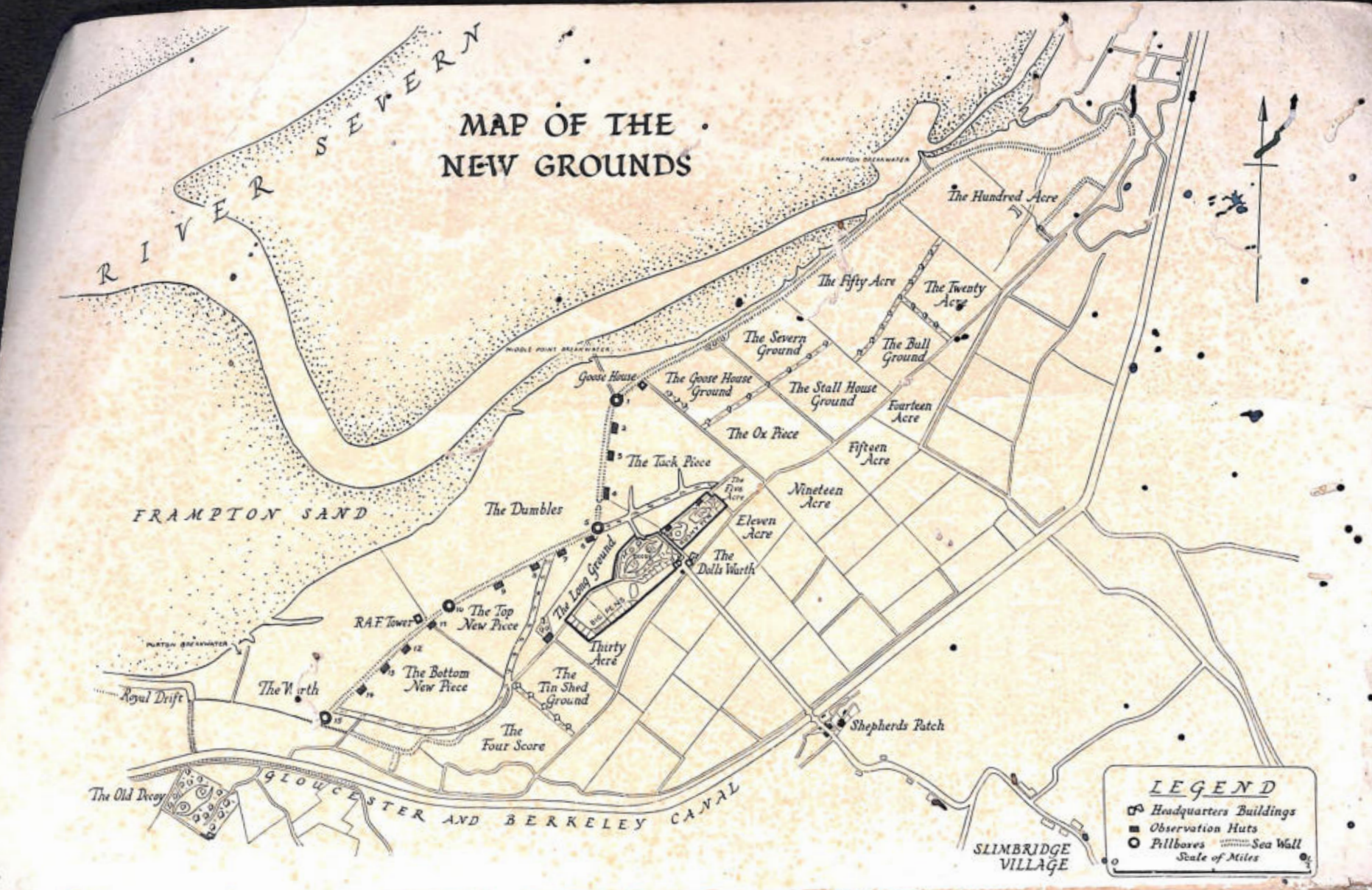
THE WILDFOWL TRUST



SEVENTH ANNUAL REPORT

1953-1954

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MAP OF THE
NEW GROUNDS
RIVER SEVERN
FRAMPTON SAND
The Hundred Acre
The Fifty Acre
The Twenty Acre
The Severn Ground
The Bull Ground
Goose House
The Goose House Ground
The Stall House Ground
Fourteen Acre
The Ox Piece
Fifteen Acre
The Tack Piece
The Dumbles
Nineteen Acre
Eleven Acre
The Long Ground
The Dolls Worth
RAF Tower
The Top New Piece
Thirty Acre
The Bottom New Piece
The Tin Shed Ground
The Worth
Royal Drift
The Four Score
Shepherds Patch
The Old Decoy
GLOUCESTER AND BERKELEY CANAL
SLIMBRIDGE VILLAGE
LEGEND
Headquarters Buildings
Observation Huts
Pillboxes
Sea Wall
Scale of Miles

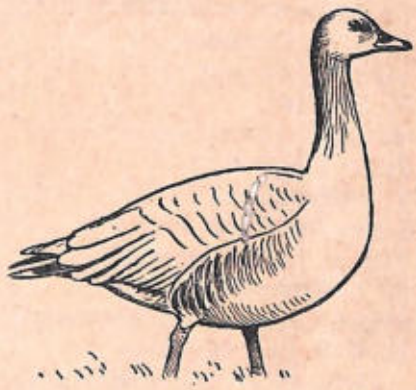
THE SEVENTH ANNUAL REPORT OF

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THE WILDFOWL TRUST

1953–1954

EDITED BY PETER SCOTT
AND HUGH BOYD



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THE WILDFOWL TRUST

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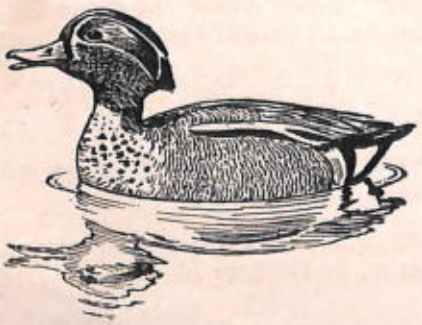
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REPORT

In the course of the year under review the Trust undertook a number of new commitments. These arose from a general reorganisation of the activities of the various bodies dealing with research on wildfowl, which was designed to avoid overlapping and duplication. The new commitments included responsibility for the National Wildfowl Counts—a network of 700 observers who count the wildfowl on selected waters monthly on a prearranged date, and the administration of the highly successful ringing station at Abberton Reservoir in Essex, as well as other ringing stations where ducks are caught. In addition the Duck Adoption Scheme is now operated from Slimbridge. Adopters of ringed ducks or geese have the interest of hearing the details should their bird be recovered, and the satisfaction of knowing that they have given valuable support to the funds which enable the ringing to continue.

The expansion of the Trust's activities was accompanied by a change of name—the word Severn being left out of the title of our society, in order to indicate its national (indeed world-wide) rather than local status. The Council is happy to report that the above changes have been effected smoothly and that meanwhile the Trust's programme of research has been greatly developed under the direction of a newly-formed Scientific Advisory Committee upon which many distinguished scientists have agreed to serve. The chairman of this committee is Sir Landsborough Thomson.

Once more the most important work has been the study of the Pink-footed Goose begun in 1950, and among a number of papers dealing with this species, the Trust's second expedition to the Central Highlands of Iceland, which resulted in the capture for ringing of 9,000 geese, is here reported (pp. 63–98). Indeed so much space has been given to Britain's most numerous wintering wild goose, that the Seventh Annual Report may almost be regarded as a 'Pinkfoot Number.' Apart from the Trust's 1953 Expedition, we are permitted to publish reports of four other expeditions undertaken wholly or in part to find out more about this species of goose. The first is an extract from the diary of S.W.P. Freme who, with W. M. Congreve, originally discovered in 1929 that the breeding geese of Central Iceland were Pinkfeet. The second is an account by G. K. Yeates (a member of the Trust's Scientific Advisory Committee) of a photographic expedition which he made with Col Niall Rankin, to the same areas of the River Skjálfandafljot and its tributaries in 1954. The third is an account of the movements of Pinkfeet in the late summer and autumn of 1954 at the south-west side of the Hofsjökull icecap in the Central Highlands

of Iceland, by two young ornithologists who were nearly snowed up in the mountain hut from which they made their observations. The fourth describes the marking of more than five hundred Pinkfeet, as well as 23 Barnacles and 74 Light-bellied Brents, in Spitzbergen in 1954. Recoveries of some of these Spitzbergen Pinkfeet indicate that their wintering ground is confined almost entirely to the east side of the North Sea, a confirmation of previous theories advanced by the Trust.

The most valuable results of the Pinkfoot study have been obtained from the sampling methods made possible by the rocket-nets. Improvements in this technique are shown in Table I on p. 57. The total catch of 1572 (all Pinkfeet) in 1954 was 281 lower than that of 1953 (1558 Pinkfeet, 294 Greylags, 1 Barnacle) but this was caused by unfavourable weather, flooding, and an unusually long run of bad luck which dogged the expedition of November 1954. The Council is most grateful to all those who have co-operated in the work—to the members of the rocket-netting teams who have now taken part in 11 different expeditions, to the landowners and farmers who have so readily given permission for the teams to operate on their land and to the wildfowlers and others who have taken the trouble to report the recovery of rings.

In the autumn of 1953 it was found that 15·4% of the 1558 Pinkfeet caught in rocket-nets were carrying rings, or about one in six and a half, and as the catches were made in eight different localities, between Montrose in the north and the Wash in the south, it is not unreasonable to suppose that they were approximately representative of the whole British winter population. The proportion of *adult* birds carrying rings in the 1572 Pinkfeet (1049 adults) caught in 1954 was virtually the same, but the young birds could not, of course, have been ringed, and so of the total population in the autumn of 1954 we might expect about one in eight and a half to have been marked. The proportion of rings in a wildfowler's bag would not be so high because young geese are more likely to be shot than adults.

In the course of the whole study 14,800 Pinkfeet have so far been ringed and some 1900 have been recaptured or recovered ; many of them having been heard of more than once. The record is held by a bird which was originally ringed as an adult in Iceland on a hill called Oddkelsalda in July 1951. Subsequently it was caught in Midlothian in November 1952, on Oddkelsalda again in July 1953, and finally on the Solway in October 1954. Five others have been caught three times in the sequence Britain-Iceland-Britain, and one in the sequence Iceland-Britain-Iceland. Being able to regard some of these birds as 'old friends' is one of the most attractive aspects of ringing so large a number of geese. Another pleasant feature is the frequency with which birds evidently paired when ringed, turn up again still paired. Further we have established that at least some young birds may be found associating with their parents over longer periods than the normal first year. Data from recoveries and recaptures of Pinkfeet within Britain during the winter have indicated that there is some degree of persistent segregation between flocks visiting different localities. But the main purpose of the study has been the measurement of population.

Estimates of the total British wintering population of Pinkfeet, and its rates of mortality, based on the large-scale ringing of the past five years are presented in this report in a preliminary form. A more complete paper giving greater detail of the statistical methods employed has been prepared for publication in an appropriate journal. These methods are new in application to bird populations, and in such work a period of at least five years is needed before reliable

results can be expected. Although in the course of lectures and discussions opinions based on early results have been expressed, we have been unwilling to publish the findings in a detailed form until now, because their accuracy increases with the length of the study and the numbers of geese ringed. We were anxious to make sure that the results of the largest-scale ringing of all—the Iceland expedition of 1953—did not conflict with those obtained earlier. In the event they produced only minor modifications.

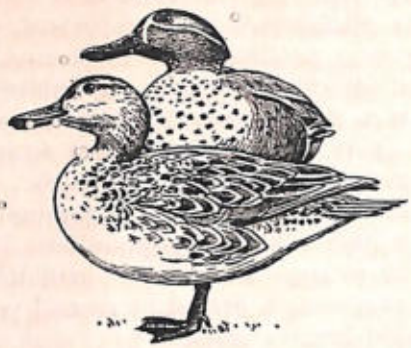
Briefly we believe that there were, at the beginning of October 1953, about 43,000 Pinkfeet in the British wintering population. The standard of accuracy may not be high enough to measure annual fluctuations in populations satisfactorily, but we think that over a period of several years any marked upward or downward trend would become apparent.



We also believe that between 1950 and 1953 the death-rate of adult Pinkfeet was about 26% and of yearlings about 42% in each year, measured from the time they arrive in Britain in October until the following October. This produced an estimated total mortality of 14,000 in 1953 of which there are indications that 12,000 were killed by shooting. These figures have been reached by three different methods of calculation (see pp. 104–105) but are regarded by many shooting men as unbelievably high, and by protectionists as distressingly so. We suggest however that this is not a particularly high figure when compared with bags measured by more direct means in other countries. The Danish Game Statistics, which are contributed by sportsmen, show that the numbers of geese shot annually in that small country in ten years 1941–51 averaged 9200 (6800 being the smallest total and 12,800 the largest). The same records show that in 1951–52 over 403,000 surface-feeding ducks and 55,000 eiders were shot in Denmark. In America bag checks have indicated an annual kill of 221,000 geese in the Pacific flyway and of 16,000 at one specific resort on the Mississippi. By comparison with such figures we do not think that 12,000 Pinkfeet in a season is an unexpectedly high total for the whole of Britain.

Furthermore we are convinced that general recognition of the fact that total shooting bags may be of this order, together with the notion of wildfowl as a natural resource which can be harvested like any other crop, offers the best chance of peaceful co-existence between wildfowlers and bird-watchers and, at the same time, the best chance of continued stocks of wildfowl for the enjoyment of both. Provided that the numbers killed are within the replacement capacity of the birds no disaster will threaten the species from this source. Population measurement and other branches of the Trust's scientific programme are, we believe, as important to the wildfowl stocks as agricultural research is to good farming.

During the rocket-netting expeditions in October and November 1953, the team included Dr W. H. Elder, Professor of Zoology in the University of



Pair of Teal with Hawk overhead

Missouri, who had brought with him the portable X-ray equipment, or fluoroscope, which he has used extensively in the United States. A total of 1476 geese were tested, and it was found that 340 of the 825 adult Pinkfeet (41%) and 60 of the 161 adult Greylags (37%) were carrying shot. In the case of 309 juvenile Pinkfeet which had only been exposed to risk for a few days or weeks, between the time of arrival from Iceland (where virtually none are shot) and the time of the catch, only 4·9% carried shot, and of 99 juvenile Greylags only three carried shot. These geese were weighed and it was found that there was no difference between the average weights of the birds which had been wounded and those which had not. One Pinkfoot carried 23 lead pellets in its body, of three different shot sizes. Another carried an armour-piercing ·303 bullet in the abdomen, and two others had mushroomed ·22 bullets. One bird had a pellet lodged in the brain and one had a pellet in the wall of the heart which moved with each dilation. Perhaps the most remarkable was a Greylag which had nine BB pellets in the head and neck, several of which had been flattened by hitting the vertebrae. It is difficult to understand how this bird had survived, but he flew away strongly on release, as did all the others.

