component fell masses are separated by deep-cut dales and watercourses.

The whole is a complex structure of Carboniferous limestones, shales and sandstones or grits which rest unconformably on various Lower Palaeozoic rocks. All three crop out in many places, limestone and sandstone in particular, to form lines of cliff, among them a remarkably elevated exposure of limestone at more than 2400 feet. Jumbles of broken blocks remain on the higher tops from a denuded capping of Millstone Grit. The crevices in a massive belt of these blocks, part of the summit slope of Crossfell, often retain snow into the middle of the year. At intervals along the length of the fells there are contrasting dark bands of igneous rock. These are edges of the great intrusive sheet-like formation, known as the Whin Sill, cropping out from the sedimentary beds as sub-columnar cliffs. The rock, a quartz dolerite, is commonly referred to as whinstone. A picturesque line of detached pikes standing out from the escarpment is connected with the Crossfell Inlier, an upthrust of older rocks situated between the Carboniferous main fell mass and the New Red Sandstone floor of the Eden valley. Exposed Ordovician rocks of this inlier include the Skiddaw Slates which largely compose Murton Pike, 1950 feet, the highest in the line. The New Red Sandstone, visible in the fell country proper at Croglin,

in Crowdundale, at Dufton and other places, has a variable covering of clay, sand and gravel, or Drift, remaining from glacial times.

The outer slopes of the fells are mostly grass covered; the peaty tableland, part grassy swamp and part heather bog, is a good deal channelled and cut up into hags, as are the peaty expanses of heather, typical grouse moors, beyond. Without much further mention of game-birds, the moors carry a good stock of Red Grouse—*Lagopus scoticus scoticus* (Lath.)—and all along the region there is a sprinkling of Black Grouse—*Lyrurus tetrix britannicus* With. & Lonn. On Stainmore are wide stretches of wet mossland, or flows, resembling the coastal mosses and on which odd pairs of Lesser Black-backed Gulls—*Larus fuscus graellsii* Brehm—nest in similar fashion to the numbers of their kind on the lower counterparts. The highest fell tops are usually grown with short, sparse grass and well littered with stones.

Many becks flow out from the western front directly or indirectly to feed the River Eden, and from the eastern side spring the Tees and feeders of this river and the South Tyne. The largest natural sheet of water, Tindale Tarn, at the northern end is fully sixty acres in extent and a strong winter haunt of Common Pochard—*Aythya ferina* (L.)—and Tufted Duck—*Aythya fuligula* (L.). Southward there are a number of small peaty tarns scattered over the high tableland and one at an intermediate level. In addition, towards the northern end, there is the reservoir which supplies the city of Carlisle with water and which is another place attractive to winter waterfowl.

The tree growth is patchy and not greatly extensive. Geltsdale has many old alders, aged trees that are a strong draw for Pied Flycatchers—*Muscicapa hypoleuca hypoleuca* (Pall.). There is a fair growth of oak and other deciduous trees in the Brough district and a mixed wood, mainly of sizeable birches, at Lathwaite away in a fold of the Westmorland part of the fells. Mixtures of trees grow about the outer end of some of the dales, and rowan and birch ascend the watercourses for considerable distances. Small plantations of mixed and coniferous trees dot the outer fell foot country.

The climate is much drier than that of the central fells of Lakeland which get the full effect of the prevailing wet winds from the south-west. Yet there are times when the Pennines are struck by heavy rainfall with easterly winds, and parts of them are subject to severe winter snow storms. The violent wind peculiar to the region, the helm wind, is prevalent at various times of the year and commonly in late spring. Coming from the east, across the damp moorlands, it blasts furiously down the highest stretch of the escarpment to the injury of trees, farm crops and herbage in the fell foot country and Eden valley below.

Sheep rearing is the principal human industry and typical fell farms carry two or three hundred, and a few a thousand or more, of heath-going sheep. Blackface and Swaledale are the predominant breeds. These sheep roam widely and to the extreme heights, and there are occasional little incidents of the kind illustrated by an agitated Curlew or Lapwing buffeting some old ewe standing wooden-like over the nest and eggs or grazing right round them. Ground nests are sometimes trodden in by sheep and the contents spoiled. A nest of Common Snipe found at some altitude and a nest of Dotterel—*Eudromias morinellus* (L.)—had been deserted as a result of this sort of mishap. Cattle are grazed in the bigger dales and along the fell bottoms. Their winter quarters, isolated stone buildings, half byre half barn, are well favoured by nesting Barn-Owls—*Tyto alba alba* (Scop.), and some of them harbour colonies of Tree-Sparrows—*Passer montanus montanus* (L.).

The extraction of minerals contained in the fells has been carried on over centuries of time. There are mines long disused, others that have been intermittently used and others continuing in long unbroken production. Coal, iron, zinc, lead and barytes have been mined to some extent or other, mostly the last two which are still worked. A recent demand for barytes has caused the reopening of old levels. There are dales, however, once noisy with tunnelling and smelting, that have long had a return of their quietude, and of their bigger crag-nesting birds. Abandoned mines buildings, fallen into decay, now provide novel nesting places for some of the smaller birds of the fells. Lime burning has become a bygone industry and the kilns fallen in or ruinous, but there is other quarrying, of whinstone for road metal, and operations have banished Ravens from a time-honoured crag.

Game preserving affects a good many birds other than those to which it is directly applied. The spring and autumn moor-burning carried out in the interests of grouse, and sheep as well, may for instance have a bearing on the distribution of Golden Plover. This burning of the ground in order to promote new growth of heather and grass is a generally favourable procedure, but the persecution of Ravens and birds-of-prey is not. In one haunt, above any other, there has been a good deal of misplaced ingenuity exercised in the destruction of Ravens and Peregrines at nesting time. Neither is the Buzzard entirely free as shown by the finding, in different localities, of one trapped at her nest and another gibbeted in company with nine Carrion-Crows and a Lesser Black-backed Gull. The abundance of rabbits on the grassy slopes provides an occupation which brings the Buzzard into more disfavour, simply because that bird regards a snared rabbit as easy meat.

Formerly, young Peregrines were in demand for the sport of falconry, from one breeding place in particular. Here, driven into the rock, and near a nesting ledge still used, are old and

rusted iron spikes, possibly remaining from about the middle of last century when the demand was keen.

The abundance of small invertebrate creatures is a prime consideration in regard to the bird life. From the rich grass growth and variety of calcicole plants of the limestone fells it is a natural step to a profusion of land molluscs. Several species of helicoid snails are common and one, *Helicigona arbustorum* L., despite the implication of its name, is plentiful on high crags, even on the limestone crag at some 2400 feet. Broken and emptied shells indicate the attentions of birds. Crustaceans are similarly encouraged by the limestone formation and freshwater shrimps—*Gammarus*—occur in becks up to an altitude of 1800 feet or more. These shrimps are appreciated by different kinds of wading birds. They were contained in several Redshanks personally examined. In the warm days of June and onward, Crane-flies—*Tipulidæ*—swarm in myriads over the high tops and I have seen a Dotterel capture and swallow one of these insects. It is no doubt they in their pre-adult stages that help to attract the bands of foraging Rooks—*Corvus frugilegus frugilegus* L.—so regularly to be seen at high altitudes. Crane-flies in all stages are relished by Curlews, and one of a number of Lakeland birds that had taken these insects had in it sixty larvae, or leatherjackets, besides insects of other kinds.

The multitude of roaming sheep accounts for an abundance of dung beetles, or dor beetles, of the genus *Geotrupes*, especially of *G. sylvaticus* Pz. These beetles are freely swallowed by Ravens, as the castings of the birds plainly show, and hard rounded insects though they are, they enter into the dietary of Curlews.

This Pennine region is rich in bird life, and wading birds, more than others, indicate that it has some peculiar appeal. Golden Plover and Dunlin breed here in some numbers and over a large extent of the ground. On the central Lakeland fells, of older sedimentary and volcanic rock structure, the Golden Plover is a decidedly uncommon nesting bird and the Dunlin almost unknown. The two fell regions are a comparatively short distance apart and are bridged by another group of fells. Further, it is in the Pennines that the Lapwing has so greatly extended its vertical range, and not in the Lake fells. The waders find more mention, with other characteristic birds, in the succeeding notes gathered during my wanderings in the Lakeland Pennines.

The three most impressive birds of the English hills, the Raven, Peregrine and Buzzard, in their common association share, if with some friction, both hunting grounds and nesting haunts, now and again taking turns at the same eyrie. The first two continue their hold despite many adversities while the other bird has increased and spread.

Whether nesting, foraging, roosting in company or simply wandering, the Raven—*Corvus corax corax* L.—is somewhere about, all the year round. It is in these fells that the one large communal roost of Ravens in Lakeland alternates from one to another of three dales. In two of them, whichever is in use, the nightly quarters for a good part of the year of any number of Ravens up to fifty or more are provided by the outcropping limestone, in the other by whinstone. During a period when the highest situated roost was in favour, twenty-seven Ravens were found assembled there in the middle of one September day, and an odd bird and a couple have been disturbed from it during the daytime in May and June. Besides the three main places there are one or two others where more than a couple of Ravens may occasionally spend the night.

Concerning wanderings from one fell region to another, a pair of Ravens, robbed of their eggs, have been twice seen in May returning high at evening to their home quarters in the Skiddaw group from the general direction of Crossfell, and in January, a couple heading for about the same fell from the neighbourhood of Ullswater.

Three of nine nesting sites are formed by the outcropping whinstone, three are limestone, two shale and one gritstone. Rarely, if ever, are more than two of these sites occupied in one season, except when a robbed pair of birds change over for a second attempt. Some of them remain neglected for lengthy periods, one shale crag used four years in succession not having been previously tenanted for a good twenty years and since abandoned these eight years. A limestone site, Ewbank Scar, in Podgill, which is within two miles of the town of Kirkby Stephen, has been deserted for more than thirty years. While an occasional bone or two are not unusual among building materials, one extraordinary nest had at least half of the outerwork composed of bleached ribs, jawbones and pelvic-bones of long defunct fell sheep. This nest like so many more did not serve its full purpose and, on the whole, the Raven here fares badly in its nesting.

At the most there are three pairs of nesting Peregrine Falcons—*Falco peregrinus peregrinus* Tunst. Two pairs are the more usual breeding strength and in some seasons there may be only one. The three haunts are well spaced out, for one reason because they are in the parts of the fells in which the biggest rock faces are to be found. Two of the principal nesting sites are exposed edges of the Whin Sill, the other an outcrop of gritstone. A range of limestone crags, in very occasional use may be regarded as an alternative to the gritstone site. Another big limestone face, certainly now and then frequented by Peregrines, has possibly had use in times past when one of the whinstone sites was out of favour. Both these limestone sites are included in those used by Ravens.

A pair of Peregrines may cling to their home crags during the winter months, even when frost and snow prevail. Few kills may be brought in during this season but numerous pellets below well defined roosting places will indicate that prey is being killed and devoured far afield. When there is one available, an old Raven nest makes a favourite roost.

The nesting urge is felt long before the eggs are laid and tentative scrapes are made from the first few days of March onward. These ordinarily are in ledges well covered with soil and maybe grass or other growth, although one nesting scrape, in which a brood was reared, was in a ledge covered as much with rock chippings as soil. Choice varies among several eyries at one site but does not always fall on a different one each year as the same eyrie may be used at least two years in succession, and that when young have been reared in it in the first. A typical Raven nest is made firm and solid with a good deal of turf and this lingering as a decayed layer, long after the other materials have fallen away, may take the fancy of nesting Peregrines. One such layer, after serving as a winter roost, was scraped out in March then rejected in favour of a similar remnant at a little distance in the same rock range. The adoption of a Raven nest in good state of preservation is just as likely and the one largely composed of sheep's bones, which was in a different locality, was given a turn.

Six years after the last occupation by Peregrines, a Kestrel—*Falco tinnunculus tinnunculus* L.—was found brooding six eggs in the identical eyrie on the occasionally used limestone crags.

Besides the established pairs, there is the occasional and rather puzzling presence of an apparently unsettled pair of Peregrines during the breeding season. In different years, one pair were hanging about a Raven site, not known as a Peregrine site, in early May, and another pair, in early June about a Raven site in a dale adjacent to one in which established Peregrines were rearing young.

Individual behaviour is very strongly marked in the Peregrine. Most often the falcon is the more demonstrative when the haunt of a pair is invaded, and the boldest falcons, with harsh rasping screams, will come hurtling down to within a few feet of an intruder at the eyrie, especially if there be young in it. Others keep a goodish distance and are more subdued in their protests. In one haunt, the falcon, presumably the same bird, in two seasons running that she had young, hardly gave cry at all and was inclined to clear right off the scene. Her mate behaved in similar fashion. The tiercel often enough contributes a fair share and one in particular, flushed from the eggs, was much the more vehement. He frequently came cursing and dashing around well within gunshot while his mate, giving tongue only once, kept a very lengthy distance. At the same place, in a previous year when there were young in the eyrie, both parents gave full vent, although the tiercel continued long after the falcon

had become silent and when they had resettled on the crag, one either side of the eyrie. Commonly the tiercel will appear as though from nowhere to warn the brooding falcon of approaching intruders. The regular practice of one well known tiercel was to fly to such a height that he appeared as a mere speck against the sky and his warning cries came down little louder than the cheeping of a farmyard chick. Very curiously, this same bird came screaming close round my head on an occasion when I was on the high ground, nearly a mile from the breeding place and not heading for it. Such unwonted behaviour, which gave the idea that the bird recognised me from my previous visits, prompted a call at the nesting crag. A late-hatched brood of young proved to be the cause of all the bother, or anxiety. Lack of demonstrativeness in Peregrines at nesting time may be due to persecution, and birds comparatively silent and chary of approach are more than likely to have been shot at, some time or another.

Hill shepherds approve of the Peregrine as being an enemy of the Carrion-Crow—*Corvus corone corone* L. My own acquaintance with Pennine Peregrines began when the tiercel of a breeding pair came into view over a fell crest, hovered for a few moments, and then stooped to drive a Carrion-Crow down the slope. The crow escaped harm by taking to ground among broken rocks and remaining there for as long as the tiercel chose to "wait on." Crows certainly do fall victims and figure in the following details of kills found at the three principal breeding sites. The sites are numbered from north to south and the dates given in order of visit.

SITE NUMBER ONE.

- | | |
|--------------|--|
| 14 May. | Two young in the eyrie.
Carrion-Crow, Starling, Meadow-Pipit, Ring-
Ouzel, Golden Plover, Lapwing, Red Grouse. |
| 25 March. | Redwing, Curlew, Stock-Dove, Red Grouse. |
| 15 April. | One egg in the eyrie.
Fieldfares and Redwings in quantity. |
| 1 July. | Three young in the eyrie.
Carrion-Crows, Rooks in quantity, Starlings.
A week later, a juvenile Red Grouse. |
| 18 April. | Ring-Ouzel, Red Grouse. |
| 4 June. | Two young and a bad egg in the eyrie.
Golden Plover. |
| 22 March. | Carrion-Crow, Starling, Fieldfare, Redwing,
Golden Plover. |
| 1 June. | Two young in the eyrie.
Ring-Ouzel, Curlew, Golden Plover, Black-
headed Gull. |
| 28 February. | Fieldfare, Blackbird, Common Snipe. |

- 9 June. Three young in the eyrie.
Starling, Song-Thrush, Swift, Redshank.
- 19 June. Three young in the eyrie.
Two Blackbirds, Cuckoo, six Common Snipe,
juvenile Red Grouse, ground beetle *Carabus*
violaceus L.
- 29 January. Starling, Fieldfare, Redwing.
- 16 April. Four eggs in the eyrie.
Two Starlings, Sky-Lark, Fieldfare, Common
Snipe.
- 30 May. Four young in the eyrie.
Starling, two Blackbirds, Curlew, three Common
Snipe.

SITE NUMBER TWO.

- 3 May. Jackdaw, Ring-Ouzel.
- 6 June. Three young in the eyrie.
Carrion-Crow, juvenile Ring-Ouzel, Common
Snipe, Redshank, Golden Plover, two Red
Grouse.
- 4 June. One young and two bad eggs in the eyrie.
Common Snipe, Red Grouse.
- 8 June. Two young in the eyrie.
Starling, Common Snipe, Common Tern.
- 17 April. Fieldfare, Dunlin.

SITE NUMBER THREE.

- 8 June. Two young and two bad eggs in the eyrie.
Golden Plover, adult and juvenile Red Grouse.
- 23 April. Four eggs in the eyrie.
Red Grouse.

The breeding strength of the Buzzard—*Buteo buteo buteo* (L.)—is now at about a dozen pairs, a considerable increase from what it used to be. The present nesting distribution is nearly from one end of the region to the other. Between nesting seasons, when they sometimes join up into small parties, Buzzards seem to be just here or there as their local wanderings and quest for food take them. In winter time the bird is very often solitary although occasionally a couple, perhaps a pair on a revisit, may then be seen about a nesting haunt. Roosting places are commonly near to nesting places or actually are old nest sites. One crag ledge long known as a roost eventually had a nest built on it. During the coldest months, fell-foot growths of timber, conifers or mixed trees, are perhaps used more for roosting than they are in the rest of the year. The Buzzard is an early riser and, on some winter days in memory, the first bird astir over the fell-side has been a Buzzard flapping along in the grey half-light of dawn as though out to make the most of the curtailed hunting.

Almost any kind of rocky outcrop will serve the Buzzard as a place for its nest. Some of the bigger rock ranges are in more or less regular use, those favoured by Peregrines being resorted to either in the absence of these birds or where space allows Buzzards a share with the minimum of conflict. An extensive line of crags may have Peregrines nesting in one part with at the same time an alternative eyrie of theirs in another part occupied by Buzzards. Very simple places, with little more to recommend them than convenient lodgment for building materials, are often chosen. A small limestone face with the nest only seven feet from the ground, and a rocky apron conforming to the general fell slope with the nest no better than on the ground, are examples. Occasionally the nest is in a tree or a bush, and in one built in a tall larch a Kestrel subsequently laid her four eggs.

The composition of the nest varies from a few scraps of plant stalks surrounding a hollow in turf to a bulky and well lined collection of sticks and heather stems. Among the grassy fells, and failing other materials, the nest is mainly made up of turf, the basal parts of grass clumps, and dead stalks of thistles, nettles or umbelliferous plants. One nest so formed, and used two years running, was for the second time merely scraped out and scantily lined with woodrush, grass and green moss. Dried grass, woodrush and dead bracken are the common lining materials. There is sometimes an additional tuft or two of sheep's wool and one exceptional nest was lined mostly with this material.

Marked differences are shown in the Buzzard's habit of decorating the nest with freshly plucked foliage. Now and then a nest is embellished with a spray or two before laying has begun; some nests are half smothered in greenery at the time they hold eggs while others appear to receive very little during the whole of the incubation and fledging periods. Sprays of Rowan or Mountain Ash leaves, occasionally with blossom, are oftenest used, other kinds noted being Cherry, Spruce, Larch, Ivy, Heather and Willow-herb—*Epilobium montanum* L. In addition are Lady Fern, young fronds of Bracken and catkin-bearing twigs of Willow. One nest had a mixture of Raspberry and Rose-bay when it held incubated eggs, and another, an adopted Raven nest, had three long flowering stems of Rose-bay—*Epilobium angustifolium* L.—at the time the single young Buzzard in it was about ready for leaving. On a grassy knoll, one of the typical places where prey is broken before being taken to the nest, a fresh spray of Rowan leaves lay among the remains of young rabbits. The decorations, of Rowan, in the nest, which held two half-grown young, were all withered at the time.

Laying begins on the early side, in mid-April, in these fells, and it was here that in one season a whole family of four young were successfully reared. The nestling Buzzards seem to be fed almost exclusively on young rabbits, other prey found at nests

amounting only to a Common Shrew—*Sorex araneus* L.—which was entire, and a Stock-Dove—*Columba oenas* L.

Two Pennine Buzzards showed the habit in the species of swooping at people and sheep. All the time I was at or near a nest of two young up a dale side, one of the parents, starting each flight from the opposite side, kept rushing almost horizontally across the dale straight for me until within a few feet and then upward over my head and round and back again. Once it did a complete somersault in the air. One of another nesting pair, in full cry overhead, came down in the more usual dive form of attack to strike a sheep on the rump.

The Merlin—*Falco columbarius aesalon* Tunst.—is widely distributed in this fell region. Favourite breeding places, clung to with characteristic fidelity, vary from a rock strewn slope or a secluded gill to a fairly high-lying stretch of peat hags, all heather grown. A Merlin in pursuit of a Snipe, as on an occasion by the head of Dukedale, and the two ringing high into the sky, affords a memorable bird picture of the moorlands. An extraordinary instance in which this little hunter had in turn been eaten came to light in Geltsdale in May 1944. In a nesting place of Tawny Owls—*Strix aluco sylvatica* Shaw, a hole in an alder, then with two young in it, there lay the remains of an adult jack Merlin along with those of a Ring-Ouzel, a Grey Wagtail and other feathered prey.

The most characteristic of the smaller perching birds of the fells is the Ring-Ouzel—*Turdus torquatus torquatus* L. Its song has a peculiar charm in a wild hill setting, often cheering the gloom on those days of mist and rain when it is piped out almost continuously. Although its numbers vary in different parts of the fells in different years, no season passes but that the Ring-Ouzel puts in a good appearance, and it is back even to its highest and innermost haunts before the end of March. Tindale Fells alone have produced five nests in one day, but again, where a short length of watercourse has held two nests at a time in one season, there has been none in the next season.

Here and there a particular place, say a small rocky gill, will be favoured year after year and have in it as well as the new nest several others of the typically solidly built structures in various stages of decay. A brooding bird disturbed from one such place, after a protracted dalliance, knowing she was under observation, appeared intentionally to mislead by going and settling herself in what turned out to be a nest of a previous season. She left with the normal show of alarm when approached. Another lengthy wait, and her reluctance finally overcome, she returned to her proper nest which held three small young to account for her at least cautious behaviour.

Besides natural situations, the Ring-Ouzel often nests in the old buildings mainly connected with the lead and barytes mines.

The holes in which the ends of flooring joists have rested are a leading fancy, and one pair of birds reared their family in a nest wedged between a bottle and a jar on a crude wooden shelf. A situation still more odd was inside a building in which the upper floor remained and on the floor an iron bedstead. Lengthwise along the bed, their business ends resting on the headrail, lay three of the long-handled besoms used to keep the flame in check during moor-burning operations. The heads of these brooms, where they touched the iron rail, supported a nest which, when found, held two feathered young, the parents of which entered and left the room through the window opening. The highest nest discovered, one on the limestone scar at over 2400 feet, was doubly distinguished. Its position was betrayed by the emergence of the brooding bird from behind a vigorous flowering clump of Cowslips—*Primula veris* L.—which had arrested attention as an extraordinary sight at this altitude. An early nest in Highcup contained four eggs advanced in incubation on 3 May, and a late one in Dukedale a single fresh egg on 9 June.

After the nesting season, Ring-Ouzels band together to roam high and low over the fells. A flock of more than twenty and another of six were encountered one early August day near the top of Crossfell, and on 7 September in a later year about the same total of birds were gathered to feed on the berries of Rowans—*Sorbus aucuparia* L.—in Croglin Dale. Two high lingering birds were at about 2000 feet on Knock Fell so late as 27 September.

Not all "Mountain Blackbirds" are Ring-Ouzels as the familiar Blackbird—*Turdus merula merula* L.—occurs as a settler in the haunts of its relative. The cock of a pair of Blackbirds that had their nest and small young in a dry wall at well over 1000 feet, far up Croglin Dale, was by timely intervention saved from the clutches of a far ranging Sparrow-Hawk—*Accipiter nisus nisus* (L.). Another hill going pair were apparently established in the head of Highcup at about 1800 feet.

The Wheatear—*Enanthe ænanthe ænanthe* (L.)—yearly takes up widely scattered nesting quarters which include the stone beds near the tops of the highest fells. Even the higher nesting birds may be back to their haunts well before the end of March. A nest in a rabbit burrow, on Milburn Pike, contained six eggs all plentifully marked with the unusual red spots. Another, similarly placed, on Crossfell, and perhaps evidence of double broodedness had four fresh so late as 14 June. An unusual nesting site in which a pair of Wheatears successfully reared their young was a low retaining wall to a garden abutting on a sidewalk in the town of Kirkby Stephen.

The Grey Wagtail—*Motacilla cinerea cinerea* Tunst.—shares a breeding range far up the becks with the Dipper—*Cinclus cinclus gularis* Lath.—and, as in other haunts, will take a disused

nest of its associate as a foundation for its own. Grey Wagtails built on top of a Dipper nest by Ardale Beck which had been robbed earlier in the same year, and a pair in Geltsdale had their nest actually inside one of Dipper from which part had fallen away. Another variation of the occasional habit of making use of another bird's nest was in Scordale. Here a Ring-Ouzel nest, found at the time it held eggs, in a hole in a wall of the ruined smelt mill by Hilton Beck, when next seen, just a year later, had inside it the nest and eggs of a Grey Wagtail.

The Dipper anywhere goes in for novel sites and instances of its nesting on a fall behind the abruptly descending water were noted up Gale Beck and at Scordale Head. Again in Scordale, the wide main beck was spanned by a narrow footbridge formed of a single beam overlaid by a plank; one end of the beam had slipped away and at the middle, in the space thus caused between the two lengths of wood, was a Dipper nest subject to a considerable springing up and down every time the weakened bridge was used. Although away from their higher haunts in winter, Dippers are not then entirely absent and even under conditions of frost and snow there was one singing by Ardale Beck shortly after dawn and again towards the dusk of a January day. On a mild day during another January, Dippers were stirred to great activity and at one time there were three of them excitedly chasing each other about the same beck.

The Meadow-Pipit—*Anthus pratensis* (L.)—ranges high and low, on grass ground and heather moor alike, and is perhaps the most abundant bird of the fells. Especially in late March does it enliven the fellsides when flocks of new arrivals, in restless prelude to dispersal, are continually flitting over them to an accompaniment of thin cheeping notes. There are again flocks by the middle of summer, then foraging over the high ground and stone beds, and in winter an occasional small party to show the all the year round presence of the bird.

The abundance of the Meadow-Pipit, a principal foster parent, may account for the comparative commonness of the Cuckoo—*Cuculus canorus canorus* L.—in the fell country, although other birds are victimised here as well. In Geltsdale a pair of Meadow-Pipits and a pair of Whinchats—*Saxicola rubetra* (L.)—which nested in close company were later in the season each attendant on a fledgling Cuckoo, the youngsters being about of an age. Found at the foot of Warcop Fell, a red-coloured egg of Cuckoo together with four unusually greenish-brown eggs of Meadow-Pipit, made a very striking nestful.

The Sky-Lark—*Alauda arvensis arvensis* L.—is here notable because of its being a much more numerous breeding bird than in the central fells of Lakeland. Its nesting extends to the highest grassy flats and it is frequently to be heard in song far above them.

Wading birds are strongly represented in the breeding season and foremost amongst them is the Golden Plover—*Pluvialis apricaria apricaria* (L.). It nests all along the fells, chiefly on the high-lying sphagnum and heather flats, but on stretches of dense grass and some of the highest and barest stone-littered ground as well. Nesting birds return early in the year and some were back to their upland haunts on Tindale Fells on 3 March in a season when these still had a covering crust of hard snow. Spring snowstorms will bring the birds down temporarily to the fell foot country, where their mournful cries betray their unsettled state.

Though reasons for variations, one year to another, in the nesting strength on any ground are not usually apparent, a near desertion of Geltsdale Middle, 1710 feet, might have been due to the altered condition of the vegetation. There were annually not less than four pairs on the top of this fell when much of the heather was short and there were bare or sparsely heather- and grass-grown stretches of peat and sphagnum. Since there had been no moor burning for some time, the place, in 1944, had become almost one great sweep of tall rank heather and grass. One day in May that year, until a clutch of four eggs was stumbled upon, there was not a plover to be seen or heard, and then only the one that had run off from the nest.