The main value of this study is to measure 'shooting pressure.' Although the relation between the number of shots fired, birds carrying shot and birds killed outright is not known, it is reasonable to suppose that it remains constant (if wildfowling techniques are not greatly altered). Thus if the incidence of body-shot in living geese rises or falls it probably reflects a corresponding rise or fall in the kill. It is particularly interesting to note that the incidence of shot in adult Canada Geese in the Mississippi flyway of North America is almost exactly the same as that in Pinkfeet in spite of the widely different shooting customs and methods on the other side of the Atlantic.

The disclosures of the fluoroscope have shown a degree of wounding in geese to which most sportsmen will not be indifferent and they may therefore be useful in support of a campaign to reduce the number of shots fired at geese at extreme ranges. If such a campaign gains widespread support it may call for a correction in comparative figures of shot incidence. Nevertheless we hope that all wildfowlers will agree to encourage any measures likely to reduce the numbers of wounded birds.

The capture of geese in bulk suggests that as much data as possible should be obtained from them in view of the outlay of time and money involved in catching them. For this reason the age and sex has been recorded in all the rocket-net catches of 1953 and 1954 and the weight was taken of all the British 1953-caught birds. In addition the mycoflora (moulds) found in the mouths

and throats of the geese have been studied, with particular reference to the fungus *Aspergillus fumigatus* which causes the disease Aspergillosis, a frequent cause of death in captive birds. Investigations based on samples taken from 254 Pinkfeet in Iceland and 63 in Britain by W. J. L. Sladen and examined by P. Austwick are reported on pp. 133–138, and further research is being conducted at the New Grounds by J. V. Beer, working for a Ph.D. while holding a Bristol Zoological Society's Scholarship in the University of Bristol. The Trust is extremely grateful for the provision of these facilities and funds.

As during the previous winter a great number of geese, estimated (perhaps inaccurately) at almost 5000 was present on the estuary for only one day. Apart from this influx the highest counts in the winter of 1953–54 were 3800. The most exciting feature of the wild geese in that winter was the appearance of an immature Red-breasted Goose, believed to be only the eleventh authenticated record in Britain. A Spoonbill was present on the Dumbles for several days in October 1953.

The catch of ducks in Berkeley New Decoy was the lowest for some years (only 383 ringed) and the catch in Borough Fen Decoy near Peterborough, where ringing is carried out for the Trust was also disappointing, only about 100 birds being ringed.[1] The future operation of this fine old eight-pipe decoy (the oldest in the country which is still being worked) depends now upon the Trust and a Fund has been launched to keep it going.

This report contains a full account of the history and records of the ringing station at Abberton Reservoir, for which the Trust has now become responsible. General Wainwright who created it and maintains it so efficiently has recently (March 1955) joined the Council. In the past six years no fewer than 26,573 birds have been ringed there, including over 8000 ducks of 13 species. A number of tables (pp. 26–28) give details of this remarkable achievement.

The work of the National Wildfowl Counts is also described by its able organiser, George Atkinson-Willes. The results so far obtained are encouraging and have been submitted to Dr M. R. Sampford of the Lectureship in the Design and Analysis of Scientific Experiment at Oxford for his views on their statistical value—which are also encouraging. It may well be that the greatest value of these counts will not be seen for a good number of years, for figures of this kind are most useful in comparison over a comparatively long period. Meanwhile we are glad to be associated with the work which has already been done by the Regional Organisers (see pp. 31–33) and their enthusiastic band of 700 counters. We hope in the next few years to increase the number of counters and the waters which they cover, and we plan also to establish a register of all waters in Britain, under the title of Operation Waterlog.

The most important birds in the Collection of waterfowl at Slimbridge are still the Ne-nes or Hawaiian Geese. Until very recently news of the last remaining specimens in the wild state in Hawaii was disquieting.

[1]The season 1954–55 has been very much better, 1451 ducks being ringed.

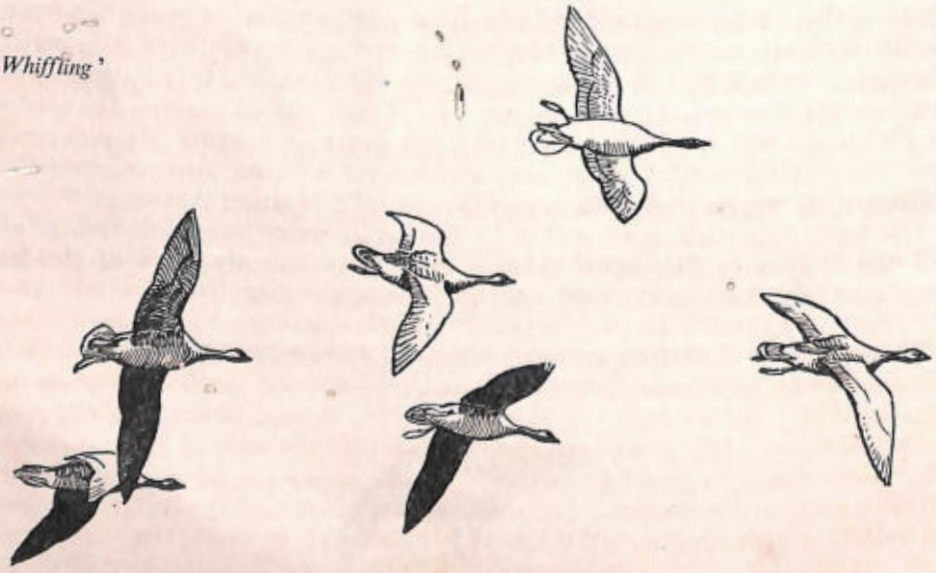


In July 1955, however, a flock of 22 was seen, which is most encouraging. This means that 70 geese are known to exist and the total population of the species may be as much as 100. Of these, 20 are at the New Grounds. The year after the arrival of the first three when nine goslings were reared still remains the most productive, in spite of the fact that some of the younger birds have now begun to breed. The very low proportion of fertile eggs appears to be the principal barrier to increased production.

Behaviour studies have continued at the New Grounds, and many distinguished ethologists visited the Trust during a symposium on animal behaviour held at Oxford in December 1953. A paper by Hugh Boyd was read, and a further paper by him in collaboration with Dr Eric Fabricius is to appear shortly.

In the spring of 1954 Dr Frank McKinney who had spent more than four years working at or in close association with the Trust took up the post of Assistant Director of the Waterfowl Research Station at Delta, Manitoba. This additional link with the Trust's opposite number in Canada is likely to be of great mutual benefit, and we wish Dr and Mrs McKinney all good luck in their new surroundings.

Inevitably the passage of the Protection of Birds Act 1954 through Parliament gave rise to fairly violent conflict on various matters relating to wildfowl. The Trust's efforts to take a long-term view were widely misinterpreted and misrepresented. No useful purpose can be served by reviving memories of the controversy. Since then more moderate counsels have prevailed and we believe that, with good will on both sides, conditions will soon arise in which those interested in the future of wildfowl, whether as bird-watchers or sportsmen, will be able to work together towards the common aim of securing the stock of ducks and geese in perpetuity.



'*Whiffling*'



WILD GEESE AT THE NEW GROUNDS

BETWEEN 20 September 1953 and 27 March 1954, nine species and sub-species of geese were recorded at the New Grounds. A Red-breasted Goose was the most exciting visitor, since it was the first to be seen since the Trust was established. Four Lesser Whitefronts were found, increasing the number of British records to 26.

Six Brent Geese were present for a short time in December, the largest number yet seen at the New Grounds. It would perhaps be rash to assume that the species is increasing from this somewhat limited evidence.

The largest number of geese did not arrive until after the cold spell which began at the end of January 1954. On 21 February, 3880 Whitefronts were counted and on the 23rd the total was estimated at about 5000 but it fell again to 3600 on the 24th.

No attempts were made to catch Whitefronts during the season. A number of recoveries of these geese ringed at the New Grounds in previous years were reported, and are discussed and illustrated below (map, p. 15).

GREY LAG GOOSE (*Anser anser*)

Three geese, which from their less orange and more pinkish bills and pale, strongly-contrasting flanks did not appear to belong to the western race, arrived on the Dumbles on 21 December 1953. It is possible that they belonged to some Baltic or Russian population. They soon came to spend most of their time in the Big Pen or the field just outside it, and remained until 30 March 1954.

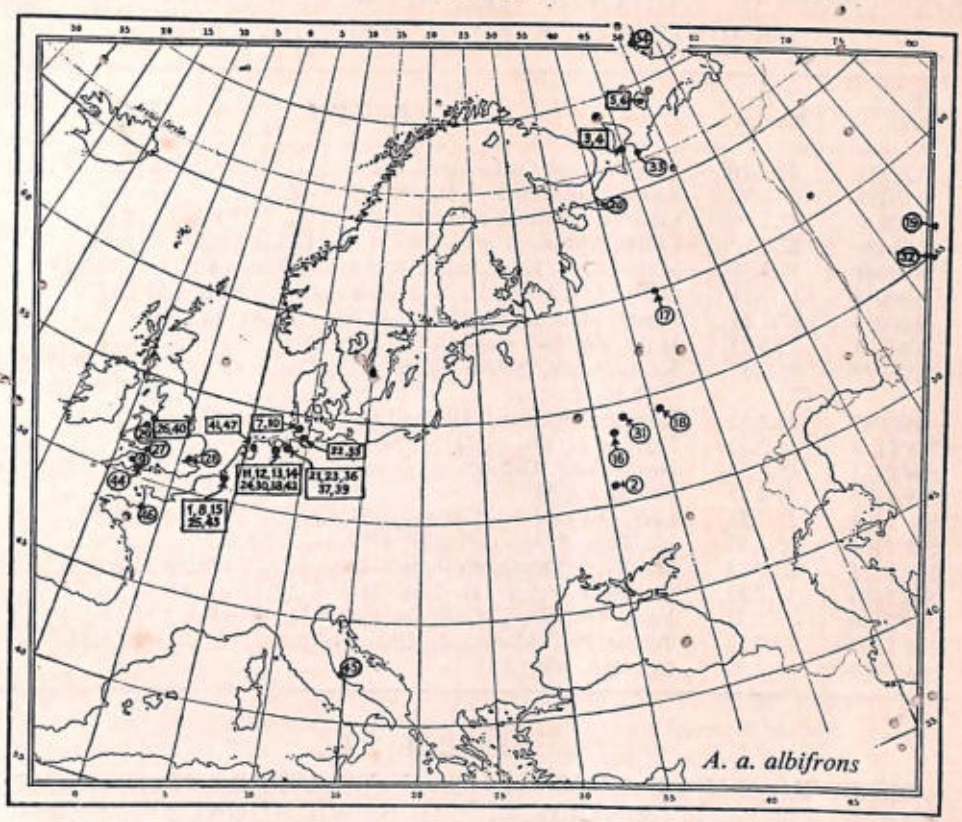
EUROPEAN WHITE-FRONTED GOOSE (*Anser albifrons albifrons*)

The first 11 Whitefronts appeared on 20 September 1953, ahead of the Pinkfeet for the second time in three years. By 9 October there were 394 and from 10 October to the middle of November numbers fluctuated between 400 and 550. On 27 November there were 780, and 935 by 7 December, but their increase during December was much smaller than usual, so that 1510 on the 24th was the highest count. It was not until 22 January 1954 that the total reached 2000. It fell almost at once and during the period 26 January to 7 February, when the ground was snow-covered, only a few hundreds remained. But on 8 February, immediately after the thaw, there were 2250 and the number continued to increase to a maximum on 23 February when there were estimated to be about 5000. The largest count was 3880 on the 21st, the next 3600 on

KEY TO MAP OF RECOVERIES OF WHITE-FRONTED GEESE RINGED AT THE NEW GROUNDS

Reference Number	Date of Ringing	Date of Recovery	Ring Number	Published in
1	18.2.48	7.1.49	128041	2nd A.R.
2	27.2.50	4.4.50	129399	4th A.R.
3	27.2.50	21.5.50	129397	,,
4	27.2.50	21.5.50	129412	,,
5	27.2.50	25.5.50	129418	,,
6	27.2.50	–.5.50	129427	6th A.R.
7	18.2.48	11.12.50	128052	4th A.R.
8	–.6.50	28.1.51	128092	,,
9	27.2.50	–.1.51	129420	,,
10	27.2.50	3.11.51	129406	5th A.R.
11	25.2.51	*c.* 1.12.51	130061	,,
12	27.2.50	15.12.51	129424	,,
13	27.2.50	28.12.51	129361	,,
14	25.2.51	28.12.51	130061	,,
15	22.2.52	29.2.52	SWT 1	,,
16	29.2.52	20.4.52	SWT 38	6th A.R.
17	27.2.50	29.4.52	129408	,,
18	29.2.52	30.4.52	SWT 46	,,
19	27.2.50	18.5.52	129398	7th A.R.
20	17.2.51	mid . 5.52	130043	,,
21	18.2.48	6.10.52	128046	6th A.R.
22	29.2.52	18.10.52	SWT 28	7th A.R.
23	27.2.50	mid. 10.52	129356	6th A.R.
24	29.2.52	31.10.52	SWT 48	,,
25	29.2.52	early 12.52	SWT 17	,,
26	29.2.52	10.12.52	SWT 33	,,
27	25.2.51	22.12.52	130054	,,
28	29.2.52	–.1.53	SWT 19	,,
29	27.2.50	26.1.53	129415	,,
30	15.2.53	14.3.53	SWT 188	,,
31	15.2.53	20.4.53	SWT 164	7th A.R.
32	17.2.51	10.5.53	130041	,,
33	17.2.53	23.5.53	SWT 208	,,
34	15.2.53	1.6.53	SWT 149	,,
35	15.2.53	25.10.53	SWT 175	,,
36	17.2.53	1.11.53	SWT 200	,,
37	27.2.50	mid. 11.53	129389	,,
38	15.2.53	end 11.53	SWT 163	,,
39	15.2.53	1.12.53	SWT 152	,,
40	17.2.53	mid. 12.53	SWT 209	,,
41	29.2.52	4.1.54	SWT 37	,,
42	27.2.50	12.1.54	129430	,,
43	22.2.52	30.1.54	SWT 13	,,
44	15.2.53	8.2.54	SWT 156	,,
45	27.2.50	13.2.54	129436	,,
46	25.2.51	14.2.54	130053	,,
47	17.2.53	11.3.54	SWT 196	,,

RECOVERIES OF WHITE-FRONTED GEESE, RINGED AT THE NEW GROUNDS 1949-1953



the 24th. On 2 March there were still 3250 and on the morning of the 7th 2500, but by that evening only 1450 were left. By 11 March the number was 7–800 and remained much the same until the 20th. On the 21st there were only six and the last five were seen on the 27th.