A pair on the top of Little Fell, 2446 feet, very evidently had a late brood on 14 August 1939, and their scrape had in it, besides pieces of egg shell, a tuft or two of freshly shed nestling down. There was a party of five other Golden Plover near the summit cairn on the same day. Towards the end of the breeding season it would seem that parties of plover, which may later band into flocks, are formed actually on the high nesting grounds. There are also gatherings at dates which suggest that both non-breeding and passage birds frequent the heights. The flat top of Knock Fell, 2604 feet, a breeding haunt, has an extensive grassy stretch and a pool of water and is an attractive place. Here, on 28 June 1925, a litter of cast feathers and droppings showed that there had recently been a fair gathering of plover. On 7 June 1932 a party of eight came flying up to this top from lower ground and, on 27 September following, there were seven birds, all clear breasted, present.

A small flock was put off the summit of Crossfell on 5 August 1923 and, while a pair with young were under observation on a flat stretch of Scarrowmanwick Pike on 19 July 1925, a party of twelve came past down from the ground above it. An occurrence quite out of the ordinary was that of a flock of twenty-one plover which, on 1 June 1936, came down off the tops above Nateby and sped across the fell sides towards High Seat, flanking Mallerstang. The early flocks in these fells might possibly be linked with those that appear in June and July on the not so distant Rockcliffe Marsh by the Solway. There I have seen in flock eleven Golden Plover on 17 June, thirty-eight on 28 June,

seventy on 4 July and four hundred on 12 July, in various years. A solitary plover was in cry high up on Tindale Fells on 7 October 1930.

Golden Plover are most vocal at approaching weather changes and foretell sunshine as well as rain. One time in May, after heavy rain in Croglin Fells, the loud and persistent cries of the birds there came down through the mist all during the dull evening that preceded a bright and sunny morning. At other times continual crying during the daytime has heralded a change to rain at night.

The Dunlin—*Calidris alpina schinzii* (Brehm)—arrives rather later to keep company with the Golden Plover, mainly in haunts from Crossfell southward. It follows the high tops, and the lower limits of its range are not so often below 2000 feet as they are on Amber Hill and Stainmore. Birds are occasionally present on the summit plateau of Crossfell, and one was watched brooding a downy chick only a little way below it.

The nesting Dunlin are seemingly in the habit of coming down to feed at the lower waters, birds having been seen during the breeding season paddling at the margins of Tindale Tarn and Dogber Tarn and in the shallows of the young River Eden in Mallerstang. Their favourite haunts are within fair reach of such waters, or of the high-lying small tarns. A solitary bird on the top of Tailbridge Fell, 1796 feet, on 11 August, appeared to be a rather late lingerer. Pluckings from a kill near the top of Great Dun, 2780 feet, and remains in a Peregrine eyrie are all the evidence found of Dunlin victims to birds-of-prey.

In his *Vertebrate Fauna of Lakeland*, 1892, Macpherson says of Dunlin: "The colour of those which breed on the salt marshes is not so bright as that of the smaller birds which nest on the Pennine range." A male that I collected at 2600 feet, on 6 June 1933, happens to have more cinnamon colour to the scapulars and inner secondaries which gives it a brighter appearance than some Dunlin, but its measurements are not out of the ordinary, the wing being 110, the tarsus 23 and the bill 27.5 mm.

The Lapwing—*Vanellus vanellus* (L.)—is remarkable for its high nesting and especially for the persistent attempts of some three or four pairs to colonize a bleak, stone-littered plateau at an altitude of rather more than 2700 feet. In May 1926, when the attempts were first noted, eight nesting scrapes were found, one of them containing an egg still fresh, and there was a premature egg lying in the open. Recent severe weather evidently had been too much for the birds and had driven them down the fell, but for not much more than two hundred feet, to try again. There were happenings of this kind in subsequent seasons and it was ten years later that the first chick was seen and this at the lower level.

Nesting attempts on a similar and adjacent top, just under 2700 feet, came to notice in June 1933 when a closely brooding

Lapwing was disturbed from a single egg, which proved to be addled, and when other scrapes were found. Earlier weather conditions had been bad. At the same time several pairs of Lapwings were established on another and, in the nature of the ground, much more favourable top, in altitude 2600 feet.

Early flocks of Lapwings were one of twenty-four at the foot of Crossfell on 8 June, and one of about a hundred on a lower slope of Hartley Fell on 13 June, in different years.

The Curlew—*Numenius arquata arquata* (L.)—which has become a plentiful nesting bird in the low country, still resorts widely to these fells, going up to about 1500 feet. The breeding birds of the East Westmorland fell meadows commonly perch on the roof ridges of the isolated stone barns, or "field houses," which they use as watch towers, particularly when their chicks are running abroad. One of a pair with four chicks in a meadow above Knock, after driving a Carrion-Crow into the shelter of a tall leafy sycamore, perched on one of the higher branches of the same tree, there to await the marauder's next move.

Fifty Curlews in a flock on a lower part of Tindale Fells in early March were equally likely to have been on through passage or about to disperse locally. Three flocks in the Westmorland part of the region, on dates within the first week of June in different years, numbered thirty, eight and thirty-three birds which seemingly were non-breeders. The last flock very surprisingly flew up farther into the fells, at early evening, by way of Knock Ore Gill. In a westerly movement of Curlews away from the fells above Kirkby Stephen, as witnessed for several days up to the middle of August, the birds came over at all times of the day, but mostly in afternoon and early evening. Many travelled singly, and five were the most seen together.

The Common Sandpiper—*Actitis hypoleucos* (L.)—goes to nest far up the dales, especially those in which the becks have a good deal of gravel in their beds. Geltsdale, a favoured one, may have two or three pairs in a year along each of its twin waters, the Old and the New, which unite in the enclosure of the fells to form the mainstream of the River Gelt. Several pairs are annually attracted to the gravelly stretches of the River Eden where it is still little more than a fell beck, in Mallerstang. Near to the head of Highcup Dale a pair nested atop of a small green hummock by the beck in its stage of a narrow runlet through damp, grassy ground, shut in by the steeply rising screes. At Tindale Tarn, a nesting haunt of a pair or two, there were one day in early May into the teens of Sandpipers still on their way to breeding quarters, near or far.

The Redshank—*Tringa totanus britannica* Math.—since its inland spread has come to be reckoned among the thoroughly established fell nesting birds. During the appropriate season it is scattered along the lower parts of the western escarpment, avoiding the narrowly enclosed dales, and going up to about 1500 feet

on Tailbridge Fell as it does farther back into the region on Stainmore. A straggler well above this height was seen flying down from the head of Knock Ore Gill, in June. A breeding bird in Tindale expostulated from a top branch of a tree and another, below Crossfell, was keeping guard on the roof of a barn.

The Common Snipe—*Capella gallinago gallinago* (L.)—breeds up to, and perhaps above, the 2000 foot line, one being flushed from four eggs at this altitude on Knock Fell, late on a June evening, and at the time another was drumming high over the summit. A bird found sitting three eggs on the top of Long Fell had chosen to nest at about the same height. Breeding birds are common at lower levels along the fells, common enough for there to be six victims at one time in a Peregrine eyrie. Snipe appear in varied situations during the non-breeding season. There was one at Dogber Tarn, at some 1500 feet, in August, and as many as ten in open runlets on a lower part of Crossfell in January, when the surrounding slopes were icebound after a week of frost, and partly covered by patches of hard snow.

The Woodcock—*Scolopax rusticola* L.—nests on some of the lower slopes and in fell foot woods. Single birds on several occasions, always in the month of March, have cropped up at about 1500 feet on open moorland on Tindale Fells and Scarrowman-wick Pike, and near the head of Ardale, on Crossfell.

Winter finds only some of the hardier Pennine bird residents clinging to their haunts, but there is always the possibility of there being feathered strangers in the land. Snow-Buntings—*Plectrophenax nivalis nivalis* (L.)—are fairly regular in their comings and they have a preference for the neighbourhood of Crossfell. Evidence proved that a flock there on a February occasion were feeding on the minute seeds of Heath Rush—*Juncus squarrosus* L. Another winter-visitor as likely to turn up here as anywhere in Lakeland is the Rough-legged Buzzard—*Buteo lagopus lagopus* (Pontopp.). One on Crossfell, on a January morning, left no doubt as to its identity when surprised from above at close range.

Another winter occasion, when fells were white with snow, the endless dry stone walls standing out in near-black lines, and almost tangible silence over the stark scene, there was one other sign of life. A little Wren, undaunted, and busily foraging in the chinks and crannies of one of the walls, was there to maintain the fascination of the bird life at all seasons.

September 1945.

A ROUND ON WESTMORLAND MOORS.

By WALTER THOMPSON.

This outing followed no plan but was taken in place of one originally fixed for the day and ruled out by the weather. When, as at first arranged, I should have been on my way in good time in the morning to meet a gamekeeper friend at his house, a steady downpour of rain brought disappointment. The land of rough heather and peat bog at 1100 feet that we had intended to visit was no place for either of us under the prevailing conditions.

After mid-day a clearing sky allowed the sun to appear and so it was I set out in the early afternoon on my altered round. A tramp of a little more than an hour brought me into a haunt shared by Golden Plover and Lapwings where the birds were running and calling in all directions under the now bright sunshine.

Another sound, the alarm chatter of a Ring-Ouzel, came from nearby rocks, and a short search revealed a nest cradling a full brood of four young.

Within a few minutes of leaving the Mountain Blackbirds, I stood at the edge of a twenty foot scar to look down upon three young Buzzards in a nest on a ledge immediately below me the while the parent birds circled high overhead. The pleasure felt at the success of this, the third nesting attempt at this site was, however, short-lived as the young ones were soon afterwards destroyed.

Trudging along for another hour, I arrived at a fair-sized mountain tarn lying at 1600 feet above the sea. A break here for sandwiches gave opportunity to play the binocular on a pair of Mallard afloat and eight Dunlin tripping about the water's edge. These bird visitors were added to by a couple each of Golden Plover and Lapwings which came to bathe and preen.

The weather holding good, I decided for a smaller tarn at a distance measured by a further ninety minutes of rough going. The way lay over peat hags and tall heather where Merlins can be expected but on this day did not turn up. A Meadow-Pipit that darted out almost underfoot disclosed a nest containing four rich dark brown eggs.

Keeping on and climbing out of a valley after crossing the two becks that flow down it I gained a top where Wheatears betrayed nesting concern by their uneasy flitting from place to place.

Here, where the altitude is some 1900 feet, my nearness to the little tarn was marked by a Lesser Black-backed Gull on wing. Although this gull had been joined by its mate when I reached the tarn, my search there on this occasion failed to produce the anticipated nest. The chance of finding it in an extended search

over the wide moorland being too remote, I took cover among the heather and trained the glasses on the now distantly settled birds to watch their return. But the gulls, a little too suspicious, would not stir except to avoid the repeated attacks of an angry Curlew.

At last, as the sun had gone down and long miles separated me from home, I had to leave unrewarded. Even though not entirely successful this outing had its own particular additions to the memories of many others spent among the moorland birds.

May 1944.

THE PROGRESS OF NATURAL HISTORY IN CUMBERLAND.

By F. H. DAY, F.R.E.S.

EARLY NATURALISTS AND PUBLICATIONS.

The purpose of this account is to give a brief but, it is hoped, connected history of the progress of knowledge concerning the wild life of the county of Cumberland from the earliest times of which there is any information extant down to the present day with, incidentally, a few notes on the men and women who have studied the natural history of the county and by their studies have contributed something to the sum total of knowledge. It is to be regretted, however, that much of the work of the early naturalists in Cumberland never found its way into print owing to the lack of a suitable medium in which to publish records, and also to the fact that collectors and observers in the first half of last century were shy of writing about what they knew. They were quite content in the possession of their specimens and had no great desire to share their knowledge with other people.

This class of naturalist was largely made up of working men who had a real love of Nature and would tramp long miles over hill and dale in quest of any bird, insect or plant that they desired to possess. There is the well-known story of James Cooper, a contemporary of T. C. Heysham, who in his hunt for the eggs of the Dotterel—*Eudromias morinellus* (L.)—tramped from Carlisle to Whiteside mountain, a distance of thirty-five miles, spent the night on the mountain, and trudged back to Carlisle the next day without a rest except on mother earth. He was a man of great powers of endurance and, as he lived to the age of eighty-seven, his health cannot have been affected much by his arduous expeditions.

Another fact about these early naturalists was their jealousy of one another and the secrecy they maintained about their finds and discoveries. For this reason alone little information has been left by them, and in later years many a species hailed as a new find was probably only a re-discovery of something they knew all about but kept silent. This policy, of course, is not without advantages. Too general an acquaintance with the haunts of a rare or local species of bird, insect or plant often leads to its extermination, although it was probably not preservation but simply the desire to have or know something that their contemporaries did not which actuated the bygone naturalists.

To go back to the beginning of last century, the knowledge of Cumberland natural history as far as the printed word was

concerned was extremely meagre. A hundred years earlier, in 1709, an *Essay towards a Natural History of Westmorland and Cumberland* had been written by Thomas Robinson, Rector of Ousby, but was of little consequence, and some years later James Clarke, a surveyor of Penrith, and the Rev. W. Richardson wrote about the fauna of the neighbourhood of Ullswater, and the latter contributed a "Catalogue of Cumberland Plants" to Hutchinson's *History* of the county. Earlier than this the botany of Cumberland had been investigated by Bishop Nicolson when he was Rector of the parish of Great Salkeld and at the same time, between 1680 and 1690, he was in association with Thomas Lawson, a schoolmaster of Great Strickland, who sent a list of one hundred and fifty plants found by him to John Ray the celebrated naturalist and one of the pioneers of natural history in Britain. Therefore it may be said that when Dr Heysham began his investigations at the end of the eighteenth century he was treading virgin ground, and the period of his activities may be taken as the starting point of the serious study of the natural history of Cumberland. Later, Dr Heysham's son, T. C. Heysham, carried on the work with great energy, but some account of what the father did should be given before passing on to the even more important work of the son.

JOHN HEYSHAM AND THOMAS COULTHARD HEYSHAM

In many ways Dr John Heysham was one of Carlisle's most distinguished citizens. A very informative account of his numerous activities is extant in *The Life of John Heysham, M.D.* by Dr Henry Lonsdale, and published by the firm of Longmans, Green and Company. He belonged to an old Lancashire family located in the district of Morecambe Bay, and apparently having an ancestry going back to Saxon times when a roving chieftain named Hessa took possession of a tract of country in the bay. Later the name of the family appears as Hessam or de Hessam and in the course of time it became Heysham, the district over which the family held authority becoming known by the same name. About two hundred years ago the town of Lancaster had several Heyshams among its residents one of whom, Robert, represented his town in Parliament from 1698 to 1715, being later elected for a period of seven years as Member for the City of London. A brother of his, William, also represented Lancaster in Parliament. Another member of the family, Gyles, was a shipowner with extensive interests in the sugar business among other concerns.

In or about the year 1750 Gyles Heysham married the daughter of a Westmorland yeoman and from that union came John Heysham, the subject of present interest. At an early age he gave indications of a love for the open country and its wild life, and no doubt the near proximity of the wide sands of Morecambe

Bay gave him plenty of opportunity to study birds. He appears to have been a keen sportsman and although guns at that period were almost debarred to young people this did not deter the rising naturalist in his quest for specimens. He practised much with the bow and arrow and became an adept in the ancient pastime of archery, but it is probable that the birds he shot would be more suitable for the pot than for stuffing. Be that as it may, it was by such old-time methods that his first ornithological studies were prosecuted.

He received his early education from Quaker schoolmasters who, at that time, were held in high repute in the north of England. Later he was apprenticed to a local surgeon for five years after which, to complete his medical studies, he prepared for a period of residence in Edinburgh. At that time the journey of one hundred and seventy miles from Lancaster to Edinburgh was no light undertaking. In the year 1774, when he had to make the journey, a means of transport known as the "Edinburgh Fly" was advertised by its proprietors to do the journey between London and Edinburgh "in ten days God willing." This stage coach, although it passed through Carlisle, did not touch Lancaster. Heysham therefore went on horseback.

This undertaking had a marked influence on his subsequent career. A keenly observant man, he derived the greatest of interest from the physical features of the country through which he rode. As he passed northwards through Kendal and over Shap and on to Penrith, and had the spreading plain of Cumberland before him, with the hills of the Lake district on the left and the Pennines on the right, he was charmed with what his eyes beheld. When he reached Barrock Fell, where the meanderings of the Petteril came into the picture and the richly wooded country spread out on all sides, his delight was, if anything, intensified. On arriving in Carlisle and noting the confluence of the three rivers Eden, Caldew and Petteril, and the distant views of the encircling hills, his impressions were so deep that he eventually decided to make the "Merrie Citie" his future home.

In the year 1778, after completing his medical course in Edinburgh, he settled in St Cuthbert's Lane, Carlisle, as a physician, first in lodgings and later, on his marriage, in a house of his own. He died there in 1834 after more than fifty years of activity in a great variety of spheres. This account is limited to his work as a naturalist. Almost at once he began to explore the country round about and to investigate the natural products it contained. He became friendly with Sir James Graham of Netherby and with John Losh of Woodside, both of whom took an interest in his pursuits, and on their estates he gathered a rich harvest of facts. He soon became known as a man whose knowledge of birds and other animals was extensive and he was consulted on all hands about uncommon creatures which came into other people's possession. Books were scarce and dear and the ability to use them

to advantage was not possessed by many people. He was therefore looked up to as a referee in cases of doubt and in this way his knowledge of the Cumberland fauna steadily grew.

He kept on with his own field work and was particularly intimate with the coastline from Burgh-by-Sands down to its southern limits. He collected a great number of birds and their nests and eggs. He would walk twenty miles to see a nest in which he was interested, and other people would travel twice as far to consult him on some matter of natural history. Pioneer work in an unexplored country has a special interest. Almost everything is new and it is never known what there may be round the corner of a lane, under a stone on a mountain top or in the hollow of an old tree. An interesting or unexpected find whets the appetite and so enthusiasm grows, and Heysham and his few associates must have realized this to the full, working as they were in an uninvestigated countryside.

The opportunity to put on record what had been discovered came in the years 1793-4 when William Hutchinson brought out his *History of Cumberland*. Dr Heysham was invited to furnish a "A Catalogue of Cumberland Animals" and he responded with fifty-three pages of double-lined quarto. Basing his classification of the Cumbrian fauna on the works of Linnaeus, Pennant and Latham, he presented a work definitely scientific in character while the local information given about nomenclature made it intelligible to the humblest readers. As Dr Lonsdale in his *Life* says: "His notes appended to each description rendered the whole compendium readable, instructive and locally interesting. His work bespeaks labour, research and a painstaking accuracy, all the more creditable that it was undertaken on behalf of the interests of science."

Although Heysham's catalogue may now appear old-fashioned, with an interest more antiquarian than anything else, the changes that have taken place in the countryside and its fauna are strongly brought to mind by a perusal of what he wrote. Mention need only be made of Newtown Common where, in the year 1783, he knew of three nests of the Hen-Harrier—*Circus cyaneus cyaneus* (L.)—and was able to observe the habits of this bird, and settle the debatable point that the Ringtail and the Hen-Harrier were sexes of one species and not distinct as Linnaeus and others had believed. Dr Heysham's notes on this bird occupy three columns of his catalogue and are described by Macpherson as "infinitely the finest piece of writing his pen has bequeathed to us." Although he lived a further forty years after the publication of his catalogue, and undoubtedly kept up his interests in natural history, there appears to be no information extant of what he did in that time.

His biographer, Dr Lonsdale, is of the opinion that he left numerous manuscripts which passed into the possession of his son. What became of these is uncertain, but there is reason to

believe that when T. C. Heysham in the later years of his life threw into the fire bundles of his own notes and papers, those of his father may have shared the same fate. Dr Heysham had a family of four sons and three daughters. Of the daughters, Isabella became the wife of G. C. Mounsey of Castletown and so began the joint names of Mounsey-Heysham familiar to the Carlisle Natural History Society.

Of the sons Thomas Coulthard Heysham was born on 21 September 1791, and died on 6 April 1857, aged sixty-six. From his father he inherited that intense love of Nature which was to dominate his career to the end of his life. He had ample leisure and the means to pursue his studies as, beyond assisting his father in his magisterial and other duties during his early years, he did not follow any profession. He never married and was wholly engrossed in his natural history pursuits. Except towards the end of his life, he enjoyed good health and was capable of great feats of endurance. In his day the easy means of transport now available were unknown and the journey to the Lake district had to be done on foot, forty miles or even more a day being lightly regarded.

T. C. Heysham was a field naturalist of the most energetic kind. The desire to see in its native haunts some bird or insect, and if possible secure specimens, induced him to explore places far remote from Carlisle where he lived, and not always was he successful in his quest at the first attempt. For instance, one day he walked from Carlisle to the summit of Skiddaw solely to get a specimen of a rare beetle, *Leistus montanus* L., for a correspondent, but was unsuccessful, and wrote to his friend: "On Tuesday I went to the summit of Skiddaw, and although I remained there several hours, and turned over several hundred of stones, I could not meet with a single specimen, indeed I never observed so few insects since I have been in the habit of visiting this mountain." He had, however, taken a specimen or two on a previous visit after numerous futile attempts to find it. It was discovered on Skiddaw in the early years of last century by John Curtis and J. C. Dale, two entomologists from the south of England, who wandered all over the country in their search for insects. John Curtis and T. C. Heysham became intimate friends and when the former brought out his important work, *British Entomology*, in eight volumes, it contained a great many notes on Heysham's finds in Cumberland, as also did J. F. Stephens' *Illustrations* in twelve volumes published about the same time. Both of these authors frequently acknowledge in their books their indebtedness to Heysham for the information he sent them; in fact a study of the various volumes reveals that he was one of their most valued correspondents.

There is no doubt that he was a painstaking and reliable collector of insects. He possessed a good library and his identification of his captures was invariably correct, a fact which both

authors were aware of and appreciated as, at that time, when entomology was more or less in its infancy, exact and trustworthy records were difficult to obtain. He collected and studied insects of all orders, but his most interesting work was with the Coleoptera. Beyond his records in the pages of *Curtis* and *Stephens* he published no connected lists of the species he found. It is noteworthy that his records are mostly of uncommon species, the more generally distributed ones being seldom mentioned, although he must have been familiar with them.

Many years ago, when I was extracting his records from the books referred to, I was much struck with some of those referring to insects which from their known distribution seemed unlikely to occur in Cumberland. As the years went on and my acquaintance with Cumberland insects extended, and one after another of Heysham's finds rewarded my search, the extreme reliability of his records became apparent and, although one or two species remain which have not since been found in the county, these may be accounted for by the changed conditions of the localities. For instance, he recorded water-beetles from Cardew Mire, a place long since drained and with a railway on what was once probably a primeval bog where the Bittern—*Botaurus stellaris stellaris* (L.)—boomed and perhaps bred. Some localities, however, remain much as they were in his day as, for one, does Baron Wood in the Eden valley where I have done a good deal of collecting. I remember one day there in June 1899, collecting beetles. The mountain ash was in flower and many species were captured by beating the blossoms over a sheet. Among them was a purple-coloured weevil, in numbers, which I had never seen before. It was midnight when I reached home but the identity of the insect had to be settled before my going to bed. Books were consulted and it was soon determined as *Rhynchites cupreus* L. Among the list of localities given was "Baron Wood, Cumberland, T. C. Heysham." What I thought would be a new record was only a confirmation of an old one. I had been anticipated by more than half a century. The marshes of the Solway, too, remain much the same as they were in Heysham's day and practically all his beetle records from that region have been confirmed.

Other writers have treated on the pioneer work of this Cumbrian naturalist. In the first volume of the Carlisle Natural History Society's Transactions there is an excellent paper on his life and work by the late member, James Murray, while much concerning his ornithological activities has been written in the *Vertebrate Fauna of Lakeland* by the Rev. H. A. Macpherson. There is one item of botanical interest that may well be added. Heysham's record of the Whorled Caraway—*Carum verticillatum* Koch—from Kingmoor has often been quoted, but it is not generally known that he first found this local plant at Newby Cross and sent a specimen to Curtis who gave a beautiful coloured figure of it in his fourth volume, plate 680.

GENERAL ACTIVITIES DURING THE NINETEENTH CENTURY.

During the period of both of the Heyshams' activities a few other workers were associated with them, such workers being mostly men of the humbler classes who acted as collectors for them, at any rate for the younger Heysham who was always ready to purchase any specimen he needed. No doubt some of these men were good field naturalists within the limitations of their circumstances, and would add something to the general stock of knowledge, but written records are very scarce. Odd notes in various serial publications such as *The Entomological Magazine*, *The Entomologist* and *The Zoologist* began to appear from about 1833 onwards from non-resident naturalists. Francis Walker of the British Museum made numerous references to Cumberland insects. George Wailes, a well-known Northumbrian naturalist, wrote the oft-quoted account of the ravages of the Antler Moth—*Charæas graminis* L.—on Skiddaw in 1824, and T. J. Bold, another Northumbrian, wrote many notes on Cumberland beetles as a result of his frequent visits, particularly to the Irthing valley, several of his captures being new to the British list. He formed a very extensive collection of British beetles which is now in the Hancock Museum at Newcastle-upon-Tyne.

In the middle of last century there was in Carlisle a little society known as The Carlisle Entomological and Botanical Society. I am not sure if T. C. Heysham was connected with it. He died in 1857 and the society was in existence some years earlier but, as during the last few years of his life, owing to indifferent health, he lived the life of a recluse, it is possible he was not in active collaboration. A little entomological magazine called *The Substitute* had a brief career about that time, and in it is a reference to this society by one Richard Cartmell in which he associates the name of J. B. Hodgkinson with its activities. This Richard Cartmell was a collector of butterflies and moths as I find in the same magazine notes by him on species captured at Kingmoor, Carlisle.

The first published note I can find from J. B. Hodgkinson is in *The Entomologist's Weekly Intelligencer*, Vol. 3, of date 1857-8, and concerns the Swallow-tailed Moth—*Ourapteryx sambucaria* L.—at Carlisle. Subsequently he wrote a good many notes on Cumberland lepidoptera and one or two on coleoptera. In 1859 he was President of the Preston Natural History Society, at one of the meetings of which he exhibited a moth, *Heliothis scutosa* Schiff., taken near Carlisle. This is an extremely rare British insect and very few have been captured. The first was taken by James Cooper near Dalston in July 1833, and carried alive to his patron, T. C. Heysham, who sent it to Curtis who figured it in folio 595 of his work. Later, three were taken by a schoolboy near Skinburness, one of which would probably be the specimen exhibited at the meeting of the Preston society. Another of the

three was in the collection of the Rev. H. Burney, a well-known entomologist. Many years later, in 1893, this specimen was purchased by Hodgkinson for £5 10s 0d. Evidently, however, this was a high price as four years later, when his collection was sold, the price dropped to £2 15s 0d

Another active collector of this period was Thomas Armstrong who lived at Newtown, Carlisle. He collected at Todhills, Wetheral, Baron Wood and elsewhere in the neighbourhood of the city. His name frequently appears in the "Catalogue of Cumberland Lepidoptera" in the early volumes of the present series of Transactions. In his time one of the night flying moths, *Noctua depuncta* L., rare or unknown elsewhere, was common near Carlisle and the local collectors were sending it out in numbers to correspondents. In this connection I find the following in *The Entomologist's Weekly Intelligencer* for 1857: "We shall be happy to exchange specimens of *Noctua depuncta* for other insects. We are in want of the Swallow-tailed Butterfly, the Emperor, etc. Signed John Lattimer, Cabinet Maker, Corporation Road, Carlisle; James Merrin, Gingham Warper, Port Road, Carlisle."