None of the Greenland race was identified with certainty this season, although three Whitefronts with noticeably yellow-orange bills were seen 20 February.

Since the preparation of the Sixth Annual Report 20 more recoveries of ringed Whitefronts have been received (Table I), bringing the total of recoveries to 46, from 231 geese caught at the New Grounds in 1948–53. This is a substantially higher recovery rate (17·5%) than has been obtained from Pinkfeet, despite the fact that the majority of the recoveries have come from overseas, 13 from Russia. The date of recovery for each locality is indicated in the key to the map (opposite) and the data are summarised in Table II.

Both the breeding range and the winter distribution of the European Whitefront are very extensive. It breeds in the Arctic tundra of North Russia and Siberia from the Kanin Peninsula (44°E.) in the west, eastwards probably as far as the Kolyma River (155°E.), although the eastern limit and the extent of possible overlap with the Pacific form *A. a. frontalis* are not known. There are six records of New Grounds birds recovered in late May and June from localities within the breeding range : two Kanin Peninsula, one Tchesk Bay, two Kolguev Island, one Novaya Zemlya. All these localities are, as might be expected, at

TABLE I

RECOVERIES OF WHITE-FRONTED GEESE RINGED AT THE NEW GROUNDS REPORTED DURING THE YEAR

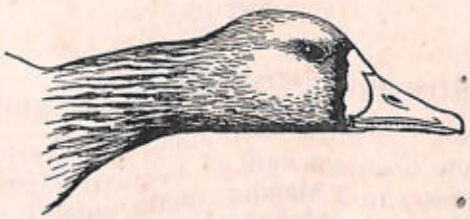
Ring No.	Date Ringed	Recovered
129389	27.2.50	Karolinensiel, Ostfriesland, Germany (53°43′N., 7°48′E.), mid 11.53
129398	27.2.50	Kazan, Russia (55°35′N., 69°10′E.), 18.5.52
129430	27.2.50	Leer, Ostfriesland, Germany (53°13′N., 7°27′E.), 12.1.54
129436	27.2.50	Chieti, Abruzzi, Italy (42°23′N., 14°10′E.), 13.2.54
130041	17.2.51	Mamljut, N. Kazakhstan, Russia (55°0′N., 68°30′E.), 10.5.53
130043	17.2.51	Delta of N. Dvina River, Russia (64°N., 42°E.), mid 5.52
130053	17.2.51	Isigny, Manche, France (48°37′N., 1°10′W), 14.2.54
SWT13	22.2.52	Hukt, Zeeland, Holland (51°18′N., 4°4′E.), 30.1.54
SWT28	22.2.52	Kellinghusen, Schleswig-Holstein, Germany (53°56′N., 9°47′E.), 18.10.52
SWT37	29.2.52	Lemmer, Friesland, Holland (52°52′N., 5°48′E.), 4.1.54
SWT149	15.2.53	Novaya Zemlya (*c.* 72°N., 54°E.), 1.6.53
SWT152	15.2.53	Nordenham, Oldenburg, Germany (53°30′N., 8°28′E.), 1.12.53
SWT156	15.2.53	Dorset, 8.2.54
SWT163	15.2.53	Leer, Ostfriesland, Germany (53°13′N., 7°27′E.), end 01.53
SWT164	15.2.53	Nr. Tula, Russia (54°20′N, 37°36′E.), 20.4.53
SWT175	15.2.53	Wilster, Schleswig-Hostein, Germany (53°54′N., 9°23′E.), 25.10.53
SWT196	17.2.53	Grouw, Friesland, Holland (53°8′N, 5°52′E.), 11.3.54
SWT200	17.2.53	Varel, Oldenburg, Germany (53°26′N., 8°10′E.), 1.11.53
SWT208	17.2.53	Tchesk Bay, Archangel, Russia (66°50′N., 46°5′E.), 23.5.53
SWT209	17.2.53	Denbigh, mid 12.53

TABLE II

DISTRIBUTION OF RECOVERIES OF WHITE-FRONTED GEESE RINGED AT THE NEW GROUNDS

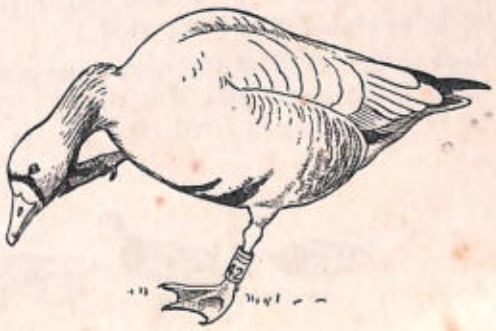
Region	Month of Recovery									Total
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	
England and Wales	—	—	3	3	1	—	—	—	—	7
Northern France										
Manche	—	—	—	—	1	—	—	—	—	1
Italy										
Abruzzi	—	—	—	—	1	—	—	—	—	1
Belgium and South Holland ..	—	—	1	3	1	—	—	—	—	5
North Holland										
Friesland	—	—	—	1	—	1	—	—	—	2
N.W. Germany										
Ostfriesland	2	3	5	1	—	1	—	—	—	12
Oldenburg	3	1	1	—	—	—	—	—	—	5
Schleswig-Holstein										
West Russia										
Tula and Ryazan	—	—	—	—	—	—	4	—	—	4
Vologda	—	—	—	—	—	—	1	—	—	1
East Russia										
Kazakhstan	—	—	—	—	—	—	—	2	—	2
North Russia										
Coast and islands	—	—	—	—	—	—	—	5	1	6
Totals	5	4	10	8	4	2	5	7	1	46

the western end of the range. But only two of the eight recoveries in April and the first part of May are from places situated on the most likely-seeming course to these breeding places from Britain and N.W. Europe. Three geese were shot in April at places roughly 150 miles S.S.W., 120 miles S. and 280 miles S.E. of Moscow, all farther east than expected. One, ringed 27 February 1950 and shot 4 April 1950 in the Sudja district, about 330 miles S.S.W. of Moscow, was in almost the same latitude as the New Grounds, but some 1600 miles to the east. This early recovery had indicated that the return route to the breeding grounds might be 'dog-legged,' east, then north. Two recent reports of birds in mid-May (each two years after marking) as far east as 69°E. in latitude 55°N. (about 2800 miles from the New Grounds) suggest that the birds found south and east of Moscow may not have been moving towards the Kanin Peninsula and Kolguev at all, but towards a much more eastern breeding place. The possibility that this may be confirmed by recoveries from Siberia is exciting, however remote.



The Italian recovery provides another surprise, for although considerable numbers of Whitefronts are found in Italy and Greece in winter it had been assumed that these populations were independent of those in N.W. Europe. Both the Italian and French recoveries and the one from Dorset show that birds ringed at the New Grounds in February are not necessarily going to be there at that time in subsequent years, although examination of the sight records of ringed birds at the New Grounds indicates that disproportionately large numbers of ringed birds have been there in late January, February and March, as compared with earlier in the winter.

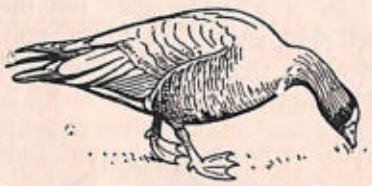
The recoveries from Germany and the Low Countries demonstrate clearly that the Western European population must be considered as a whole. The relative abundance of recoveries in Schleswig-Holstein and Ostfriesland conforms well with the known distribution of flocks of Whitefronts in Germany, (see J. G. Harrison *Pastures New*, 1954). The largest number of Whitefronts are found in the region of the Elbe in October, moving to the Ems and Jade



Ring with readable number

in November and remaining until driven out by frost in December, when they move to Flanders and Zeeland, or on to England. The return through Europe in March is evidently more rapid. Large numbers are not seen in Germany in that month.

Although no recoveries have been made in July, August or September, Table II brings out a feature of some comparative interest and importance. In the Pinkfoot adult deaths are mainly from October to January. In the Whitefront the spring kill is probably of much the same order as in autumn. But there is no indication of a decline in this species in N.W. Europe, although like most other geese it shows continual gradual changes in its favoured localities.



LESSER WHITE-FRONTED GOOSE (*Anser erythropus*)

Four during the season : a single adult appeared as early as 7 October 1953 and was seen on many occasions until 15 February 1954 ; a first-winter bird was seen from 16 January to 2 March ; another adult (a female) stayed from 25 January to 5 March ; and a third adult (a male) was noticed on 25 February.

BEAN GOOSE (*Anser arvensis*)

A first-winter bird was found on 7, 8 and 13 February 1954.

Another possible Bean × Whitefront hybrid was seen on 25 February. It was a first-winter bird but very large and very long-legged. The bill was long and pale pink, with a black nail. The head was long, like that of a Bean. The flanks were noticeably pale. The bird was associated with a family of seven Whitefronts, none of which appeared at all unusual.

PINK-FOOTED GOOSE (*Anser brachyrhynchus*)

Six on 28 September 1953 increasing to 50 on 5 October, to 87 by the 20th and to a maximum of 103 on 4 November. By the end of November only ten remained. From 4 December to 13 February no more than one was seen, but on the latter date a party of seven arrived and stayed until 17 March, one or two others also being seen during this period.

The main flock in late October included at least seven Iceland-ringed birds. One of the seven in February was also ringed. One of two juveniles seen together on 25 February carried a red ring, put on in Britain, in the autumn of 1953.



DARK-BELLIED BRENT GOOSE (*Branta bernicla bernicla*)

A first-winter bird seen 30 November 1953 to 25 January 1954 and a party of five 7–15 December.

BARNACLE GOOSE (*Branta leucopsis*)

The inclination of several of the full-winged Barnacles in the collection to join the wild geese made it difficult to establish how many wild individuals of this species appeared at the New Grounds during the winter. Two appeared after the thaw on 8 February 1954 and from then until 17 March one to six were seen on most days. Four of the birds seem to have been wild.

From 8 to 23 February 1954 a hybrid, apparently Barnacle × Whitefront, was present. Two similar hybrids were seen at the New Grounds in December 1939, by Mr H. H. Davis.

RED-BREASTED GOOSE (*Branta ruficollis*)

A young bird seen 8–25 January 1954 and again 13 February to 5 March. The second to be seen at the New Grounds (the other being in February 1941) and the 11th British record.





WILD DUCKS

In the season 1953–54 the capture of ducks for ringing was undertaken at Berkeley New Decoy, Slimbridge, and at Borough Fen Decoy, Peakirk, Northamptonshire. The ducks ringed were made available to the Duck Adoption Scheme, at that time operated by the Wildfowl Inquiry Committee, but since April 1954 by the Trust (see p. 46). A further result of the general redistribution of wildfowl research to avoid overlapping is that the Trust has assumed responsibility for duck ringing on a national scale. This arrangement first became effective for the season 1954–55.

BERKELEY NEW DECOY

An attractive, and exasperating, feature of a decoy is the unpredictability of its success in any year. From Table III it will be seen that 1953–54 entirely failed to live up to the promise of the previous year, the catch being 60% less and the number of ducks ringed only 383. The difference was due to a drop in the numbers of Mallard, although this species continued to predominate. More Teal were ringed than in any previous year and Shovelers increased considerably, but Wigeon continue to avoid the pool and the catch of Pintails dropped, despite a further increase in the number of this species frequenting the Trust enclosures.

There were no large catches made during the season. The best days were 30 September, when 50 were caught (35 and 15), and 1 October, with two catches, each of 27.

BOROUGH FEN DECOY

Mr Billy Williams, who carries out ringing at this decoy for the Trust, also had a disappointing season, partly due to a period of illness. He marked only 97 Teal, 2 Shoveler, 2 Wigeon and 1 Tufted Duck. No ringing of Mallard was done in 1953–54, but in future years this species too will be ringed.

RECOVERIES OF DUCKS

One hundred and four recoveries of birds ringed at Slimbridge and Borough Fen were reported during the year (Tables IV and V). Some of these recoveries were made long before 1953. Most of the delayed reports are of birds found in Russia or Russian-controlled territories. Recaptures at the place of ringing are not listed here.

There were only 45 Mallard reported, compared with 102 in the previous year. This reduction is a direct result of the much smaller catch at Slimbridge in the autumn of 1953 : the first winter always produces a large proportion of the total recoveries from any group of birds. Thirteen of the 45 were continental, five from France, two each from Estonia, Germany and Holland, and single

birds from Finland and Denmark. Since there had only been nine French recoveries in 251 reported before June 1953, five in one winter represents an interesting change. The Estonian birds were long ago, as well as far away.

Last year 44% of the Teal recoveries were from overseas. This year, thanks to the appearance of the Russian lists, the proportion has risen to 59%. The total of recoveries is much reduced, to only 46, because few Teal were caught at Borough Fen, so that changes in the regional occurrence of recoveries are of doubtful value. The most unusual record was one from Italy. A duck ringed at Slimbridge in January 1954 and found dead beside an egg in Shetland in May is perhaps more surprising. During the coming year a general review of the results of Teal ringing will be made, which should provide a clearer background against which to consider recent changes in movements.

The Wigeon, hand-reared at Slimbridge, which reached the Komi Republic carried its attempt to conform to the canons of wildness to an extreme degree (51°E.).

Shoveler continue to provide a high proportion of recoveries in relation to the small numbers ringed (21·6%). Winter reports are mainly from France and Ireland : the duck found in Finland in August 1953 is the first of this species reported from Scandinavia.