In the sixties and seventies of last century a period is reached when the entomological magazines contained many notes on Cumberland insects. I have collected numerous news cuttings which show an increasing interest in the biology of the county and mark a definite step in the progress of knowledge. An even greater number of notes concerns the adjoining county of Westmorland, especially Witherslack, which seems to have been an entomological Mecca to Lancashire collectors. J. B. Hodgkinson, perhaps more than anyone else, described its insect fauna particularly the smaller species of moths.

In the year 1876 there came into existence an association known as The Cumberland Association for the Advancement of Literature and Science, the name later being changed so as to include Westmorland. At that time each town in the county had a small scientific society which had the support of the local clergymen, doctors and other professional people. Semi-popular lectures were given on a great variety of subjects and the different societies became affiliated into the association above named and, although individually never very strong, as a confederation they were able to publish transactions recording the work being done by the more active members. In all seventeen volumes were published, the first in 1876, the last in 1893 after which year the association expired, although several of the individual units carried on in a more or less desultory way without publishing any records, beyond notices and reports of their lectures in the local newspapers.

While the seventeen volumes of transactions referred to contain many papers not of direct interest to the naturalist, there are not a few that do, several, indeed, being very useful contributions to the natural history of Lakeland. The first editor of these

publications was J. Clifton Ward, an eminent geologist; he was followed by J. G. Goodchild of H.M. Geological Survey many of whose own important papers on local geology appear in the volumes.

Of the subjects which more directly come within the scope of this account, mention may be made of the several papers on botany by William Hodgson giving evidence of the close attention he was paying to plant life, later to culminate in his *Flora of Cumberland*, published in 1898. A very charming paper by Hodgson, "The Hill Naturalist," in one of the volumes of transactions is full of general information, while his "Grasses of Mid-Cumberland" commands the attention of both botanist and agriculturist. Other contributions to Cumberland botany are from Joseph Adair, a Whitehaven man and a close and careful observer, and from the Rev. W. Johnson in the form of a long paper, "The Lichens of Cumberland," which bears evidence of extensive field research and includes several species claimed by the author to be new European records. Another important paper on the lower forms of plant life, "Fungi growing round Carlisle," was contributed by Dr David S. Carlyle who was a mycologist of much more than local reputation.

The mosses of Cumberland received the attention of the Rev. Robert Wood of Westward, who also wrote on the flowering plants. Father and son of this name were successively Rectors of the Parish of Westward. Both were accomplished botanists and did good local work. Dr John Leitch of Silloth wrote on the flowering plants of West Cumberland, in collaboration with John Glaister of Skinburness.

The several papers by Miss Jane Donald of Stanwix on land and freshwater shells were a valuable step forward, compared with Dr Heysham's pioneer work. Entomology, too, makes notable advances in these transactions, in papers on the lepidoptera by George Dawson of Carlisle, a naturalist with varied interests and some local standing. Then there was George Mawson of Cockermouth who recorded in a long list a few species of some rarity and of which no further information has come to hand.

The other great orders of insects are, however, untouched except for a chatty, popular paper on beetles by William Duckworth, a naturalist who also wrote on plants and more extensively on birds. His brother, Tom Duckworth, was also a good field observer who could talk well on his experiences as evidenced by his paper, "Reminiscences in the Study of Natural History," in the seventeenth volume of these transactions. To the bird papers of William Duckworth may be added mention of a paper by J. N. Robinson of Cargo-on-Eden, "The Birds of our Marshes," read in 1888, and interesting for comparison with the present status of various birds on Burgh and Rockcliffe marshes. Then in 1882, when the Rev. H. A. Macpherson came to Carlisle, he at once made his presence felt and frequently lectured to the

various units of the association. His outstanding contribution to their transactions was his masterly paper, "The Visitation of Pallas's Sandgrouse to the North-west of England."

It may be said of the Transactions of Cumberland and Westmorland Association that they provided a convenient medium for reporting and recording natural history progress without which a good deal of very useful information would not have been passed on to the present day. They showed that in the two counties there *were* people interested in the wild life of the woods and moors, hills and marshes, and that their discoveries were a noteworthy contribution to knowledge. But valuable as these contributions were to local natural history, there was still a need for an assemblage of all known facts to serve as a basis for further study and research.

HUGH ALEXANDER MACPHERSON, WILLIAM HODGSON AND CONTEMPORARIES.

Soon after his arrival in Carlisle in 1882 Macpherson got to work, in collaboration with William Duckworth, on *The Birds of Cumberland*, which four years later was published by Messrs Thurnam of Carlisle. Although this little book bears evidence of somewhat hasty preparation, it marked a great stride forward, and even now is still a treasured volume on the shelves of local bird-students. Macpherson himself was conscious of the book as only a preliminary one. The entire fauna of the county was so rich and varied that there was a decided need for a more ambitious work. Losing no time, although he was temporarily absent from Carlisle, he diligently collected and tabulated the records of others, did a great deal of field work himself, especially on the Solway marshes, and spent long hours of research into old church and parish registers for curious scraps of information about birds and mammals which, as well as having an antiquarian interest, threw some light on numerous species which had later become rare or had almost died out. He eventually broadened his field of operations so as to include Westmorland and Lancashire North of the Sands.

The book appeared in 1892 with the title, *A Vertebrate Fauna of Lakeland*. Mammals, birds, reptiles, amphibians and fishes were fully dealt with, and the book at once became the standard work on the branches of local natural history it covered and was undoubtedly the most important publication of its kind that the north-west of England had hitherto seen. This monumental work of Macpherson's and the personality of the man himself have been ably described by L. E. Hope in the second volume of the Transactions of the Carlisle Natural History Society.

When the Carlisle Natural History Society came into existence in 1893, Macpherson associated himself with its activities. As President his personality and enthusiasm went a long way towards

firmly establishing the society, and the two remaining foundation members retain the pleasantest recollections of his friendship. It was his enthusiasm, too, which gave to the Carlisle Museum and its collection of birds the importance it justly holds among the provincial museums of the country, and as a final word on this remarkable man I consider that the progress of natural history in Cumberland was very strongly marked during the all too short years he spent in the county.

Six years after the publication of the *Vertebrate Fauna of Lakeland*, another work of outstanding importance appeared. Cumberland had never had a *Flora* in print, although J. G. Baker of Kew had written *A Flora of the English Lake District* in 1885 which naturally included many Cumberland notes he had obtained from correspondents. Baker had never resided in the district, but was an occasional visitor, so that his book is largely a compilation of the notes of other botanists.

As a result of his many years of research in many parts of the county William Hodgson gave to the world his *Flora of Cumberland* in 1898. A keen botanist throughout the seventy-seven years of his life, spent entirely in his native county, he was in touch with all other local workers, from whom he received every assistance, and the publication of the book was another definite stepping stone in the progress of local knowledge. The features of the book are the careful tabulation of plant localities into zones of altitude and the interesting biographical notes on the various workers who rendered assistance. Hodgson was a careful botanist, reluctant to admit any doubtful records into his book. He has been rather criticised for this but it is certainly better to err on the side of caution than over-confidence in the matter of scientific records. His life's work is the subject of a fairly full account by my friend, the late James Murray, in Volume 4 of the *Transactions of the Carlisle Natural History Society*.

With the publication of the *Vertebrate Fauna of Lakeland* and the *Flora of Cumberland* neither Macpherson nor Hodgson had said their last words, as at the end of last century, the London publishing house of Constable was planning its important series of county records under the title, *The Victoria Histories of the Counties of England*. Cumberland was one of the first counties to be taken in hand, the first volume relating to it being issued in the year 1900. Natural history was a prominent feature of the work, Macpherson being the editor of this section. He himself wrote on the birds, mammals, fishes and other vertebrates; Hodgson was responsible for the flowering plants; Binstead did the mosses; Woodward the mollusca; Cambridge, who at one time was a curate in Carlisle, presented a first list of Cumberland spiders, while the present writer wrote the chapters on insects. We had, however, to write our contributions according to the general plan of the whole series and consequently, in certain directions at any rate, the information given was confined to bare

facts, without amplifying details. Still, the natural history sections gave an epitomized account of all that was known on the various branches at the end of 1900, and as such it marks another definite milestone in the progress of knowledge.

A publication which appeared a year or two later and passed through several editions, *The Lake Counties*, by W. G. Collingwood, may be referred to here because of a certain amount of information it contains on natural history applicable to Cumberland. There are notes on birds contributed by Mary L. Armitth and revised by Arthur Astley, some time member of the Carlisle Natural History Society; on macro-lepidoptera by Dr R. C. Lowther, and on plants by S. L. Petty.

THE CARLISLE NATURAL HISTORY SOCIETY.

The Carlisle Natural History Society came into being in 1893. On the appearance of the *Victoria History* seven years later the Society made the records it contained the basis of its investigations into the fauna of Cumberland, with particular reference to entomology. As regards ornithological and botanical knowledge it may be said that in 1900 the species of both birds and plants were then pretty fully known and not a great many additional species could remain to be discovered. An abundance of work, however, still remained to be done in working out the local distribution, the fluctuating occurrences from year to year, and the changes brought about by altered conditions and environment.

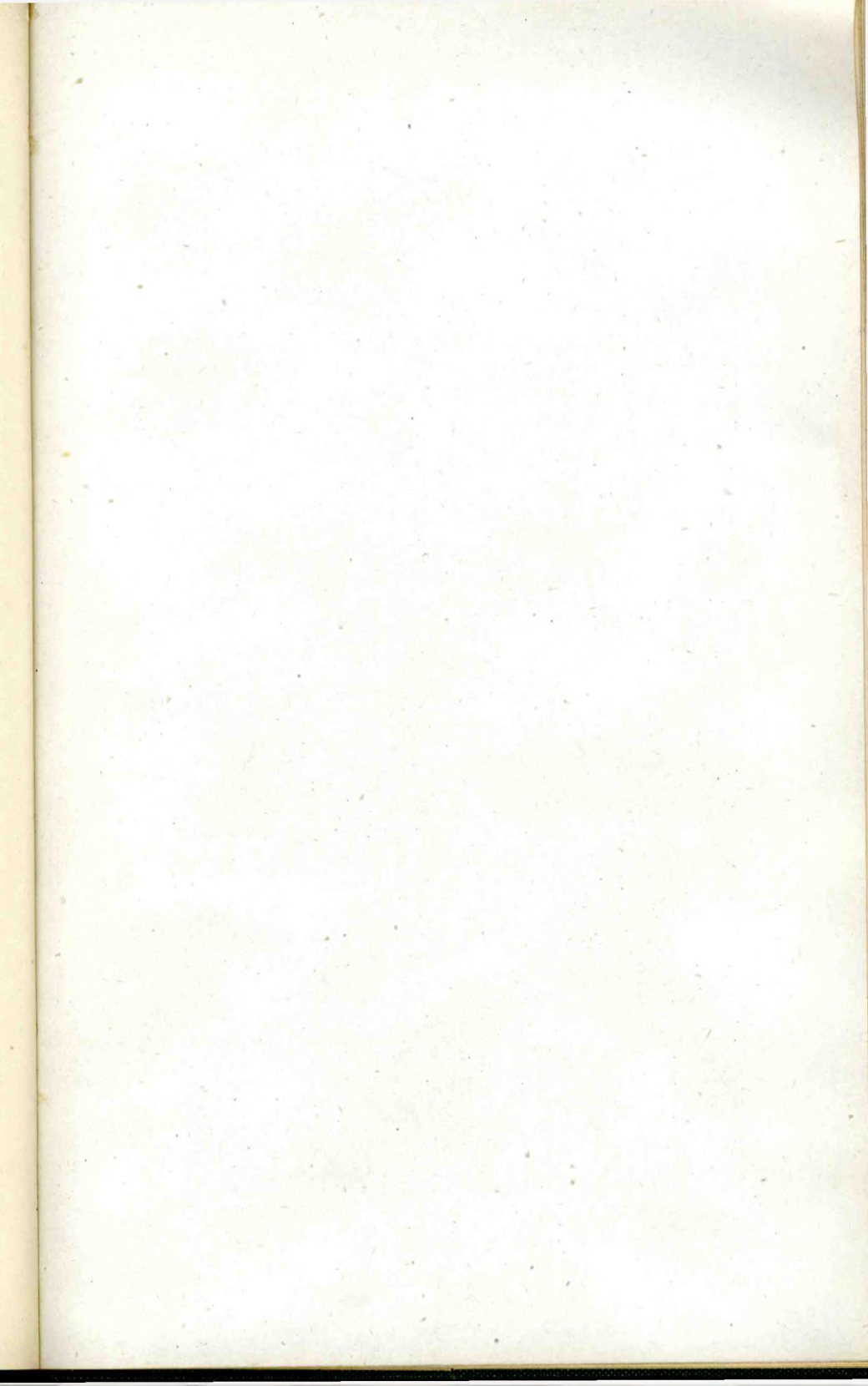
With insects the case was very different. The *Victoria History* deals with 2300 species of insects known to occur in the county, at the end of 1900; a comparatively small number against the total contained in the British fauna. Further, the *Victoria History* lists were mainly of lepidoptera and coleoptera, the other great orders being poorly represented, some even not included at all. There was here, therefore, a great need for further field work in order to arrive at a fuller knowledge of the insect fauna of the county. The small number of entomologists among the society's members set about this task with enthusiasm, exploring new ground in hitherto unworked parts of the county, and taking up the collecting and study of those orders which previously had been neglected. The results of this work formed the subject of numerous notes and papers in the various entomological magazines.

It was, however, the great wish of the members to have a medium of their own in which to record the results of their researches and, in 1909, nine years after the appearance of the *Victoria History*, they realized their desires and issued their first volume of transactions. This volume has been followed by four similar, and just recently by a sixth publication which, under the title, *The Birds of Lakeland*, has made a wide appeal to the students of British ornithology. From the beginning it was the

wish of the society to make the contents of the transactions as varied as possible and so mammals, birds, plants, molluscs, insects, spiders and minerals all find a place in their pages, together with memoirs of three of Cumberland's most notable naturalists and a history of the society itself. It may be fairly claimed for these Transactions of the Carlisle Natural History Society that they have greatly extended the knowledge of wild life in Cumberland and contributed not a little to its progress.

In conclusion, a summary of the milestones that mark the progress of natural history in Cumberland may be given. First, Dr John Heysham's "Catalogue of Cumberland Animals" in 1793-4; second, the field work of his son, T. C. Heysham, as recorded by Yarrell, Stephens and Curtis; third, the papers in the Transactions of the Cumberland and Westmorland Association; fourth, the *Vertebrate Fauna of Lakeland* which followed the advent of Macpherson to Cumberland; fifth, the *Flora of Cumberland* by William Hodgson, published in 1898; sixth, the *Victoria History of Cumberland*, published in 1900, and finally, the work of the Carlisle Natural History Society as recorded in its Transactions, of which the present volume is the seventh in the series.

February 1945.





W. C. LAWRIE.

LAKELAND RAVENS.

THE BIRDS OF LAKELAND.

A SUPPLEMENT.

By THE EDITOR.

Notes and records received since the publication of *The Birds of Lakeland*, in December 1943, form an appreciable addition to the ornithology of the area. In part they further illustrate those changes in local bird life that include the spread of the Green Woodpecker and the quickening occurrences of the Little Owl.

Alterations in status and distribution, variations in habit and other aspects are becoming much better known with the increasing interest that is taken in birds.

It is put forward in *The Birds of Lakeland*, p. 124, that many rare waders and other birds must have escaped notice in Morecambe Bay because its shores had not been so closely watched as had those of the Solway. This view of the past is strengthened by the recent valuable notes covering the Kent estuary and the neighbourhood of Arnside in the Westmorland part of the bay.

Albinistic birds find mention for one reason that such abnormalities afford clues to bird movements.

Thanks are given to all the contributing workers in the field and to the Chairman and Committee of the Carlisle Public Library, Museum and Art Gallery.

Personal names in brackets are names of actual finders or observers.

Classification and nomenclature again follow *The Handbook of British Birds*.

Order PASSERIFORMES.

THE RAVEN—*Corvus corax corax* L.

Ravens have been found nesting in trees in three more localities in Cumberland. A pair chose a pine in mid-county in 1945 (H. Mellor). Another nest of the same season was built in a birch in the Pennine region (D. Ratcliffe). In 1946 Ravens took over a deserted tree nest of Buzzards in the south of the county (James Bell).

THE HOODED CROW—*Corvus cornix cornix* L.

Two Hooded Crows frequented the Kent estuary in early January and another appeared there on 23 February 1945 (J. A. G. Barnes).

THE CARRION-CROW—*Corvus corone corone* L.

From the winter of 1943 until the spring of 1945, a white Carrion-Crow kept to the neighbourhood of Kirkby Stephen,

Westmorland (Walter Thompson). The place is within ten miles of where a white Carrion-Crow was trapped in 1924.

THE GOLDEN ORIOLE—*Oriolus oriolus oriolus* (L.)

A black-and-yellow plumaged Golden Oriole was disturbed by a passing railway train in Baron Wood, Eden valley, Cumberland, on 7 May 1943. It flew for some little distance alongside the engine (Robert Pringle).

THE BRITISH GOLDFINCH—*Carduelis carduelis britannica* (Hart.)

Small parties of Goldfinches were notably numerous and widespread in parts of Cumberland during the summer and autumn of 1944.

The Goldfinch is still increasing in South Westmorland in which part of the county a pair nested at Heversham and a family was seen at Arnside in 1944 (J. A. G. Barnes).

THE SISKIN—*Carduelis spinus* (L.)

Siskins were under observation in a Westmorland dale from 17 to 24 July 1944, three together in the top of a tall fir being the most seen at any one time. Birds were present at the place where first seen, and another in the dale, in late April 1945 (M. G. Robinson, *British Birds*, Vol. 39, p. 150).

In the same dale, in April 1946, at least five pairs of Siskins were traced, and two nests discovered through watching birds carrying building materials (J. R. Cooper).

The first account of the Siskin as a nesting bird in Westmorland.

THE BRITISH TWITE—*Carduelis flavirostris pipilans* (Latham)

A Twite, a solitary bird, was seen at Finsthwaite, North Lancashire, in January 1945 (D. Pedder).

THE COMMON CROSSBILL—*Loxia curvirostra curvirostra* L.

A nest containing four eggs was found in one of some old pines, at 1500 feet on a Cumberland fell, on 12 March 1944. A pair of Crossbills were at the same place on 4 March 1945 (Ernest Blezard).

A Crossbill was heard at Melkinthorpe on 1 April, another seen at Patterdale, both in Westmorland, in July, and a party of four seen near Loweswater, Cumberland, on 6 August, all in 1944 (M. G. Robinson).

THE CORN-BUNTING—*Emberiza calandra* L.

At Skinburness, Cumberland, on 5 February 1945, there were eighteen Corn-Buntings in a hedgerow. Then, on 14 February, there were forty-two there together with six Yellow-Buntings and

one Reed-Bunting while, in an adjacent field, there were at least twenty-five more Corn-Buntings (K. D. G. Mitchell).

Notable winter flocking in a coastal district.

THE CIRL BUNTING—*Emberiza cirius cirius* L.

A bird at Buttermere, Cumberland, on 14 June 1936 was, from such observations as were possible, taken to be a Cirl Bunting. Its black bib was obvious enough and it was feeding in tree tops (Walter Griffiths).

THE YELLOW WAGTAIL—*Motacilla flava flavissima* (Blyth)

In May 1945 a pair of Yellow Wagtails were apparently established by the River Petteril within the Carlisle city boundary, and a family party were seen at the same place in October (Ritson Graham).

A Yellow Wagtail was noted for the first time at Gilsland, North Cumberland, on 14 June 1945 (G. A. K. Hervey).

On 28 August 1945, more than a hundred Yellow Wagtails, halted on passage, were feeding along a strip of grassy shore at Anthorn, in Moricambe Bay, Solway (T. L. Johnston and R. Martindale).

THE PIED WAGTAIL—*Motacilla alba yarrellii* Gould

Near Holme Head, Carlisle, a dense growth of willows, osiers and shrubby alders runs along the right bank of the River Caldew for some four hundred yards. This line of bushes has been known to R. Martindale for fully thirty years as an autumn roost of large numbers of Pied Wagtails. It is at times shared by Swallows and Sand-Martins and is deserted as the leaves begin to fall.

On the evening of 14 September 1943, the total of Pied Wagtails that came in to roost was not far short of seven hundred. The birds all came from a north-easterly direction, up river, and away from the city, and in a succession of parties varying in number from six to more than sixty (T. L. Johnston, E. Blezard and N. F. Ellison, *North Western Naturalist*, Vol. 18, p. 206).

The numbers of Pied Wagtails using the roost during the autumns of 1944 and 1945 were well below those of 1943.

THE BRITISH TREE-CREEPER—*Certhia familiaris britannica* Ridgw.

A Tree-Creeper's nest, containing six eggs on 30 April 1944, at Finglandrigg, Cumberland, was only fifteen inches above ground in a vertical crevice in a railway sleeper which had at some time served as a gate post (E. Blezard and R. A. Carr-Lewty).

THE BRITISH NUTHATCH—*Sitta europæa affinis* Blyth

A Nuthatch was several times seen during 1945 at Seathwaite, North Lancashire (J. Longmire) and once, in the vicarage garden there, in the early spring of 1946 (John Ford).

THE BRITISH WILLOW-TIT—*Parus atricapillus kleinschmidti* Hellm.

The Willow-Tit was recognised at Gilsland in 1944 (G. A. K. Hervey). A pair were seen near Blencowe on 27 April 1944 (M. G. Robinson), a single bird at the south end of Derwentwater in June 1944 (A. Graham Brown), and a pair at the north end of this lake in September 1944 (N. F. Ellison).

A Willow-Tit was identified beyond doubt, by the side of Coniston Water, in May 1943 (Walter Griffiths). This is the first record to be received of the Willow-Tit in North Lancashire, while of the four above, from Cumberland, the Gilsland record extends the known range of the bird towards the northern limits, and the other three towards the middle of Lakeland.

THE GREAT GREY SHRIKE—*Lanius excubitor excubitor* L.

A visitor at an uncommon time of year, a Great Grey Shrike was seen at Watendlath, Cumberland, on 18 June 1944 (A. Graham Brown, *British Birds*, Vol. 38, p. 199).

THE WAXWING—*Bombycilla garrulus garrulus* (L.)

The Waxwing invasion of late 1943 barely reached Lakeland, only two occurrences being recorded, both from Cumberland. There were two Waxwings with Fieldfares and Redwings at Penrith on 14 November (M. G. Robinson, *British Birds*, Vol. 38, p. 34) and one, solitary, at Little Corby on 22 November (F. A. Lowe).

A single Waxwing was closely viewed at Hale Hall, Egremont, Cumberland, on 25 November 1945 (St John R. B. Walsh, *The Field*, 22.12.1945, p. 662, and *British Birds*, Vol. 39, p. 177).

THE PIED FLYCATCHER—*Muscicapa hypoleuca hypoleuca* (Pall.)

Three pairs of Pied Flycatchers at Seathwaite in the Duddon valley, North Lancashire, in 1944, all nested in stone walls (Kenneth R. Burgess).

A pair of Pied Flycatchers nested in the Belah valley, Kirkby Stephen, Westmorland, in 1945 (Walter Thompson).

The first note is additional information on distribution in the south-west of Lakeland and the second goes towards filling a gap in the Pennine region.

THE BRITISH GOLDCREST—*Regulus regulus anglorum* Hart.

A nest found in Westmorland in May 1946 was in a Scots pine, a kind of tree seldom chosen, and not suspended but built on the top of a branch much in the style of a Chaffinch nest (J. R. Cooper).

THE WILLOW-WARBLER—*Phylloscopus trochilus trochilus* (L.)

An exceptionally early Willow-Warbler was seen and heard at Blackwell, Carlisle, on 22 March 1944 (Dorothy Blezard).

Following arrivals were plentiful in Cumberland by 9 April.

THE LESSER WHITETHROAT—*Sylvia curruca curruca* (L.)

One or two Lesser Whitethroats are usually to be heard in spring at Arnside where, in 1944, one sang throughout May and most of June (H. Chawner).

The Lesser Whitethroat is a familiar bird in the Grasmere district, and in Langdale where there was a nest of five young in 1944 (Alan F. Airey).

All are Westmorland records.

THE BLACKBIRD—*Turdus merula merula* L.

An adult male Blackbird, in all white plumage, but with normally coloured eyes, given to the Carlisle Museum by Andrew Barclay, was picked up at Oxenholme, Westmorland, on 20 April 1943.

THE SAND-MARTIN—*Riparia riparia riparia* (L.)

Sand-Martins nesting in various walls, all within the boundary of Carlisle, provide the first instances of the kind to be recorded from Lakeland.

In 1939, several pairs were nesting in tubular drain tiles set in a four foot concrete wall built against the bank of the River Eden at Etterby. The two rows of tiles in the wall, one and a half and two and a half feet above water level, were in use (George Walton).

In 1944, at least four pairs were nesting in drainage holes, six and eight feet up, in a twenty-foot stone retaining wall at the Citadel Railway Station (Frank Ashton). This wall, which is faced across a narrow street by a similarly high wall, and right in the heart of the city, was reoccupied in 1945 and 1946. Also in 1946, three pairs of Sand-Martins came to nest in drainage holes, three and six feet up, in the stonework of St Nicholas Bridge (T. R. Stewart), and three pairs in drainage holes in a railway retaining wall by the River Caldew (R. Martindale).

A pair of Sand-Martins, away from any others, nested in an old Kingfisher tunnel by the River Petteril, near Carlisle, in June 1943 (Ritson Graham).

Order APODIFORMES.

Sub-Order APODES.

THE SWIFT—*Apus apus apus* (L.)

For several years Swifts have been known to nest in old copper mine galleries at Coniston, North Lancashire. There were

about thirty birds at this unusual kind of nesting place at the end of the breeding season of 1945 (V. Curry and J. Taylor).

A Swift was in active, hawking flight at Harraby, Carlisle, on 12 November 1945 (W. H. Little). It is likely to have been this bird again that was seen about the same road in the city for several days up to 20 December 1945 (D. Stordy).

Order CORACIIFORMES.

Sub-Order CORACII.

THE HOOPOE—*Upupa epops epops* L.

A Hoopoe, which arrived on 2 May 1946, stayed two days in a garden at Windermere, Westmorland (A. Somervell).

Order PICIFORMES.

Sub-Order PICI.

THE GREEN WOODPECKER—*Picus viridis pluvius* Hart.

Records in south to north order indicate a spread of the Green Woodpecker in East Cumberland.

At different points near Penrith, one was seen on 7 August 1943, and one from 5 to 14 April 1944 (M. G. Robinson).

A pair nested at Cotehill in 1943 (E. Lowe).

In the Gelt valley, the bird was noted about Edmond Castle during 1943 (W. Armstrong) and seen once at Middle Gelt in 1944 (G. A. K. Hervey).

An adult male, given to the Carlisle Museum, was picked up on 12 March 1944 in the vicinity of the Gelt at Hayton where, in the following May, a pair had young in a large ash tree. There were later estimated to be eight Green Woodpeckers in the wood (John Dixon).

There had been one at Walton Wood from October 1944 (T. E. Oliver) and then, in June 1945, three were noted there (Ritson Graham).

Reports have one at Gilsland in February 1945 and, back from the north of the county to the Caldew valley, one at Dalston in March 1945.

In East Westmorland, during the summer of 1945, the bird was constantly about Mallard House, Temple Sowerby (J. Oliver Wilson).

THE BRITISH GREAT SPOTTED WOODPECKER—

***Dryobates major anglicus* (Hart.)**

In 1944 several pairs of Great Spotted Woodpeckers nested around Seathwaite, North Lancashire, where the bird had been remarked as very rare during the previous three years (Kenneth R. Burgess).

THE BRITISH LESSER SPOTTED WOODPECKER—
Dryobates minor comminutus (Hart.)