TABLE III

CATCH AND RINGING FIGURES IN BERKELEY NEW DECOY

Species		1946–50	1950–51	1951–52	1952–53	1953–54	Total
Mallard	Ringed ..	579	802	108	730	214	2433
	Recaptured ..	96	222	35	223	54	600
	Total Catch ..	675	1024	143	954	268	3034
Teal	Ringed ..	106	98	77	106	117	504
	Recaptured ..	9	12	10	42	12	85
	Total Catch ..	116	110	87	148	129	590
Wigeon	Ringed ..	90	4	—	6	6	106
	Recaptured ..	22	2	—	—	—	24
	Total Catch ..	114	6	—	6	6	132
Pintail	Ringed ..	32	36	22	12	10	112
	Recaptured ..	10	7	9	5	—	31
	Total Catch ..	42	43	31	17	10	143
Shoveler	Ringed ..	58	18	7	17	34	134
	Recaptured ..	3	2	2	3	11	21
	Total Catch ..	61	20	9	20	45	155
Garganey	Ringed ..	5	—	—	1	—	6
	Recaptured ..	—	—	—	—	—	—
	Total Catch ..	9	—	—	1	—	10
Gadwall	Ringed ..	—	—	7	2	2	11
	Recaptured ..	—	—	—	—	2	2
	Total Catch ..	—	—	7	2	4	13
Total	Ringed ..	870	958	221	874	383	3306
	Recaptured ..	140	245	56	273	79	793
	Total Catch ..	1017	1203	277	1148	462	4107



TABLE IV

RECOVERIES OF DUCKS RINGED AT BERKELEY NEW DECOY

Ring No.	Species	Date Ringed	Recovered
926523	Mallard ♀	19.11.48	Pjarner, Estonian Republic (58°30′N., 24°10′E.), 1950
926574	Mallard ♂	14.12.48	Virtsu, Estonian Republic (58°36′N., 23°35′E.), 2.9.49
403683	Mallard ♂	27.7.49	Aust, Glos., 15.11.53
403856	Mallard ♂	3.10.49	Ravensthorpe, Northants, end 9.53
928168	Mallard ♀	25.8.50	Harringworth, Northants, 22.9.53
928182	Mallard ♂	30.8.50	Dunston, Stafford, 10.10.53
928251	Mallard ♂	11.9.50	Aust, Glos., 4.10.53
928260	Mallard ♀	11.9.50	Tortworth, Glos., 4.9.53
928418	Mallard ♂	13.9.50	Longnor, Salop, early 12.53
928487	Mallard ♀	16.9.50	Sedgmoor, Somerset,–1.54
928575	Mallard ♂	22.9.50	Bridgnorth, Salop, 4.9.53
928608	Mallard ♂	23.9.50	Texel, Holland (53°5′N., 4°50′E.), 12.8.53
928612	Mallard ♂	23.9.50	Walshford, Yorks, 21.11.53
928722	Mallard ♀	1.10.50	Uffington, Berks, 9.12.53
928736	Mallard ♂	4.10.50	Vaskivesi, Finland (62°10′N., 23°50′E.), 20.8.53
928782	Mallard ♂	17.10.50	Eckernförde, Schleswig-Holstein (54°29′N., 9°52′E.) 23.10.53
929360	Mallard ♂	30.10.51	Kempen, Crefeld, Germany (51°22′N, 6°25′E.), 6.8.53
970299	Mallard ♂	24.8.52	Stoke Edith, Hereford, 17.10.53
970267	Mallard ♂	12.9.52	Shrawley, Worcs., 3.10.53
970110	Mallard ♀	18.9.52	St. Sornin, Char. Mar., France (45°45′N., 1°0′W.), 31.1.54
970132	Mallard ♂	18.9.52	Hartpury, Glos., early 12.53
970183	Mallard ♂	22.9.52	Walberswick, Suffolk, 14.12.53
970199	Mallard ♂	22.9.52	Faabord, Fyen, Denmark (55°8′N., 10°17′E.), 16.8.53
970277	Mallard ♀	22.9.52	Tregare, Mon., 1.10.53
970333	Mallard ♂	22.9.52	Newent, Glos., 30.1.54
970350	Mallard ♂	22.9.52	Shrawley, Worcs., 24.10.53
970377	Mallard ♂	22.9.52	Frampton, Glos., –.9.53
970411	Mallard ♂	23.9.52	Lampeter, Cardigan, 10.10.53
970477	Mallard ♂	27.9.52	R. Conway, Caernarvon, 28.9.53
970492	Mallard ♀	27.9.52	Frampton, Glos.,–20.9.53
970510	Mallard ♂	29.9.52	Droitwich, Worcs., 24.10.53
970522	Mallard ♂	29.9.52	Heemstede, Holland (52°21′N., 4°38′E.), 21.4.54
970555	Mallard ♂	3.10.52	Rhayader, Radnor, –.2.54
970557	Mallard ♂	3.10.52	La Roche, Bernard, Morbihan, France (47°32′N., 2°17′W.), 19.7.53
970558	Mallard ♂	3.10.52	Baupte, Manche, France (49°20′N., 1°20′W.), 3.2.54
970565	Mallard ♀	4.10.52	Wootton Bassett, Wilts., early 6.53
970638	Mallard ♀	4.10.52	Minsterworth, Glos., late 1.54
970663	Mallard ♂	12.10.52	Neston, Cheshire, 11.12.53
970675	Mallard ♂	13.10.52	Biarritz, Basse Pyrenées, France (43°28′N., 1°33′W.), 4.2.54

TABLE IV—*continued*

Ring No.	Species	Date Ringed	Recovered
970593	Mallard ♂	15.10.52	Bronwydd Arms, Carmarthen, 1.1.54
935599	Mallard ♂	29.9.53	Deeping, Northants, 21.12.53
935646	Mallard ♀	30.9.53	Holme Lacy, Hereford, 21.11.53
935696	Mallard ♂	1.10.53	Eastnor, Hereford, 7.11.53
935705	Mallard ♂	1.10.53	Gouville-sur-mer, Manche, France (49°6′N., 1°35′W.), 20.12.53
935710	Mallard ♀	1.10.53	Strensham, Worcs., 19.11.53
909611	Teal ♂	19.10.50	Reitdiep, Groningen, Holland (53°19′N., 6°25′E.), 15.11.53
909567	Teal ♀	8.11.50	Skamby, Fyen, Denmark (55°35′N., 10°20′E.), 20.8.53
909650	Teal ♀	14.12.50	S. shore of L. Ilmen, Russia (58°15′N., 31°20′E.), 5.9.52
911832	Teal ♀	1.12.51	Borger, Dreuthe, Holland (52°57′N., 6°48′E.), 24.9.53
911906	Teal ♂	19.1.52	Fikov, Vorontsovo, Russia (57°20′N., 28°55′E.), 22.4.52
914017	Teal ♂	18.9.52	Kristianstad, S. Sweden (56°3′N., 14°8′E.), 7.9.53
914139	Teal ♀	13.10.52	Nyköbing, Zealand, Denmark (55°52′N., 11°42′E.), 17.9.53
906787	Teal ♂	27.8.53	Minsterworth, Glos., 7.11.53
906839	Teal ♂	1.10.53	Frodsham, Cheshire, 23.1.54
906840	Teal	2.10.53	Torpoint, Cornwall, 30.1.54
915315	Teal ♂	5.12.53	Sherborne, Dorset, c. 8.2.54
915316	Teal ♀	5.12.53	Viinijärvi, E. Finland (62°5′N., 29°0′E.), 19.5.54
915271	Teal ♂	8.12.53	Coventry, Warwicks, 30.1.54
915340	Teal ♀	15.1.54	Scalloway, Shetland, 11.5.54
A.S.35 (hand-reared)	Wigeon	7.8.50	Syktyrhan, Komi, Russia (61°45′N., 51°10′E.), 19.5.52
910460	Wigeon ♂	26.9.52	Esbjerg, Denmark (55°28′N., 8°25′E.), 27.10.53
906843	Wigeon ♂	14.9.53	Aylburton, Glos., –.11.53
928979	Pintail ♂	23.2.51	Sumy, Yampold, Russia (50°56′N., 34°47′E.), 19.9.52
914171	Pintail ♂	21.1.53	Clairmarais, Pas-de-Calais, France (50°45′N., 2°16′E.), 26.3.54
914121	Shoveler ♀	30.9.52	Crusheen, Co. Clare, late 1.54
914153	Shoveler ♀	18.11.52	Pori, Finland (61°34′N., 21°35′E.), 25.8.53
935501	Shoveler ♀	12.9.53	Leon, Landes, France (43°53′N., 1°18′W.), 8.1.54
935628	Shoveler ♂	29.9.53	St. Gilles-sur-Vie, Vendes, France (46°42′N., 1°55′W.), 5.2.54
935630	Shoveler ♂	29.9.53	St. Joachim, Montoir, France (47°26′N., 2°12′E.), 21.2.54
915323	Shoveler ♀	30.12.53	Minsterworth, Glos., late 1.54
915325	Shoveler ♂	31.12.53	Beauregarde, Lot-et-Garonne, France (44°13′N., 0°37′E.), 7.2.54





TABLE V

RECOVERIES OF DUCKS RINGED AT BOROUGH FEN DECOY

Ring No.	Species	Date Ringed	Recovered
911707	Teal	14.9.51	R. Blackwater, Co. Waterford, 22.9.53
911731	Teal	25.9.51	Burton-on-Trent, Staffs., 14.11.53
912036	Teal ♀	21.11.51	Segosero, Karelo-Finnish Republic (63°40′N., 34°20′E.), 12.8.52
912064	Teal ♀	23.11.51	Whittlesey, Cambs., 14.11.53
912094	Teal ♂	24.11.51	Marano, Udine, Italy (45°43′N., 13°10′E.), 28.11.53
912105	Teal ♀	27.11.51	Leeuwarden, Friesland, Holland (53°13′N., 5°48′E.), 14.9.53
912113	Teal ♂	27.11.51	Burnham, Essex, 21.10.53
912128	Teal ♀	28.11.51	R. Petchora, Nenetsk, Russia (67°38′N., 52°30′E.), 17.5.53
912179	Teal ♀	2.12.51	R. Scorff, Lorient, Morbihan, France (47°45′N., 3°21′W.), 3.2.54
912191	Teal ♂	2.12.51	Przahinsk, Karelo-Finnish Republic (61°40′N., 33°25′E.), 10.5.53
912278	Teal ♀	6.12.51	Ennis, Co. Clare, 10.10.53
912279	Teal ♀	6.12.51	Murkebjergby, Zealand, Denmark (55°35′N., 11°35′E.), 23.9.53
912282	Teal ♀	6.12.51	R. Don, Stalingrad Region, Russia (49°40′N., 43°8′E.), –.5.52
912294	Teal ♂	7.12.51	Thisted, Jutland, Denmark (56°58′N., 8°41′E.), 29.9.53
912306	Teal ♀	9.12.51	L. Ladoga, Stalingrad Region, Russia (60°24′N., 32°40′E.), 10.5.53
912311	Teal ♂	9.12.51	Möelan, Finistère, France (47°49′N., 3°37′W.), 4.2.54
912371	Teal ♀	16.12.51	Locmariaquer, Morbihan, France (47°34′N., 2°57′W.), 30.1.54
912410	Teal ♂	23.12.51	Old Hall Marshes, Essex, –.11.53
912486	Teal ♀	1.1.52	R. Alde, Iken, Suffolk, 12.10.53
912498	Teal ♀	2.1.52	R. Test, Totton, Hants, 5.12.53
912568	Teal ♂	16.1.52	R. Yssel, Doesburg, Holland (52°2′N., 6°8′E.), 7.1.54
912673	Teal ♀	20.2.52	Ryazan Region, Russia (54°45′N., 39°22′E.), 5.8.53
912681	Teal ♀	20.2.52	Holbeach, Lincs., before 4.54
912754	Teal ♀	20.3.52	Hejls, Jutland, Denmark (57°0′N., 10°18′E.), 17.9.53.
912757	Teal ♀	20.3.52	Cheddar, Somerset, 16.12.53
912758	Teal ♂	20.3.52	Moerdijk, Brabant, Holland (51°42′N., 4°38′E.), 27.8.53
912771	Teal ♀	20.3.52	Savvkoski, Finland (67°15′N., 28°10′E.), 30.7.53
912809	Teal ♂	5.10.52	Milton Park, Peterborough, Northants, 13.10.53
912831	Teal ♂	9.11.52	Fulbourne, Cambs., 17.10.53
912870	Teal ♀	15.9.53	Arzal, Morbihan, France (47°30′N., 2°28′W.), 4.2.54
916508	Teal ♂	29.11.53	Moylough, Co. Galway, late 2.54
916544	Wigeon ♀	29.12.53	Deeping St. James, Lincs., 16.1.54

ABBERTON RINGING STATION

THE assumption by the Trust of some of the functions of the Wildfowl Inquiry Sub-Committee of the British Section of the International Committee for Bird Preservation, which was dissolved in April 1954, has included the provision of financial assistance to other ringers of ducks in Britain. First among them is Major-General C. B. Wainwright, C.B., who has achieved an outstanding success in ringing 8082 ducks between the autumn of 1948 and 31 December 1954. In future a report on ringing at Abberton will be included in the accounts of the Trust's activities. General Wainwright has been good enough to contribute the following history of his ringing station.

ABBERTON

By C. B. Wainwright

I have been ringing birds since 1933, and when I retired, in 1948, I tried to find somewhere to ring ducks.

After trying many authorities I wrote to the Wildfowl Inquiry Committee who put me in touch with Captain H. A. Gilbert, who was one of the starters of duck ringing at Orielton in 1934. Captain Gilbert suggested many places among which was Abberton Reservoir. In spite of this being near Colchester, a sanctuary for retired soldiers like myself, I decided, after visiting various other places, that Abberton was the best bet. Through the good offices of Mr Stanley Allderidge, the Resident Engineer, the Directors of the South Essex Waterworks Company gave permission for the Ringing Station to be established, and the success at Abberton has been due to their great kindness and help.

Captain Gilbert took me to Orielton to study the permanent stationary duck traps there and from these the Abberton moveable traps have been developed.

From a modest beginning with seven traps in 1949 the traps and methods have been and are still being improved.

I built all these traps myself. The daily visits to the traps, which take many hours—in snow and ice as many as five or six hours—by boat and on foot were done by me and Lady Craven, and after that the ducks had to be ringed and the records written up. Sometimes twice a week, as the water level alters, the traps (12 feet square) have to be moved up or down, very often struggling in a foot of mud.

By the end of 1951 this work, day in—day out, had become too much and it became essential to employ a whole-time assistant. The Duck Adoption Scheme which had hitherto refunded part of the expenses was not able to bear the whole of the extra expense. However, with the very generous help of the



Yellow Wagtail

Directors of the South Essex Waterworks Company, of Mrs J. Coulthurst of Gargrave and of Captain G. Fane, it was possible to employ Mr B. Winchester in March 1952, and he has taken on a large amount of the outside work, though I still do most of the duck ringing and all the record keeping myself.

With the ever increasing numbers ringed and consequent numbers recovered it becomes daily more necessary to have secretarial help.

A large number of all kinds of birds go into the duck traps and these have also been ringed. From May 1949 to 31 December 1954 20,573 birds of 106 species have been ringed including 8082 ducks of 13 species, (Tables I and II), as well as 32 ducks and 11 other birds ringed at subsidiary stations.

Many migratory birds, such as Yellow Wagtails and Common Sandpipers return like ducks, year after year to the traps ; very many within a few days of their original capture in previous years. A large number of ducks and other birds have been recovered elsewhere. Table III shows that nearly 7% of ducks have been recovered outside the British Isles.

TABLE I

NUMBERS OF DUCKS RINGED AT ABBERTON, 1948–1954

(Single Chilean Pintails ringed in 1951–52 and 1952–53 have been excluded from the table as exotic ; the Red-crested Pochard are regarded, with reservations, as respectable. The second entries in the 1953–54 column record ducks caught in October–December 1954.)

Species	Season (1 Oct.–30 Sept.)						Total
	1948–49	1949–50	1950–51	1951–52	1952–53	1953–54	
Mallard	3	165	334	558	760	213+104	2137
Teal	8	401	1580	501	1216	1193+178	5077
Garganey	—	1	4	13	34	4	56
Gadwall	—	1	—	5	1	4	11
Wigeon	—	6	21	35	176	261+8	507
Pintail	—	—	5	4	29	23	61
Shoveler	4	7	1	3	20	15	50
Red-crested Pochard	—	1	—	—	1	—	2
Scaup	—	—	—	—	2	—	2
Tufted Duck	—	44	30	25	9	31+3	142
Pochard	—	2	—	—	11	3+3	19
Shelduck	—	2	—	2	8	4	16
Total	15	630	1975	1146	2267	1751+296	8080



Common Sandpiper

TABLE II

NUMBERS OF BIRDS OTHER THAN DUCKS RINGED AT ABBERTON, 1948–1954

Season (1 Oct.–30 Sept.)	No. of Species Caught	No. of Birds Ringed
1948–49	15	340
1949–50	40	1482
1950–51	29	629
1951–52	63	2747
1952–53	63	3110
1953–54 (including Oct.–Dec. 1954) ..	69	4183
Total	93	12,491



TABLE III

RECOVERIES (OVER 30 MILES DISTANT) OF BIRDS RINGED AT ABBERTON, 1948–1954

	Mallard	Teal	Garganey	Gadwall	Wigeon	Pintail	Shoveler	Tufted Duck	Pochard	Shelduck	Little Grebe	Kestrel	Moorhen	Coot	Lapwing	Ringed Plover	Common Snipe	Common Sandpiper	Redshank	Black-headed Gull	Turtle Dove	Blackbird	Pied Wagtail	Yellow Wagtail	Starling	Greenfinch	Chaffinch
England	27	224	1	1	3	2	1	—	—	1	1	1	4	7	—	—	1	1	2	8	—	—	2	—	7	2	—
Scotland	1	8	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—
Wales	2	14	—	—	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Ireland	—	45	—	—	3	1	—	2	1	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	1	—	—
Siberia	—	1	—	—	2	—	—	4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Russia	6	35	—	—	1	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Finland	7	30	—	—	—	—	—	3	—	—	—	—	—	—	—	—	—	2	—	—	—	—	—	—	1	—	—
Sweden	10	24	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—
Norway	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Iceland	—	1	—	—	3	—	1	—	—	—	—	—	—	2	—	1	—	—	—	—	—	1	—	—	—	—	—
Denmark	11	42	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	1	—	—
Poland	2	1	—	—	—	—	—	—	—	—	—	—	—	2	—	—	—	—	—	—	—	—	—	—	—	—	—
Czechoslovakia ..	—	1	—	—	4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Germany	15	25	—	1	6	—	—	—	—	—	—	—	1	2	—	—	1	—	1	—	—	—	—	—	—	5	1
Holland	38	43	1	—	—	—	—	—	—	—	1	—	—	3	—	—	6	2	3	—	—	—	3	—	—	—	—
Belgium	1	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	3	1	—	2	—	—	—	—
France	20	152	—	—	1	—	2	—	—	—	1	—	—	3	—	—	6	2	3	—	—	—	3	—	—	—	—
Channel Islands ..	—	4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	3	1	—	2	—	—	—	—
Spain	—	11	1	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	1	—	—	4	—	—	—	—
Portugal	—	1	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Azores	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Italy	—	5	3	—	1	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—
Sicily	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Algeria	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Morocco	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	1	1	—	—	—

WILDFOWL COUNTS IN THE BRITISH ISLES.

By George Atkinson-Willes, Central Organiser

WILDFOWL Counts were started in 1947 by the British Section of the International Wildfowl Inquiry Committee in an attempt to ascertain whether the populations of wildfowl wintering in this country were increasing, decreasing, or remaining unchanged.

The original conception of regular monthly counts of wildfowl for a prolonged period as the best means of providing the necessary evidence remains sound and unaltered in the light of experience and is a striking credit to the foresight of its authors. Certain refinements in the uses to which the results may be put have been evolved since, but the original plan of comparing year by year the numbers of each species on selected waters remains the basis of the investigation.

During the season of 1951–52 the Wildfowl Counts greatly increased the extent of their cover, and reference to the table below, which shows the progress of the counts before and since then, indicates that there is every sign of this interest remaining unabated. The upper columns of the table show the number of waters which were counted regularly each month throughout the season, whilst the lower columns show the number of waters for which isolated or irregular returns were received.

	1948–49	1949–50	1950–51	1951–52	1952–53	1953–54
Regular Counts						
England	185	242	219	368	327	345
Scotland	37	50	53	85	77	91
Wales	7	7	3	7	6	14
Ireland	—	—	—	18	39	36
	229	299	275	478	449	486
Percentage of counts which are regular..	40%	59%	55%	71%	72%	77%
Occasional Counts						
England	253	163	166	137	124	105
Scotland	86	37	52	42	39	22
Wales	5	6	7	5	5	9
Ireland	—	—	—	12	3	6
	344	206	225	196	171	142
Total Regular and Occasional ..	573	505	500	674	620	628

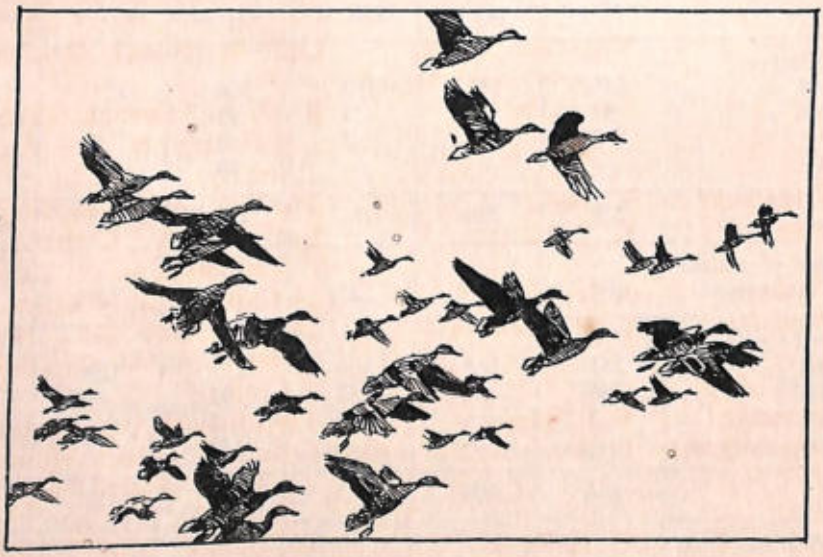
It will be seen that the number of 'regular' counts has increased whilst the number of 'occasional' counts has tended to dwindle. This steady rise in the percentage of 'regular' waters counted is eminently satisfactory, as they

have a wider application in the analysis of population trends, although the 'occasional' counts must also play a very important part in assessing the status of wildfowl in Great Britain.

The decrease in the number of 'occasional' counts is due not so much to their transference to the list of 'regular' counts but rather to the temporary abandonment of small waters which showed little or no results. The 'regular' counts on the other hand owe their increase in number to the addition of more major waters. Since the Wildfowl Counts started six years ago, information, some of it admittedly very incomplete, has been collected on the wildfowl populations of some 1100 waters.

Organisation of the Counts

It was appreciated at the very beginning that a project such as the Wildfowl Counts must depend for its success on the enthusiasm of its voluntary counters, and that as much use as possible must be made of local knowledge. It was decided that the only way to achieve this was to find county or Regional Organisers who would be prepared to run the counts in their own areas with a minimum of interference from headquarters. In this the Wildfowl Counts have been most fortunate. Seldom can an organisation have been served by such a willing band of helpers, and the success of the project is a direct reflection of their whole-hearted efforts. Limited space precludes a full list of all counters, but opposite is given a list of the Regional Organisers.



REGIONAL ORGANISERS

**denotes British Trust for Ornithology's Regional Representative*

BEDFORDSHIRE	F. Gribble	Jasmine, 42 The Grove, Bedford.
BERKSHIRE	W. D. Campbell *	The School House, Cholsey.
	assisted by	C. E. Douglas (Reading Ornithological Club).
		Middle Thames Natural History Society.
		Newbury Field Club.
BUCKINGHAMSHIRE	J. Field	Widbrook Cottage, Widbrook Common, Cookham (Middle Thames Natural History Society).
CAMBRIDGESHIRE	I. C. T. Nisbet	King's College, Cambridge. (Cambridge Bird Club.)
CHESHIRE	Maj. A. W. Boyd, M.C. *	Frandley House, Northwich.
CORNWALL	A. G. Parsons	Parc Vean, Redruth. (Cornwall Bird Preservation Society.)
CUMBERLAND	W. Atkinson *	2, Duke Street, Penrith.
DERBYSHIRE	Capt. W. K. Marshall *	The Silverhill, Radburne, Kirk Langley, Nr. Derby.
DEVONSHIRE	D. P. Holmes	25, Lang's Rd., Paignton. (Devon Bird Watching and Preservation Society.)
DORSETSHIRE	J. C. Follett	Windward, Mayfield Ave., Parkstone.
ESSEX	Maj.-Gen. C. B. Wainwright, C.B.	Little Berechurch, Colchester.
	assisted by	R. U. A. Marshall (Essex Bird Watching & Preservation Society).
GLOUCESTERSHIRE	H. Boyd	The Wildfowl Trust, Slimbridge.
HAMPSHIRE	K. V. Edwards	Buena Vista, Carlton Road, Southampton.
ISLE OF WIGHT	J. Stafford *	24, Cypress Rd., Newport, I.o.W.
HEREFORDSHIRE	C. J. Brecknell	243, Ledbury Rd., Hereford. (Herefordshire Ornithological Club.)
HERTFORDSHIRE	B. L. Sage	138 Fitzjohn Ave., High Barnet.
HUNTINGDONSHIRE	Professor A. N. Worden	Cromwell House, Huntingdon. (Hunts Fauna and Flora Society.)
KENT	G. B. Rimes	65, Third Ave., Gillingham. (Rochester and District Naturalists Society.)
LANCASHIRE, N.	R. M. Band	516, North Drive, Cleveleys, Nr. Blackpool.
LANCASHIRE, CENTRAL	R. Donnally	96, Forest Road, Southport.

LANCASHIRE, S.	E. Hardy	47, Woodsorrel Rd., Liverpool, 15. (Merseyside Naturalists Association.)
LEICESTERSHIRE and RUTLAND	Mrs Richardson	48, Stoneygate Rd., Leicester. (Leicestershire and Rutland Ornithological Society.)
LINCOLNSHIRE	R. K. Cornwallis	Bleasby Grange, Legsby, Market Rasen. (Lincolnshire Naturalists Trust, Ltd.)
LONDON and MIDDLESEX	R. C. Homes *	5, Shelvers Way, Tadworth, Surrey. (London Natural History Society.)
NORFOLK	J. Williams	Old Hall Farm, Tunstead, Nr. Norwich.
NORTHAMPTONSHIRE	R. Felton	57, Brecon St., Spencer Estate, Northampton. (Northamptonshire Natural History Society and Field Club.)
	M. Goodman	18, Hallwood Rd., Kettering. (Kettering and District Naturalists Society and Field Club.)
NORTHUMBERLAND and DURHAM	G. W. Temperley *	Restharrow, Stocksfield, Northumberland.
	assisted by	Miss U. M. Grigg, 13, St. George Terrace, Newcastle-on-Tyne. (Natural History Society of Northumberland, Durham and Newcastle-on-Tyne.)
NOTTINGHAMSHIRE	A. Dobbs	40, Caythorpe Rise, Sherwood, Nottingham. (Trent Valley Bird Watchers.)
OXFORDSHIRE	Dr Bruce Campbell *	2, King Edward Street, Oxford.
SHROPSHIRE	E. M. Rutter *	Eversley, Kennedy Rd., Shrewsbury.
SOMERSET	B. King	Mayfield, Uplands Rd., Saltford, Bristol. (Somerset Archeological and Natural History Society.)
	assisted by	Miss E. M. Palmer, Highfield, Sandford Hill, Bridgwater.
STAFFORDSHIRE, WORCESTERSHIRE and WARWICKSHIRE	A. R. M. Blake	472, City Rd., Birmingham, 17. (Birmingham and West Midland Bird Club.)
SUFFOLK (EAST)	Lt-Col F. Penn	Bawdsey Hall, Woodbridge.
SURREY	Haslemere N. H. S. and	Charterhouse Natural History Society.
SUSSEX	J. Reynolds	6, Argyle Rd., Bognor.

WESTMORLAND and LANCS in FURNESS	J. W. Allen	122, Highgate, Kendal. (Kendal Natural History Society.)
WILTSHIRE	Mrs E. C. Barnes *	Hungerdown, Seagry, Chippenham. (Wiltshire Archeological and Natural History Society.)
YORKSHIRE	A. Walker	Penlee, 14, St. Helen's Rd., Harrogate. (Harrogate and Wharfedale Naturalists Society.)
	J. Cudworth	17A, Prospect Rd., Ossett, Yorks. (Leeds Bird Watchers Club.)
	R. M. Garnett *	The Chapel House, Whitbygate, Thornton-le-Dale.
	E. C. J. Swabey	46, Kennedy Ave., Fixby, Huddersfield. (Huddersfield Naturalists Society.)
WALES, SOUTH	Col H. Morrey Salmon *	24, Bryngwyn Rd., Cyncoed, Cardiff.
CENTRAL WALES	W. M. Condry	Eglwysfach, Machynlleth, Montgomery. (West Wales Field Society.)
WALES, NORTH	D. J. Williams	13, Hendre St., Caernarvon. N. Wales.
	assisted by	Bangor University Bird Group.
SCOTLAND	Miss E. Garden	Foucausie, Grandhome, Aberdeen. (Scottish Ornithologists Club.)
	assisted by	Col W. M. Logan Home, Edrom, Berwickshire.
		P. E. D. Cooper, 31, Rosebank-by-Carluke, Lanark.
		Miss M. Flower, 5, Airthrey Ave., Glasgow, W. 5.
		Mr Milligan, High Street, Rothesay.
NORTHERN IRELAND	L. Turtle	34, Malone Park, Belfast.
CO. FERMANAGH	Mrs Richardson	Rossfad, Ballinamallard, Co. Fermanagh.
Eire		
CO. DUBLIN	G. R. Humphreys	59, Sandymount Rd., Dublin.
CO. CORK	J. E. O'Donovan	Union Hall, Co. Cork.

The Analysis of the Wildfowl Counts

In the last report on the Wildfowl Counts,[1] published in 1952, the methods used to collate the information were described at some length. As these methods are still in use and remain fundamentally unaltered, it is felt that only a very brief summary is required here.