A Lesser Spotted Woodpecker was under observation for a quarter of an hour as it moved about hedgerow trees, near Carlisle, on 4 August 1944 (R. H. Brown).

In Westmorland, one was seen at Rydal during the summer of 1944 (R. E. Porter), and one at Milburn in December 1945 (J. Oliver Wilson).

Order STRIGIFORMES.

THE LITTLE OWL—*Athene noctua vidalii* A. E. Brehm

The Little Owl has been turning up widely in Cumberland. One was trapped near Cumrew on 25 October 1943 (F. Wheelians) and, at Cummersdale, Carlisle, where one was caught and released again in December 1943, another was flushed on 8 January 1945 (E. Brown).

A female, given to the Carlisle Museum by Mrs Inglis, was trapped at Unthank, Dalston, on 25 January 1944 (Robert Thow).

Twice during the spring of 1945 a Little Owl was seen in a wood by Loweswater (W. C. Lawrie).

Other Little Owls have recently been reported from the Dalston district, and one from Buttermere.

THE SHORT-EARED OWL—*Asio flammeus flammeus*
(Pontopp.)

A nest, containing six young, was found in the Westmorland Pennines on 26 June 1943, and a Short-eared Owl was several times seen at the same place in June 1945 (Walter Thompson).

Order FALCONIFORMES.

Sub-Order FALCONES.

THE MERLIN—*Falco columbarius aesalon* Tunst.
Correction. Birds of Lakeland, p. 73.

The two Merlins recovered, one in Lancashire the other in France, were after all ringed on the Yorkshire and not the Westmorland part of the Howgill Fells (Ingram Cleasby, ringer).

For the third winter over a period of some years, an adult male Merlin was noted in February 1944 to be resorting to the identical bush in a clump of willows by the River Caldew where it flows through large railway marshalling yards in the city of Carlisle (Ritson Graham).

THE GOLDEN EAGLE—*Aquila chrysaëtus chrysaëtus* (L.)

A Golden Eagle passed within close range as it flew over Nab Scar, Rydal, Westmorland, on 17 April 1912 (Richard Clapham).

THE ROUGH-LEGGED BUZZARD—*Buteo lagopus lagopus*
(Pontopp.)

A Rough-legged Buzzard, flying from west to east, passed over Tailbridge Fell, Westmorland Pennines, on 24 June 1945 (Walter Thompson).

An unusual time of year, but the bird was satisfactorily identified with the aid of field glasses.

THE COMMON BUZZARD—*Buteo buteo buteo* (L.)

In the return of the Buzzard to the Eden valley, Cumberland, a pair successfully nested at a new place in 1943 and two pairs attempted at others in 1944 (W. F. Davidson and M. G. Robinson).

Two pairs nested in 1944, and three pairs in 1945, in the East Westmorland haunt which had its first known nesting pair in 1937 (Walter Thompson).

A ground nest, simply a scrape lined with tufts of grass, and containing three eggs, was found on a Westmorland fell side in 1919 (Richard Clapham).

THE HEN HARRIER—*Circus cyaneus cyaneus* (L.)

In Cumberland, a Hen-Harrier, in brown plumage, was seen on a coastal moss on 9 April 1944 (Ernest Blezard), and another, in male dress, near Keswick, in August 1944 (J. A. Graham).

Order CICONIIFORMES.

Sub-Order ARDEÆ.

THE COMMON HERON—*Ardea cinerea cinerea* L.

A newly established heronry near Eden Lacy in the Eden valley, Cumberland, the reported site of one nest in 1943, had five nests on 25 April 1944 (M. G. Robinson).

The Crofton heronry, near Carlisle, which had fourteen nests at the time of the Census in 1928, had only three in 1945 (L. Thompson).

There were ten nests in 1945 and twelve in 1946 in a Cumberland Solway region heronry which began with two nests in 1929 and still had two in 1943 (T. L. Johnston).

Both newly known sites in Cumberland, one at Inglewood, Penrith, had two nests and one at Sowerby Row had one nest in 1946 (W. F. Davidson).

The heronry at Temple Sowerby, Westmorland, had increased from three nests in 1941 to eight in 1944 (M.G.R. and W.F.D.) and had dropped to five in 1946 (W.F.D.).

There were two nests in Deepdale, Westmorland, in 1946 (W.F.D.).

THE LITTLE BITTERN—*Ixobrychus minutus minutus* (L.)

Macpherson in his *Fauna* says John Hancock informed him that a Little Bittern was captured on the River Petteril, Cumber-

land, in 1850, and that a note by T. C. Heysham placed the date about three years earlier, in July. The history of this bird, which is in the Hancock Museum, Newcastle-upon-Tyne, has been cleared by G. W. Temperley who has come across the following entry in some old notes from a diary of John Hancock:—

“Little Bittern. A specimen of this bird was shot in Cumberland near Woodside about 18 October 1847 which I saw fresh in the hands of Mr Duncan, birdstuffer.” After fully describing the bird in first plumage, the note goes on—“No shot marks on the body in any part. Said to be shot by Mr Losh at Woodside about 18 October 1847.”

The specimen is labelled “First plumage, Carlisle, 1850,” and in R. Howse’s *Index Catalogue of the Birds in the Hancock Collection*, 1899, there is the further note about it—“This bird was caught by a dog on the River Petteril.”

Heysham’s note goes back to 1847, the year in which Hancock examined the fresh specimen but, as Mr Temperley points out, July would be too early to find a juvenile bird in this country and Hancock’s “about 18 October” much more likely to be correct. He adds as probable that the year 1850 on the data label refers to the time the specimen was given to Hancock.

The date of the occurrence can now be given as October 1847. Cf. *Fauna of Lakeland*, p. 226, and *Birds of Lakeland*, p. 82.

Order ANSERIFORMES.

Sub-Order ANSERES.

Birds of this Order have lately taken to visiting Whins Tarn in much greater numbers and more variety than they used to do. The tarn has been made more open in recent years by the felling of surrounding timber. The following counts made by M. G. Robinson during a passage period show how attractive this sixty acre sheet of water in East Cumberland has become.

- 31 March 1944.—4 Whooper Swans, 8 Mute Swans, a few Mallard and a few Teal, 1 Gadwall, 150 Wigeon, 8 Shoveler, 1 Common Pochard, 23 Tufted Duck, 11 Goosanders.
- 5 April 1944.—4 Whooper Swans, 7 Mute Swans, 4 Sheld-duck, 20 Mallard, 2 Gadwall, 50 Teal, 150 Wigeon, 2 Pintail, 10 Shoveler, 4 Common Pochard, 40 Tufted Duck, 15 Golden-eye, 16 Goosanders, 1 Smew.
- 7 April 1944.—1 Mute Swan, a small number each of Mallard and Teal, 100 Wigeon, a Shoveler or two and a few Tufted Duck.

THE WHOOPER SWAN—*Cygnus cygnus* (L.)

On the four days, 15 to 18 January 1940, and during a period in which twenty-eight degrees of frost were registered, nine, thir-

teen, sixteen and five Whoopers respectively were counted on Windermere, near Calgarth (H. Tetley).

Movements of Whoopers among the Westmorland lakes were noted in the winter of 1943-44. In November there were nine, and in December seven birds on Elterwater. On 1 January twelve came to Elterwater from Little Langdale Tarn where they had been seen only half-an-hour earlier. After early January no Whoopers were seen on Elterwater but, through February and March, seven to eleven moved to and fro between Rydal Water and Grasmere. By 28 March there were none on any of these waters (Alan F. Airey).

There was a solitary Whooper on Derwentwater so late in the year as 30 June and 1 July in 1944 (A. Graham Brown, *British Birds*, Vol. 38, p. 199), and there were four on Bassenthwaite Lake on 11 April 1945 and again on 3 November 1945 (J. A. Graham).

Six Whoopers spent two weeks or more on Skeggs Water in February 1945 (Marjory Garnett), and others were reported on this water in February 1946.

In 1946 there were nearly forty Whoopers on Derwentwater in January and a similar number, possibly the same birds, on Bassenthwaite Lake in March (G. A. K. Hervey).

BEWICK'S SWAN—*Cygnus bewickii bewickii* Yarr.

Correction. Birds of Lakeland, p. 84.

The dates for a Bewick's Swan cygnet on Whins Tarn should be 21 January to 2 April 1943, not 1942.

There were two adult Bewick's Swans on the same tarn on 15 January 1944 (M. G. Robinson).

THE CANADA GOOSE—*Branta canadensis canadensis* (L.)

"Crofton Hall . . . the park of 142 acres is well stocked with deer, and has an ornamental lake of 9 acres containing tench, carp and other fish; a flock of swans, Canada geese and wild ducks is also preserved here, and on an island in the lake is a fine heronry." *Kelly's Directory of Cumberland*, 1894, p. 248.

Two Canada Geese paid a brief visit to Upperby Park, Carlisle, in April 1946 (Joseph Howe).

THE SHELD-DUCK—*Tadorna tadorna* (L.)

On three occasions in April 1944 six pairs of Sheld-duck were noted at Boretree Tarn, North Lancashire (D. Pedder).

An additional inland haunt for the species.

THE GADWALL—*Anas strepera* L.

A pair of Gadwall were on a pond at Hutton-in-the-Forest on 1 May 1944; twenty-six on Whins Tarn, the most yet seen there, on 28 October 1944, and fourteen on a pond at Greystoke on 4 April 1945 (M. G. Robinson).

A female was flushed from a pond between Penrith and Grey-stoke on 19 December 1945 (H. Mellor), and another seen on Thurstonfield Lough on 10 February 1946 (Ritson Graham). A pair were on the Hutton pond on 28 April 1946 (E. Blezard and P. S. Day).

These occurrences, all in Cumberland, show still more progress by the Gadwall.

THE TEAL—*Anas crecca crecca* L.

There were two hundred Teal on Whins Tarn in mid-November 1944 (W. F. Davidson).

A late date for so many to be seen together.

THE GARGANEY—*Anas querquedula* L.

A drake Garganey was in the company of several Wigeon at Bassenthwaite Lake on 10 April 1944 (H. G. Alexander, *British Birds*, Vol. 38, p. 17).

There were two drakes on Whins Tarn on 24 March 1945 (M. G. Robinson) and they were again seen next day by the same observer and W. F. Davidson. One Garganey was still present on 2 April.

THE WIGEON—*Anas penelope* L.

During the winter of 1943-44, Wigeon were on the Solway in exceptionally large numbers, perhaps thousands where normally hundreds.

On Windermere, in January 1940, some few Wigeon were attendant on the Whoopers there when they were feeding close inshore, presumably to share in the aquatic vegetation pulled up by the swans (H. Tetley).

A pair of Wigeon were on Skeggles Water, Westmorland, on 27 July 1944 (Marjory Garnett), and fourteen pairs on Bassenthwaite Lake on 11 April 1945 (J. A. Graham).

In mid-December 1945, three pairs of Wigeon spent several days on the pond in Upperby Park, in Carlisle (E. Blezard and J. Howe).

THE RED-CRESTED POCHARD—*Netta rufina* (Pall.)

A juvenile male Red-crested Pochard, which is preserved at Castletown, was shot on Rockcliffe Marsh, Cumberland, on 6 October 1934 (R. H. G. Mounsey-Heysham).

THE COMMON POCHARD—*Aythya ferina* (L.)

Three Pochard, two drakes and a duck, were noted on Elterwater, Westmorland, in June 1944 (Alan F. Airey).

THE SCAUP-DUCK—*Aythya marila marila* (L.)

On Whins Tarn in 1943 there was a female or immature Scaup on 7 November, and a drake in company with Tufted Ducks on 5 December (M. G. Robinson).

A female was seen on Windermere on 27 November 1944, and three adult females, very early arrivals, on Sunbiggin Tarn on 11 October 1945 (Marjory Garnett).

All interesting as inland occurrences.

THE GOLDENEYE—*Bucephala clangula clangula* (L.)

Two very early Goldeneye, described as a pair by the shooter of one of them, were in the River Eden at Rockcliffe, Cumberland, on 26 August 1944. The bird obtained, and which was examined on the spot by the Editor, was a drake in eclipse.

A flock of from fifty to sixty Goldeneye, including seven or more adult drakes, frequented the west side of Windermere, near Wray, during November 1945 (Marjory Garnett).

THE LONG-TAILED DUCK—*Clangula hyemalis* (L.).

A Long-tailed Duck, an immature drake, was at Arnside on 3 April 1944 (J. A. G. Barnes).

THE COMMON SCOTER—*Melanitta nigra nigra* (L.)

Three Common Scoters, all drakes, were on Grisdale Tarn, Westmorland, on 3 September 1935 (T. Tetley).

As another inland occurrence, an adult drake was shot, on 11 December 1944, at the place where the River Eamont joins the Eden on the Cumberland and Westmorland boundary (H. Musgrave).

During the latter half of April and in early May 1944 great numbers of Scoters were congregated in the upper Solway, off the point of Rockcliffe Marsh. The birds were described by the marsh herdsman as being in thousands, and considerable numbers were seen by Ritson Graham to be still present on 9 May.

THE VELVET-SCOTER—*Melanitta fusca fusca* (L.)

A Velvet-Scoter was at Arnside on 29 January 1944 (J. A. G. Barnes).

THE RED-BREASTED MERGANSER—*Mergus serrator* L.

Seven Red-breasted Mergansers, three of them drakes, were seen at Foulshaw, Westmorland, on 7 March 1946 (Marjory Garnett).

Order PELECANIFORMES.

Sub-Order PELECANI.

THE CORMORANT—*Phalacrocorax carbo carbo* (L.)

Conclusive evidence of the nesting of the Cormorant at St Bees Head, Cumberland, a half-grown young one, with an adult, was apparently being fed when seen on 21 May 1945 (W. C. Lawrie).

Four Cormorants were on Derwentwater on 27 June 1944 (A. Graham Brown).

THE SHAG—*Phalacrocorax aristotelis aristotelis* (L.)

A Shag at Arnside, from 12 October to 1 November 1943, and at first apparently oiled, seemed fully recovered before it left (J. A. G. Barnes).

THE GANNET—*Sula bassana* (L.)