When the completed returns are received at the end of each season they are

[1] Obtainable from Miss Barclay-Smith, c/o British Museum (Natural History), Cromwell Road, London, S.W.7. (Price 2s.)

grouped into the geographical area to which they belong. For the purposes of analysis the British Isles have been divided into 23 areas, each of which is bounded so far as is possible by high ground or other terrain providing unsuitable habitats for wildfowl. Since each count is made on the same set date, the monthly records for every water in the same area may be added together with little fear of duplication, and the resulting totals, when plotted on a graph, will show the seasonal fluctuations in population. If, in later years, similar totals for the same group of waters are superimposed on the graph a direct comparison of one year with another may be made, and by this means in due course an indication of any population trend will become apparent. In this method of analysis, however, only counts made regularly throughout each season under review can be used as the direct comparison is essential and only a limited amount of interpolation is permissible.

The Value of the Wildfowl Counts

It was decided during the summer of 1953 that the time was ripe to review the uses to which the Wildfowl Counts could be put and to obtain statistical advice on their value as a means of detecting population trends. The results for the years 1948–1952 were therefore submitted to Dr M. R. Sampford of the Lectureship in the Design and Analysis of Scientific Experiment at Oxford, and he very kindly spent a considerable amount of his time on them.

He reached the conclusion that the value of the counts might be considered under three main headings :

1. *As contemporary records :* If nothing more, the counts are a contemporary record of the populations of wildfowl on various selected waters. If a similar survey had been made during the first decade of this century, it would be of the greatest value at the present time, and it is reasonable to suppose that the present survey will in future years assume a similar importance.
2. *In relation to other branches of wildfowl research :* The Wildfowl Counts are primarily a study in distribution, and since distribution must necessarily be the basis of any investigation into the status and ecology of a species it seems probable that future studies into wildfowl problems and related research might well be based on information obtained through the counts.
3. *In detecting population trends :* The question has been raised whether the acknowledged lack of precision (caused by such factors as errors in estimating numbers, large fluctuations due to day-by-day weather variations, disturbance, etc.) which is inevitable in investigations of this type, would vitiate any attempt to detect population changes of a magnitude short of catastrophic. Dr Sampford has expressed the opinion, based on his provisional analysis, that such sources of variability will be of less importance than the considerable year-to-year fluctuation (due to periods of prolonged hard weather, etc.) which is likely to be the principal factor in tending to mask population trends. The investigation has not yet been carried on for a sufficient number of years for a reliable estimate of the magnitude of this variation



to be available, and without such an estimate it is impossible to assess the duration of observation which will be needed to detect a trend of any given order. In simpler language it is those sudden freeze-ups which are more likely to upset the value of the counts rather than the possible errors in counting.

Reliability of the Counts

Although the standard of accuracy in counting is considered to be more than adequate for the main purpose of the investigation, every effort ought to be made to overcome as many of the numerous small sources of error as possible. The possible sources of error fall into four categories.

1. *Errors in Counting*

(*a*) Incorrect recognition. Occasional cases of incorrect identification, usually of rarer species, are not disastrous as the numbers are likely to be small and in any case the counts are mainly designed to produce information on the main body of the common wintering fowl.

(*b*) Incorrect estimation of numbers. Overestimation of large numbers is possibly one of the commonest sources of error, but one which is likely to be reduced by experience. It must also be realised that underestimation, where it exists, is just as serious an inaccuracy, and the practice of subtracting a few hundreds from a large figure to allow for overestimation is not to be recommended.

(*c*) Lack of synchronisation in counting. It is not reasonable to ask for every count to be made at exactly the same time on the same day, and therefore some duplication must result. Disturbance due to counting is, however, more likely on small waters with correspondingly small numbers of wildfowl, and in some areas where duplication is likely to occur steps have been taken to synchronise counts.

2. *Errors due to Natural Conditions*

(*a*) Differences in weather conditions. Certain weather conditions may be responsible for considerable error. During rough weather ducks inland are likely to be tucked away in reedbeds or sheltered bays, and on the coast to remain in creeks and saltings out of sight. A space is, however, provided on the count forms for observers to record unusual weather conditions which may be responsible for an abnormally high or low return.

(*b*) Differences in the density of vegetation. The density of aquatic vegetation in summer and early autumn and the tendency of moulting ducks to keep in cover are responsible for low returns at that period, but there is no reason to suppose that this factor varies unduly from year to year. Many species of wildfowl are not present in significant numbers in this country during this period, and only certain types of habitat are affected.

3. *Errors due to Incomplete Cover*

Three main sources of error arise from incomplete cover :

(*a*) Disturbance or weather conditions might drive the wildfowl off a water normally counted on to one which is not, or vice versa.

(*b*) A large number of minor waters with small populations of wildfowl not normally counted might show a considerable change in status, especially of particular species, without this being reflected in the returns from the major waters.

(*c*) A certain type of water (e.g., gravel pits, ornamental lakes, etc.) might not be adequately represented in the cross-section of selected waters, with the result that any change in status of wildfowl peculiar to that particular type of water would not be presented in its true proportion.

The factors responsible for errors in this section, and to a large extent the solutions, are common to all three and may be discussed together.

The greatest difficulty has been found in recruiting observers in some of the more remote districts of the British Isles, although it is known that large numbers of wildfowl are present there. Even in areas where plenty of observers are available, there are many minor waters which are too small to warrant regular counting. They may, however, in the aggregate, carry a considerable population. Hitherto all the available effort has been directed towards an attempt to extend the counts in the thinly covered areas and a certain measure of success has been achieved in some places, but it now seems probable that an effort ought to be made to improve still further the cover in those areas already most thoroughly counted. To this end the following plan has been devised and is to be put into general use. It was tried as a pilot scheme in certain areas last year and proved successful.

All waters are to be divided into two categories.

Category A will contain all major waters which have been counted for some years and which are to continue being counted on the set count dates as hitherto.

Category B will contain all minor waters which carry small populations of wildfowl and for which a counter cannot be found on the set count dates. They are to be counted three or four times during the year, at any time convenient to the observer, but at about monthly intervals between October and February. At the end of the season the approximate capacity of each will be assessed and the counts on them will be abandoned for four or five years whilst other similar waters are being counted. In this way the wildfowl population of a very considerable number of minor waters can be assessed and a check on their status can be maintained every fourth or fifth year.

Register of Waters (Operation Waterlog)

With regard to the correct proportional representation of the various types of water covered by Wildfowl Counts, it has been suggested by Dr Sampford that in as much as the sample of waters counted will not be a true random sample of all waters in the British Isles because of the inconvenience of reaching remote areas, there is a very definite need for a register of all waters in the land. Such a register should include details of the type, size, environment and peculiarities of each water and would indicate whether any particular type of habitat was being ignored. There are many other uses to which a complete register could be put, both in direct relation to the Wildfowl Counts and in connection with studies into other forms of aquatic life. It is thought that if, as well as the details of the water itself, there could be added a note of the average population over a period of years of both surface feeding and diving ducks, it might in due course help to make possible an estimate of the country's total wildfowl population. In this project the returns from Category B waters would, of course, be of the greatest value. It should also be possible to determine which factors are most conducive to a high wildfowl population, a piece of information of the greatest importance in selecting sites for possible sanctuaries. A pilot survey is being attempted in the summer of 1955, to discover as many of the

practical difficulties as possible before launching the Register of Waters on a country-wide scale.

4. *Errors of Analysis and Interpretation*

As has been explained above, the method of analysis consists of adding together the monthly counts of wildfowl on all waters which have been covered regularly in each geographical area and comparing the totals for each species graphically with similar totals obtained in previous years. This method has, however, two disadvantages. In the first place only the results from waters counted consistently throughout the season can be used (i.e., those in Category A). The results from waters in Category B (those counted irregularly or occasionally) can only be used to provide a check against a sudden change in status occurring on a large number of minor waters. It is, however, reasonable that the survey of population trends should be confined to the major waters provided that it can be proved that its accuracy is not being prejudiced by a change in status on the smaller waters.

Secondly, whenever a count on a Category A water is missed an interpolation must be made. Frequently this estimate can be based on an observation made a few days earlier or later, or on the preceding and subsequent counts. In such cases the accuracy of the interpolation is probably adequate, provided that it does not form too high a percentage of the total for the whole series. But if two or three consecutive counts on an important water are missed interpolation is impossible, and the series, being incomplete, cannot be plotted on its graph in that year.

The necessity for interpolation and the inflexibility of the system of analysis are without doubt two further sources of possible error, but so far no alternative method has been suggested.

In endeavouring to assess the reliability of the counts all these numerous possible sources of error must be taken into account. Dr Sampford has, however, expressed the opinion that singly none of them is likely to vitiate the value of the counts. But it should be realised that errors in individual counts, although perhaps not so serious as year-to-year fluctuations caused by weather conditions, will nevertheless be superimposed on the variability caused by these fluctuations, and will still further add to the difficulty in detecting a trend of moderate order. It is therefore desirable that individual counts should be made as reliable and as representative as possible.

Wildfowl Counts and Ringing Data

Ringing is, perhaps, the field of investigation most intimately allied to the Wildfowl Counts, but hitherto no attempt has been made to combine the information provided by the two methods of inquiry. A form of graphic analysis of ringing returns has now been designed, which it is hoped will help to disclose the three main items of information required by the counts.

1. The general line of the migration routes of each species which pass through a ringing station.

2. The 'speed of flow' of migrants passing through a ringing station at various times of the year.

3. The probable location at any given time of birds ringed at any other given time.

(*c*) A certain type of water (e.g., gravel pits, ornamental lakes, etc.) might not be adequately represented in the cross-section of selected waters, with the result that any change in status of wildfowl peculiar to that particular type of water would not be presented in its true proportion.

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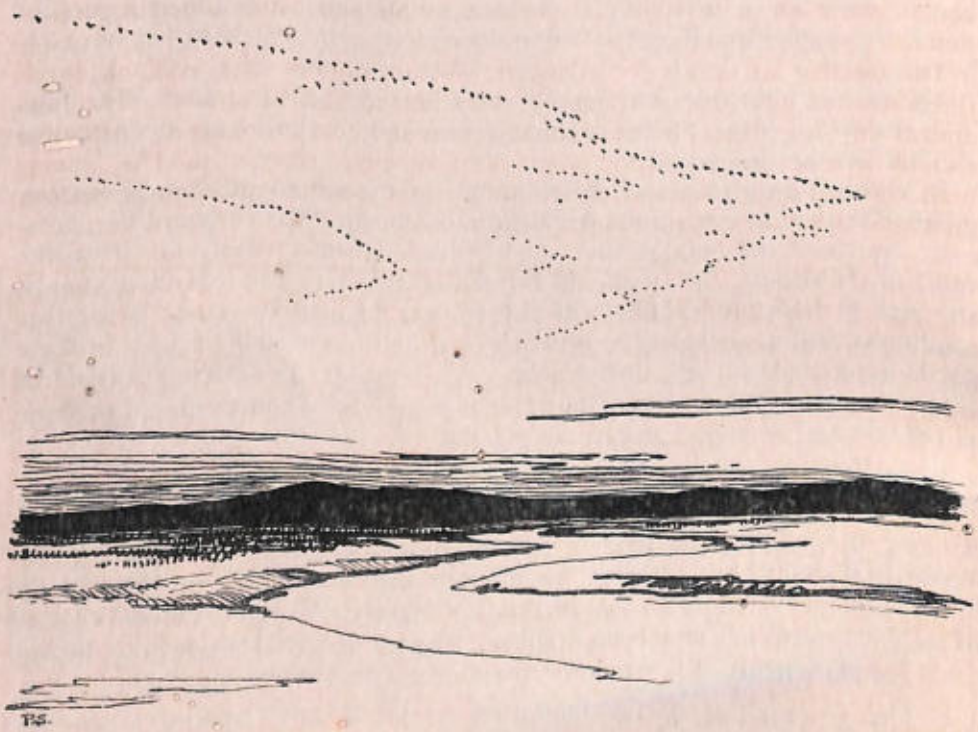
2. The 'speed of flow' of migrants passing through a ringing station at various times of the year.

3. The probable location at any given time of birds ringed at any other given time.

When this information is available it should be possible to relate the fluctuations in one geographical area to corresponding fluctuations in others, and even, eventually, to assess the success of the breeding season in certain areas outside the British Isles by relating them to wintering populations. Furthermore, some indication will be available of areas of high shooting pressure and periods of especial vulnerability, when the percentages of recoveries in various places and at various times are compared. It may also be possible to detect any differential patterns of migration (if these exist) by distinguishing in analysis between cock and hen and young and old birds.

New Counters

Additional helpers are wanted in all areas. There must be many Members who could help with this work, but are not at present doing so. Anyone wishing to help is asked to write to the Central Organiser, at the New Grounds, or, preferably, to the appropriate Regional Organiser (listed on pp. 31–33).





WINTER COUNTS OF MALLARD IN BRITAIN, 1951-1954

By George Atkinson-Willes

THIS is a brief summary of a review of changes in the number of Mallard in Britain in the three winters, 1951–52, 1952–53 and 1953–54, as indicated by returns made under the Wildfowl Count Scheme. The review appeared at length in *National Wildfowl Counts*, 1952–1954, a report issued to all the participants in the counts. (Copies of the Report are obtainable from the Trust headquarters, price 4s.) The object of the investigation was to attempt to discover the normal pattern of fluctuation in the Mallard populations in winter and to see how far changes in numbers appeared to be related to weather conditions, both in Western Europe as a whole and within different parts of Britain.

The number of waters for which satisfactory counts were available in all three seasons was 326, of which 228 were inland and 98 coastal. The total counts on these waters on each count date are plotted in Figure 1. Attention should be concentrated on the points marked, rather than on the lines joining each season's series, because these lines give no reliable indication of possible fluctuations between count dates.