Gannets intent on fishing offshore from St Bees Head now seem to be of regular occurrence. Four were seen together on 27 June 1946 and single birds on two occasions earlier in the month (J. H. Vine Hall). Single birds were previously noted at St Bees in July 1939, June 1940 and May 1941 (Ralph Stokoe), and a later one at Skinburness in August 1946 (R. C. Hunt). These visitors may be attributed to the Scar Rocks colony, Wig-town, where more than sixty nesting pairs were counted in 1946 by M. Rowling.

A juvenile female Gannet was found dead at Stainton, Carlisle, on 7th October 1944 (James Finlay), an adult on the coast at Fleswick in May 1945 (J.H.V.H.), and an adult male at Mossband on 26 September 1945 (H. Whiteside). All are Cumberland occurrences and the birds from Stainton and Mossband are preserved in the Carlisle Museum.

Order PROCELLARIIFORMES.THE FULMAR PETREL—*Fulmarus glacialis glacialis* (L.)

An injured Fulmar, proved a female after received at the Carlisle Museum, was caught in the Wampool estuary, Cumberland Solway, on 27 May 1944 (James Storey).

Seven or eight pairs of Fulmars were seen at St Bees Head in 1945, but seemingly none of these birds laid eggs and they all left the place about 20 July (J. H. Vine Hall). In 1946 there were at least as many pairs present by 10 April (J.H.V.H.), and fully twenty pairs in June (Ralph Stokoe).

Order PODICIPITIFORMES.THE GREAT CRESTED GREBE—*Podiceps cristatus cristatus* (L.)

A pair of Great Crested Grebes were giving courtship display on Elterwater in May and June 1944 (Alan F. Airey).

There was a nest with three eggs on Rydal Water in June, and two young with their parents in July 1945 (G. A. K. Hervey). Both these waters are in Westmorland.

Tindale Tarn, in East Cumberland, had a pair of Great Crested Grebes on 30 March 1946 (G.A.K.H. and M. G. Robinson).

THE RED-NECKED GREBE—*Podiceps griseigena griseigena*
(Bodd.)

A Red-necked Grebe was diving in the lake near Low Wray Bay, Windermere, on 4 November 1945 (P. H. T. Hartley).

THE SLAVONIAN GREBE—*Podiceps auritus* (L.)

A Slavonian Grebe, its bill and cheeks seen well enough to establish identity, was noted in the Kent estuary on 3 and 5 November 1945 (J. A. G. Barnes).

Order COLUMBIFORMES.

Sub-Order COLUMBÆ.

THE ROCK-DOVE—*Columba livia livia* Gm.

Two Rock-Doves flushed from the shore at Allonby, Cumberland, in August 1945, headed towards breeding haunts on the opposite side of the Solway (W. L. Finch).

THE TURTLE-DOVE—*Streptopelia turtur turtur* (L.)

There were two Turtle-Doves at Arnside on 19 May, and three on 21 May 1944 (H. Chawner and J. A. G. Barnes).

Another Turtle-Dove seen in Westmorland was at Skelwith Bridge on 15 June 1945 (P. S. Day, R. D. Humber and W. R. Laidler).

Order CHARADRIIFORMES.

Sub-Order CHARADRII.

THE BLACK-TAILED GODWIT—*Limosa limosa limosa* (L.)

Two Black-tailed Godwits were seen in the Wampool estuary, Solway, on 24 September 1944 (Ernest Blezard), and one in the Kent estuary during September 1945 (J. A. G. Barnes and J. C. S. Ellis).

THE COMMON CURLEW—*Numenius arquata arquata* (L.)

Particulars from Sweden of two more Curlews ringed there and recovered in Cumberland have been obtained by the British Trust for Ornithology and kindly supplied by Miss E. P. Leach.

Ringed 13 June 1943 at Ottenby, Oland, recovered 23 December 1944 on Beaumont Marsh (W. B. Reed).

Ringed 1 July 1942 near Orebro, recovered 6 January 1945 at Crosby-on-Eden (T. Thompson).

THE WOODCOCK—*Scolopax rusticola* L.

A good many Woodcock nest on the bracken-covered fells on both the North Lancashire and Cumberland sides of the Duddon in the neighbourhood of Seathwaite (Kenneth R. Burgess).

THE NORTHERN DUNLIN—*Calidris alpina alpina* (L.)

A Dunlin killed against wires, and from a flock of about three hundred at Arnside, on 14 August 1944, gave measurements placing it to the Northern race (J. A. G. Barnes).

THE CURLEW-SANDPIPER—*Calidris testacea* (Pall.)

Five Curlew-Sandpipers, which kept aloof from other shore birds, were in the Kent estuary from 12 to 17 September 1943 (J. A. G. Barnes and H. Chawner), and three were seen there in September 1945 (J.A.G.B. and J. C. S. Ellis).

THE LITTLE STINT—*Calidris minuta* (Leisl.)

In the Kent estuary, at Arnside, were seen two Little Stints in full summer plumage, on 28 May 1943; two juveniles associating with Dunlin from 7 to 11 September 1943; one juvenile on 16 September 1944 (J. A. G. Barnes and H. Chawner), one in September 1945 (J.A.G.B. and J. C. S. Ellis) and a late bird on 14 October 1945 (J.A.G.B.).

A party of eighteen Little Stints, with two Dunlin nearby, were on the Cumberland coast north of Maryport on 24 August 1945 (G. A. K. Hervey).

THE RUFF—*Philomachus pugnax* (L.)

Two juvenile Ruffs were in the Kent estuary on 7 and 8 September 1944 (J. A. G. Barnes and J. C. S. Ellis).

THE WOOD-SANDPIPER—*Tringa glareola* L.

A Wood-Sandpiper was twice flushed at Penrith Sewage Farm, Brougham, Westmorland, on 30 August 1945, and the second time flew across the River Eamont into Cumberland. It gave a clear view and called during each flight. Its visit, similarly to the arrival of ducks uncommon in the district, came after an easterly wind (M. G. Robinson and W. F. Davidson).

The first recorded occurrence of the Wood-Sandpiper in Westmorland (M.G.R., *British Birds*, Vol. 39, p. 57).

THE GREEN SANDPIPER—*Tringa ochropus* L.

A Green Sandpiper was flushed from a flooded gravel pit by the River Caldew at Dalston, near Carlisle, on 11 July 1944 (Ernest Blezard).

THE SPOTTED REDSHANK—*Tringa erythropus* (Pall.)

A Spotted Redshank, a juvenile, was in the Kent estuary on 8 September 1944, and there were two there in September 1945 (J. A. G. Barnes and J. C. S. Ellis).

THE GREENSHANK—*Tringa nebularia* (Gunn.)

An early Greenshank, slightly lame, appeared in the Kent estuary on 16 July 1943 and was joined by another on 24 July,

from which date two or three Greenshanks, including the lame one, were present until 20 September. A Greenshank remained in the Kent during conditions of hard frost until 24 January 1945, and one was present in November 1945 (J. A. G. Barnes).

Two Greenshanks were noted on spring passage in Cumberland in 1944; one at Anthorn on 7 May (James Storey), and one at Thurstonfield Lough on 9 May (T. L. Johnston and N. F. Ellison).

THE DOTTEREL—*Eudromias morinellus* (L.)

There were two Dotterel near the cairn on Black Combe, 1969 feet, in South-west Cumberland, on 3 October 1930 (John S. Gayner).

An autumn record of special interest.

A trip of four Dotterel were at 2250 feet on one of the higher central fells, on 8 May 1944 (Alan F. Airey).

THE LAPWING—*Vanellus vanellus* (L.)

A Lapwing in all white plumage, save for a buff tinge above, was with a flock at Durdar, Carlisle, on 10 January 1946 (Joseph Howe).

THE BRITISH OYSTER-CATCHER—*Hematopus ostralegus occidentalis* Neum.

A nest of three eggs was found on 7 May 1944 in Mallerstang, Westmorland, at a place where a pair of Oyster-catchers had been seen in June 1937 (Walter Thompson).

This means that, after moving up in stages, the Oyster-catcher as a nesting bird has now reached the headwaters of the River Eden, sixty miles or more from the mouth.

The freshly picked remains of an Oyster-catcher, presumably a victim of a bird-of-prey, were found near the top of Grassmoor, 2791 feet, in August 1944 (Frank Ashton).

Sub-Order LARI.

THE BLACK TERN—*Chlidonias niger niger* (L.)

A juvenile Black Tern was seen in the Kent estuary on 17 September 1943. At the same place, near Arnside, there were, in 1944, five Black Terns, juveniles or birds in winter dress, on 29 August; four, including one showing a considerable amount of black, on 1 September; three on 7 September, and two, juveniles, from 27th September to 3 October (J. A. G. Barnes, H. Chawner, and J. C. S. Ellis).

During the autumn of 1945 only one Black Tern, a September visitor, was seen in the Kent (J.A.G.B. and J.C.S.E.).

Two adult Black Terns, after one a little earlier in the month, were noted on 11 June 1946 at Bowness-on-Solway (William Storey).

THE LITTLE GULL—*Larus minutus* Pall.

An immature Little Gull was flying over Helm Crag, Grasmere, and towards Dunmail Raise and the north, on 24 December 1943 (Ingram Cleasby).

Another immature held interested attention at Arnside from 24 to 26 March 1946 (J. A. G. Barnes).

These are the first really definite Westmorland records and that of the Grasmere bird is also the first for the central region of Lakeland.

THE HERRING-GULL—*Larus argentatus argentatus* Pont.

A Herring-Gull with almost pure white upper plumage, but showing a faint trace of the mirror pattern at the wing tips, was in the breeding colony at St Bees Head in April 1944. By the colour of the bill and legs the bird was fully adult (H. G. Alexander).

Undoubtedly the same albinistic bird was back at the Head and presumably breeding in May 1945 (J. H. Vine Hall).

THE SCANDINAVIAN LESSER BLACK-BACKED GULL—

Larus fuscus fuscus L.

Two to four adult Scandinavians frequented Carlisle refuse tips, in company with Herring-Gulls, during the winter 1944-45. There were often four together in February 1945, and there were five together on 5 January 1946 (R. Martindale).

THE BRITISH LESSER BLACK-BACKED GULL—

Larus fuscus graellsii Brehm

A Lesser Black-back having a large white patch on each wing, and presumably the same bird mentioned in *The Birds of Lakeland*, p. 145, as being at Carlisle in 1942 and 1943, has come under more notice. In 1944, it was at Carlisle during early April, at Anthorn on the Solway on 5 August, and back at the city from 12 August into September. It was again at Carlisle in August 1945.

A Lesser Black-back, with a distinctive white crescent towards the leading edge of each wing, at Carlisle in August 1945, agreed with a bird seen by E. Blezard in a Solway breeding colony two months earlier (James Storey for Anthorn note; T. L. Johnston and R. Martindale for others).

J. A. G. Barnes in "The Status of the Lesser Black-backed Gull in North-west England and North Wales," *British Birds*, Vol. 38, pp. 342-346, traces a recent development in the mid-winter occurrences of the British Lesser Black-back and discusses passage movements of this bird and occurrences of the Scandinavian Lesser Black-back. Lakeland data are drawn from the Solway region, Windermere, and the estuary of the Kent.

THE GREAT BLACK-BACKED GULL—*Larus marinus* L.

There were more than fifty Great Black-backs, in two groups, in the Kent estuary on 8 October 1944 (J. A. G. Barnes).

Solway nesting haunts are now very nearly deserted and, at any time, the bird is much more numerous on the southern shores of Lakeland.

Inland in Cumberland, there was a solitary Great Black-back over Derwentwater on 20 June 1944 (A. Graham Brown), and two adults at Castle Carrock reservoir on 4 January 1945 (M. G. Robinson and W. F. Davidson).

There was a solitary adult inland in Westmorland at Killington Reservoir on 27 December 1945 (Marjory Garnett).

THE KITTIWAKE—*Rissa tridactyla tridactyla* (L.)

From some twenty pairs in 1932, the Kittiwake colony at St Bees Head has grown to at least six hundred pairs in 1946. On one northern part of the head especially, the birds now occupy all suitable nesting ledges from five to fifty feet up the face (Ralph Stokoe).

Sub-Order ALCÆ.**THE LITTLE AUK—*Alce alle alle* (L.)**

During a spell of wild westerly winds a Little Auk was picked up alive, inland at Harker, Cumberland, on 2 February 1946 and brought to the Carlisle Museum (Noel Coward).

Order RALLIFORMES.**Sub-Order RALLI.****THE CORN-CRAKE—*Crex crex* (L.)**

Corn-Crakes were at least of wide occurrence in Lakeland during 1945.

Cumberland. In the north at Bewcastle, Lanercost (G. A. K. Hervey); to the east at Talkin; in the extreme east at Alston. In the Carlisle district, where four were flushed during harvesting at Drawdykes and Walby (J. Milbourn), birds were also at Newtown, Cummersdale, Westlinton (W. H. Little), Cumwhinton (W. H. Stordy). In mid-county at Southwaite (W.H.S.), Plumpton (W.H.L.), Greystoke (H. Mellor). In the west at Cleator.

Westmorland. At Kirkby Stephen in the east (W. Thompson), and Meathop in the south.

North Lancashire. At Coniston, the first heard there since 1936 (V. Curry).

In 1946 there was a similar number of records from Cumberland. Three Corn-Crakes were noted around Kirkby Stephen (W.T.), and one at Broughton-in-Furness, the first there for a good many years (K. R. Burgess).

Order GALLIFORMES.

Sub-Order GALLI.

THE RED-LEGGED PARTRIDGE—*Alectoris rufa rufa* (L.)

A Red-legged Partridge was shot in the Troutbeck valley, Westmorland, on 14 September 1943 (L. Sewell).

THE QUAIL—*Coturnix coturnix coturnix* (L.)

A Quail was calling in rough pasture at Broadfield near Carlisle, on the evenings of 25 and 27 June 1945 (Ernest Blezard).

ERRATA.

Page 31, line 15, for preglacial, read unglaciated.

Page 39, line 19, for melting, read halting.

Page 46, line 45, for exhausted, read being exhausted.