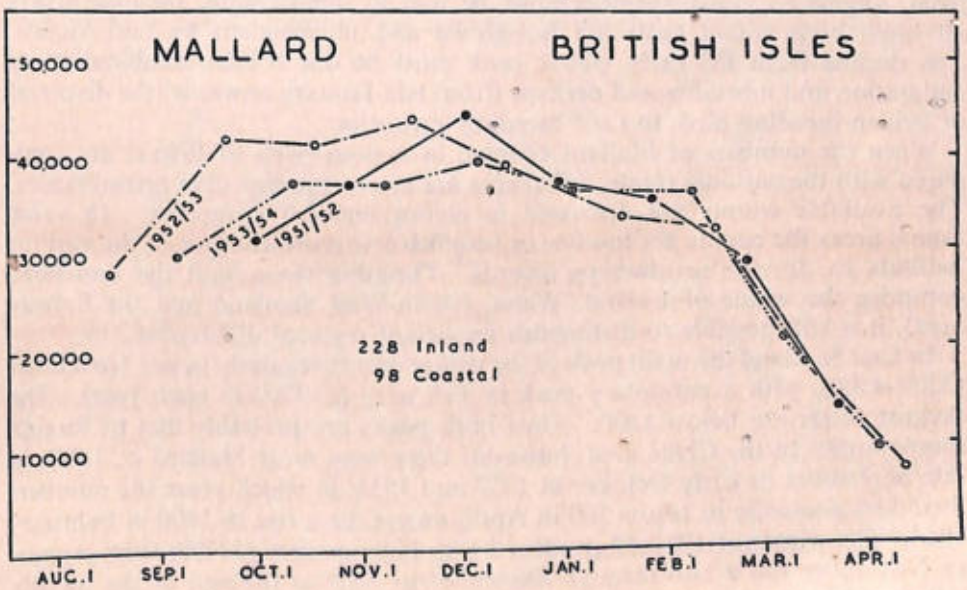


FIGURE 1

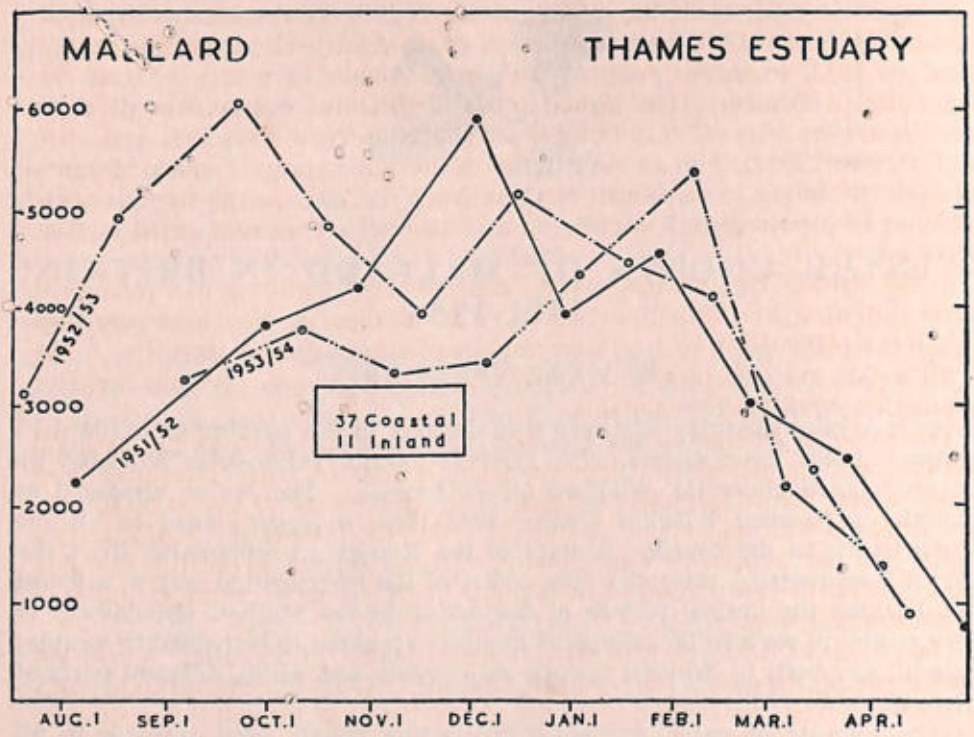


FIGURE 2

There is a general resemblance between the numbers found at comparable dates in each season, with maxima of 44,500 on 2 December 1951, 44,100 on 16 November 1952 and 39,800 on 6 December 1953. The increase in numbers from August to mid-November must be due to immigration, because nearly all home-bred young birds are full-grown and independent by mid-August. The decline from the early winter peak must be due to the combination of emigration and mortality and perhaps (from late January onwards) the dispersal of British-breeding birds to their breeding territories.

When the numbers of Mallard counted in various parts of Britain are compared with the national totals, differences are more apparent than resemblances. The available counts are discussed in eleven regional groupings. In some faunal areas the counts are too few or insufficiently representative of the various habitats to provide satisfactory records. Omitting these (and the omissions comprise the whole of Ireland, Wales, North-West Scotland and the Solway area), it is still possible to distinguish important regional differences.

In East Scotland the main peak of the winter occurs regularly in late November (3500–4500), with a subsidiary peak in February (*c.* 3200 in each year). The August totals are below 1500. Thus both peaks are probably due to foreign immigrants. In the Clyde area, however, there were most Mallard (*c.* 1600) in late September or early October in 1952 and 1953, in which years the numbers dwindled gradually to below 500 in April, except for a rise to 1400 in February 1954. The winter of 1951–52 produced very low numbers (5–700) from August to November but a rise through December to 1500 at the end of the month, followed by a decline to usual numbers in the spring.

Whereas in other areas the autumn totals in 1951 were substantially lower than in 1952 and 1953, in the North-East of England the 1951 numbers resembled those of 1953, increasing from 1000 in early August to nearly 3000 at the beginning of October. The highest totals in this area occurred in different months in each year (4300 in October 1951, 4900 in November 1952 and 3800 in December 1953), but all were followed by comparatively sharp declines through the winter to very small totals in April (*c.* 250), though there is some evidence of a passage in February, on a smaller scale than that noted in East Scotland.

In the Ribble-Dee area the seasonal changes were consistent and resembled those indicated by the national totals, with maxima in November or early December (4600–5400) and a rather rapid and steady decline thereafter. The April totals are low (3–600). Apparently a large majority of the autumn population consists of immigrants.

The seasonal changes in the Humber region also conform to the national picture, with large-scale immigration from August to early December and steady egress from December to April. The April totals, of about 1000, may be compared with mid-winter maxima of 5800–6600. Since the counts in this region are not adequately representative of the estuarine population, though good inland, the proportion of immigrants in the whole population may well be considerably higher.

The counts in the Wash area also are representative of the inland waters but inadequate on the coast. Here, August totals of 1500–2000 increased to maxima of 5500–6500 at the beginning of December, dropped by about one-fifth by mid-January, then rose again in March to about the early December level before falling off very rapidly in March and April. This double peak may indicate a to-and-fro movement, although no corresponding rise in January totals is found in adjacent areas. Alternatively it is possible that in January a considerable portion of the birds in this region resort to the Wash and thus escape being counted.

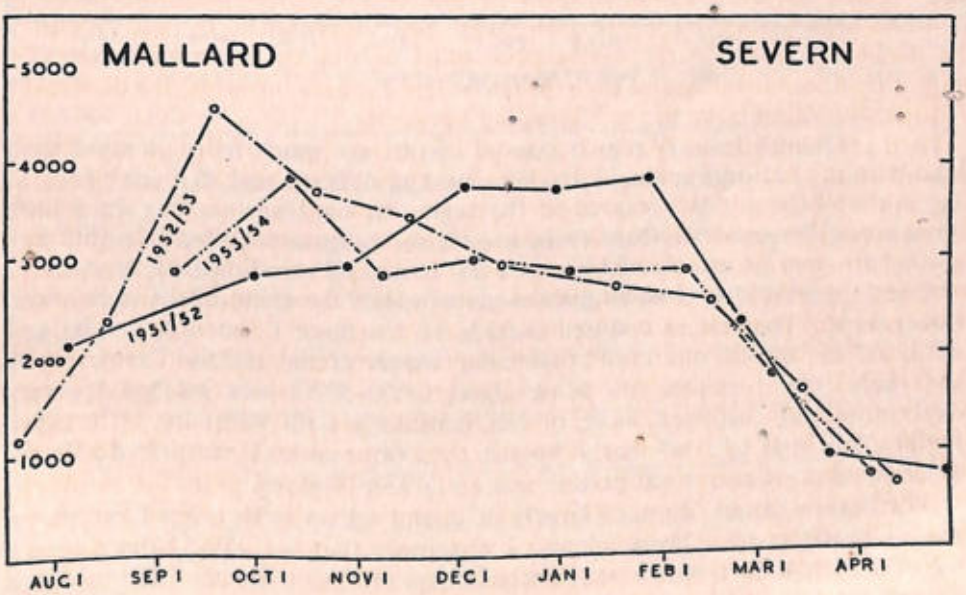


FIGURE 3

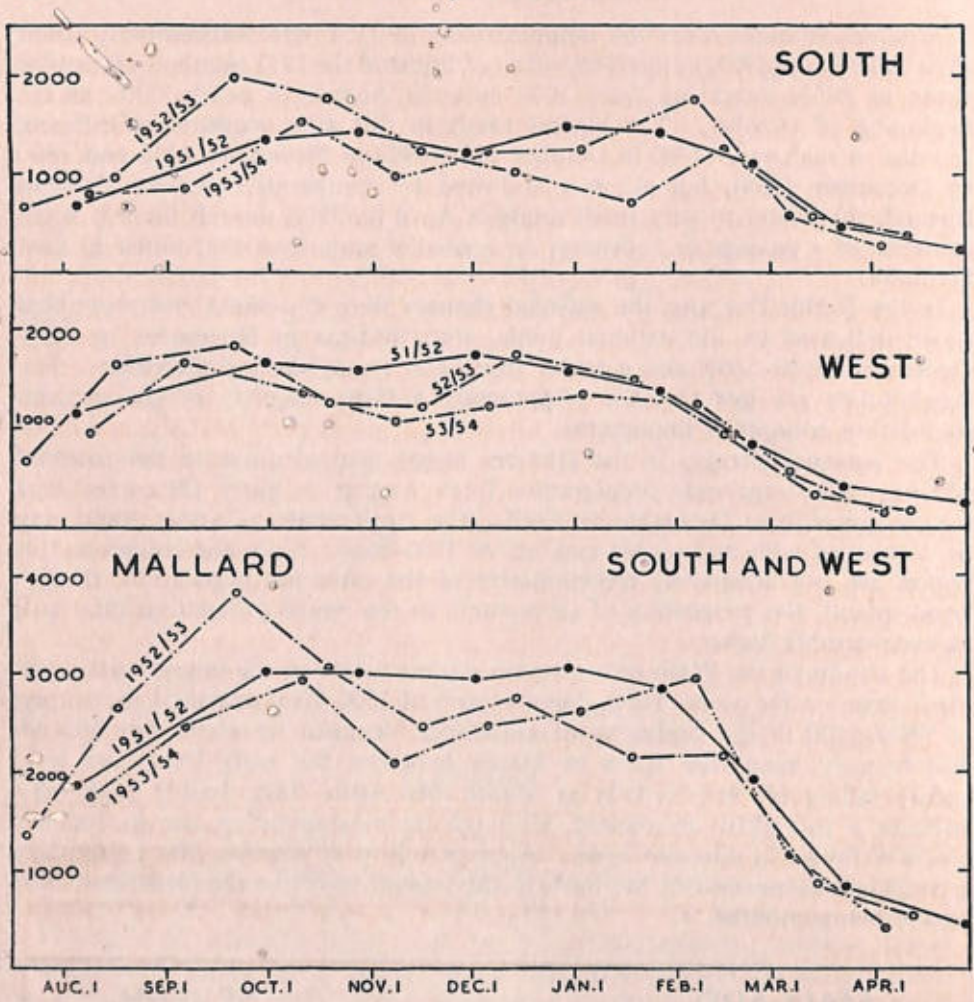


FIGURE 4

In the Thames Estuary region coastal counts are much more plentiful than inland ones. Counting ducks on the coast is difficult and this may help to explain why the totals obtained in the region in the three seasons show little consistency (Figure 2). Data from several more years are needed before any regularities can be established here, or the causes of variation understood.

The Thames Valley area comprises the whole of the basin of the river above Greenwich. The waters counted include all the large London reservoirs and many of the gravel pits and ornamental waters of the middle Thames area. On these inland waters the winter level (3500–5000) was reached by mid-September and sustained more or less constantly until February. The April (1500–2000) and late July-early August (*c.* 2300) numbers constituted a larger fraction of the winter total than in more northerly regions.

The Severn sample consists largely of inland waters, with a few localities on the Somerset coast. From Figure 3 it appears that in 1951–52 there were a lot of locally-bred birds or very early immigrants with smaller additions until December, but that in the other years there were big increases in September.

In the South and West of England the number of waters counted was rather small and their distribution far from ideal. If the counts from both areas are combined the pattern they present resembles that of Severn, with no substantial increase after September. If the South Coast counts, east of Lyme Bay, are separated from those further west it appears that the latter are relatively stable (Figure 4) and not subject to late winter influxes.

The relation between weather conditions and numbers was examined from two points of view. First, to see if spring and summer weather affected the autumn totals and, second, to see if hard weather during the winter, both on the Continent and in Britain led to perceptible changes in numbers.

In Britain the spring of 1951 was unusually wet : the summer was mainly fine. The spring and summer of 1952 were sunnier and drier than normal throughout. In 1953 March was mild and dry, April and May changeable, June and July dull and cool. The July-August numbers of Mallard are most likely to reflect the effects of weather on breeding success. In most parts of Britain these numbers were low in 1951, high in 1952 and intermediate in 1953. It may be that in Britain relatively dry conditions lead to greater breeding success: but direct observations in the summer would be a more satisfactory way of studying the problem and are badly needed to supplement the count data.

The histograms of air temperatures (Figures 5, 6 and 7) at selected stations in N.W. Europe provide a guide to the severity of frost in the three winters. The horizontal lines represent 32°F., each unit below this line representing a fall of 5°F. Comparison of the numbers of Mallard recorded in the monthly counts (Figure 1) with these histograms indicates no obvious correlations and

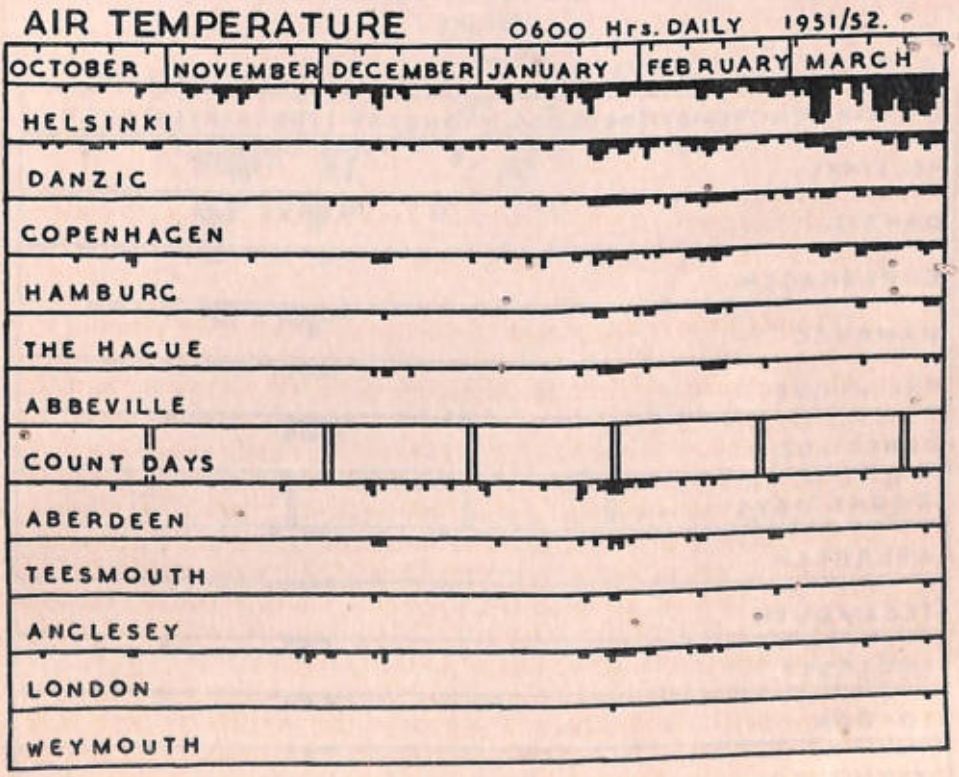


FIGURE 5

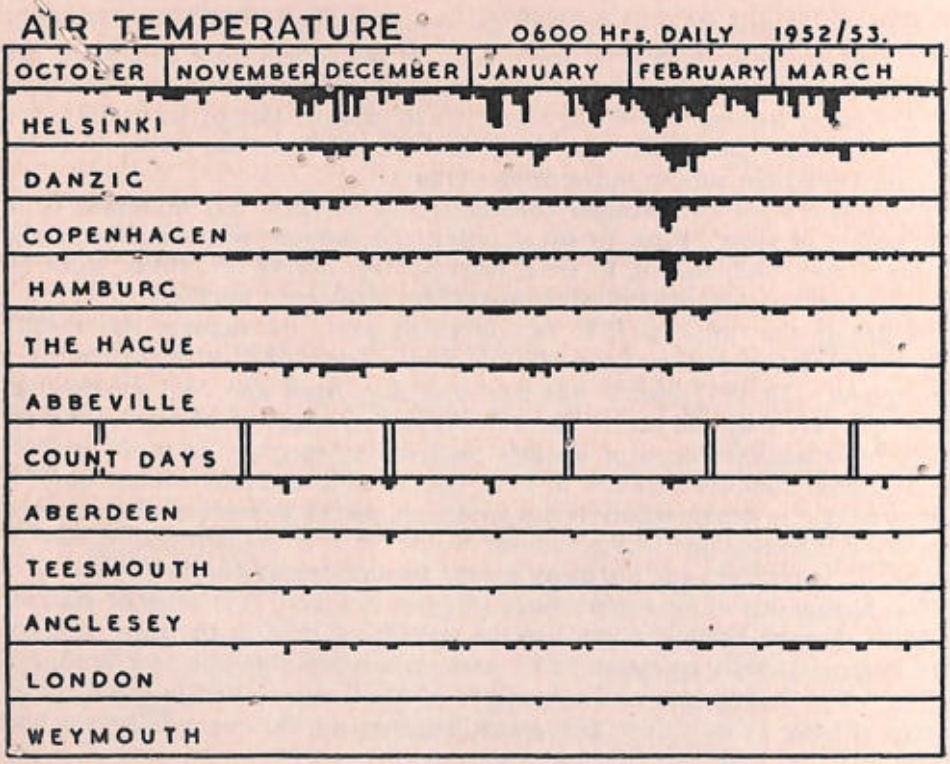


FIGURE 6

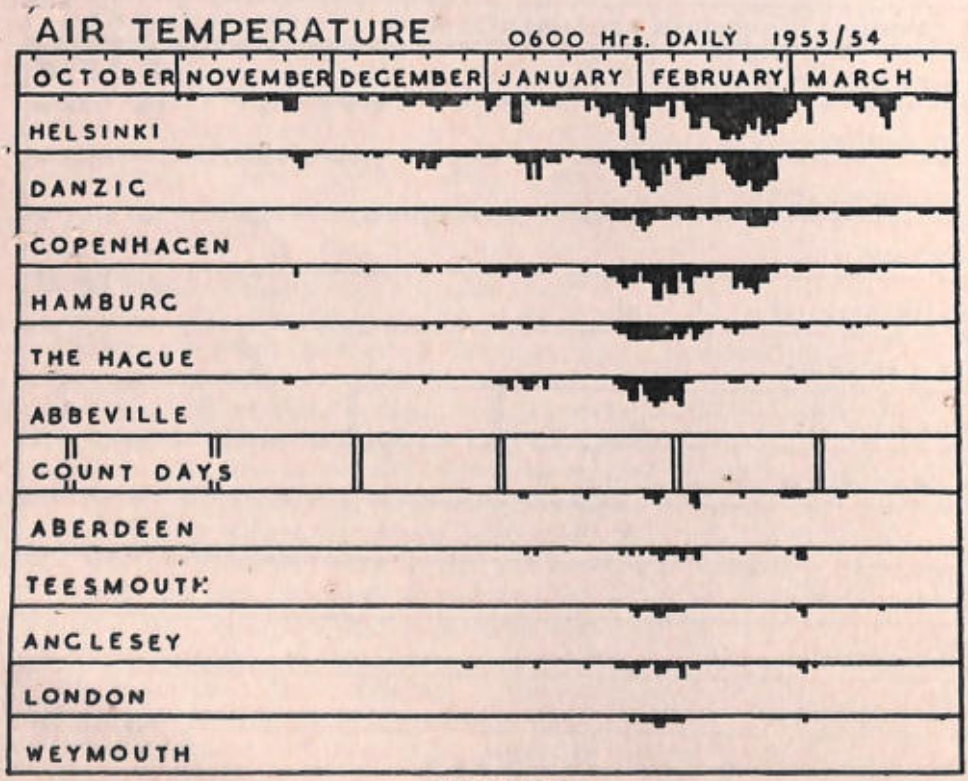


FIGURE 7

it appears that the presence, or lack, of frost in N.W. Europe between October and the end of December has no great influence on the numbers of Mallard in Britain. The effects of hard weather in producing long-distance movements within Britain, if these exist, are masked by an observed tendency for ducks to concentrate on larger waters as smaller ones freeze, this tendency increasing their liability to be included in counted samples. The regularity of the decrease through February and March is such that there is evidently little response to cold spells at this time.

In 1953 there was a slight increase in the proportion of Mallard using coastal waters from August to December in the Thames Estuary region, and a big increase in January and February 1954 (when a majority of the sample was on the coast), but on 7 March the proportion had returned to the autumn level. The coastal waters in the Wash area showed a similar increase on the coast in January and February 1954, together with some desertion of small inland waters in favour of large reservoirs and lakes.

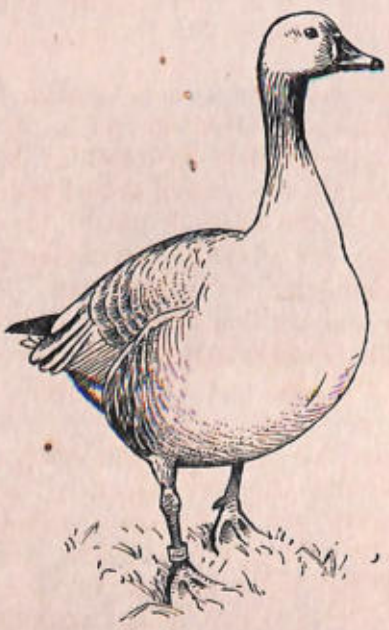
This somewhat sketchy attempt at an analysis of the numbers of a single species will be able to be extended greatly as more count data become available. It may show, however, what a wealth of information the counts will be able to provide, especially when they are related to the results of duck ringing.



THE DUCK ADOPTION SCHEME

THE Trust has now accepted responsibility for all the ringing of wildfowl in Britain. This involves the purchase and distribution of rings and most of the costs of operation and maintenance of the major duck-ringing stations, at Abberton, Borough Fen and Berkeley New Decoy. Funds are also made available to Orielton Decoy in Pembrokeshire. These costs were formerly met by the Wildfowl Inquiry Sub-Committee of the British Section of the International Committee for Bird Preservation. In order to raise funds for this purpose the W.I.C. introduced in 1948 a scheme devised by Mr C. W. Mackworth Praed. Under this scheme on payment of 5s. the subscriber is allotted a duck or goose, and given particulars of its species, the number of its ring and the date and place of ringing. If the bird is later recaptured or recovered the subscriber is notified of the date and place of recovery: and all subscribers, whether or not their 'own' birds are heard of, receive for the next two years after paying the subscription a summarised annual report of all interesting recoveries. This scheme soon received the support of the Press and grew very rapidly in popularity. In 1953, the last year in which the scheme was operated by the W.I.C., the subscriptions yielded £825, making available £542 towards the cost of ringing, after deducting administrative expenses. Since the scheme was transferred to the Trust in May 1954, it has continued to prosper. It is most important that the interest aroused should be sustained, for the yield of the Duck Adoption Scheme, though substantial, is not sufficient to maintain existing ringing stations, while it is highly desirable that other stations should be established.

Members wishing to adopt ducks or geese should write to Miss E. Temple-Carrington, Duck Adoption Scheme, The Wildfowl Trust, Slimbridge, enclosing 5s. for each bird. Adopted Duck Tokens (analogous to Book Tokens) are available, price 6s.





WATERFOWL COLLECTION

THERE are 243 living forms of *Anatidae* at present known to science, of which 149 have been kept in the collection at one time or another in the last seven years. (Only 134 forms are alive at the New Grounds at the present date —June 1955).

During the year under review no species or subspecies new to the collection were added, and further increases in the number of forms represented is now likely to be rather slow.

By far the rarest and most valuable birds in the collection are the Ne-nes or Hawaiian Geese.

THE PRESENT STATUS OF THE NE-NE OR HAWAIIAN GOOSE

FROM our Member, Rev Arthur Davies, who has recently visited Hawaii, and from the reports sent to us by Mr Herbert Shipman and by those responsible for breeding the birds at Pohakuloa in Hawaii, we are able to draw up a new table of the total numbers of this species surviving in May 1955 which can be compared with the table on p. 67 of the Fifth Annual Report.

The following is a quotation from Mr Davies's most interesting letter of 3 April 1955 :

'I am now able to give you some account of what I have seen and heard about the Ne-ne since my arrival in Honolulu on 16 March.

'Mr Herbert Shipman, whose estate on Hawaii is dangerously near to the eruptions of the volcano which has already caused considerable damage, was in Honolulu and on 19 March he took me to the Honolulu Zoological Gardens where the Director, Mr Breese, showed me his two birds. The gander has mated with two different geese in successive years. There have been several clutches of eggs this year and last, but none have been fertile. The gander is about 16 years old, and the Director feels that his experience has demonstrated that there is no hope of the geese that are mated with this gander producing fertile eggs.

'On 21 March, I visited Mr Shipman in his own estate at Keaau on the Island of Hawaii. It was there—by the sea—that I saw his seven Ne-nes in 1952. He has retained only two at Keaau—one blind and the other lame. The rest are now at his other estate, further inland, Ainahon. I saw six birds. A pair with two sturdy goslings, and another pair, the offspring of one of the pairs loaned by him to Pohakuloa. So he has altogether eight birds.

'I was not able to visit Pohakuloa,[1] but last Friday, 1 April, I called on Mr Vernon Brock, the Director of the Division of Fisheries and Game, and met Mr J. R. Woodworth who is in charge of the Ne-ne "project," and who co-operated with Mr John Yealland when he was out here. They were kind enough to give me the enclosed notes which bring the story of the project up to date.

'When I was on Hawaii I visited a ranch some two or three miles inland. The people told me that 30 or 40 years ago the geese came there in flocks after raising their broods in the mountains and a very distinguished scientist here in Honolulu tells me that he remembers accompanying Mr Shipman when he took his first pair of birds to Keaau.'

Total Numbers

The notes referred to above report that at Pohakuloa in 1953 one gosling was reared, in 1954 four, and in 1955 again four. This brings the total at Pohakuloa to 16 birds including the four hatched this year. For the first time goslings were successfully hatched and reared by a muscovy duck, and as a flock of muscovies is now being maintained it should be possible to obtain more than one clutch of eggs annually from each pair of Ne-nes as has been done at Slimbridge.

In April 1950 it was thought that the total population of the species did not exceed 40 birds, of which 24 were in captivity.[2] Thirty wild ones might have been more accurate, bringing the total to 54. By June 1952 the population was estimated to have increased to 62 of which 32 were in captivity. In July 1955 Mr Ah Sam, a forest ranger, reported a flock of 8 Ne-nes. Mr David Woodside followed up this report and at 5 p.m. on the evening of 28 July he found a flock of no less than 22. They circled and then landed in a grassy flat near the Saddle Road above Hilo. They were in groups of 13, 7 and 2. He was able to watch them feeding for over an hour, and at the same time on the following day 20 of them were feeding in the same place.

[1] The home of the propagation scheme sponsored by the Hawaiian Government.
[2] On p. 64 of the 5th Annual Report it is stated that four pairs of Mr Shipman's birds were lent to the Pohakuloa project. This should have read four birds, and the preliminary stock at Pohakuloa was, in effect, only two pairs and not ten birds as indicated.



In sending the news of this important observation Mr Breese points out that there are large areas of Ne-ne range in which almost no observations are made, and suggests that this news probably indicates that the previous estimate of only 30 wild Ne-nes is too low.

HAWAIIAN GEESE KNOWN TO BE LIVING, JULY 1955

In Hawaii :	
In the wild state	at least 22
Honolulu Zoo	3
Mr Shipman's garden at Keaau, Hilo	2
Mr Shipman's ranch at Ainahou	7
Pohakuloa project	16
In England :	
Wildfowl Trust	20
Total	70

Future Policy

As, for the time being, it seems that the wild range of the species is in no condition to receive liberations of captive-bred birds it may be useful to consider the future possibilities for this handsome and extremely interesting species. It may well be that at least a part of the range can be made safe for them *in due course*, meanwhile stocks must be maintained against the time when restocking becomes a practical possibility. But even if this time never comes it is clearly better to have Ne-nes in captivity than to have no Ne-nes at all. The example of Père Davids Deer, preserved from extinction by the Dukes of Bedford in Woburn Park after it had been exterminated in China indicates the value of such an effort.

It is the Trust's plan that as soon as sufficient birds are available for selective breeding so as to maintain the virility of the stock, pairs will be distributed to Zoos and private collections where good care can be guaranteed. After that it might be worth considering the release of a feral stock centred on some collection, though this would only be undertaken after very careful consideration of all the possible consequences.

Quotation from the Past

The following extracts (sent by Mr Davies) are taken from 'The Journal of William Ellis : a narrative of a tour through Hawaii in 1823.'

Page 20.—'The circumstance of large flocks of wild geese being frequently seen in the mountains, would lead to the supposition that there must be large ponds or lakes to which they resort ; but if they exist they have hitherto remained undiscovered.'



Page 180.—Extract from a vivid description of the active crater of Kilauea on the slope of the mountain Mauna Loa.

'Flocks of Wild Geese'

'On our way to the sulphur banks we saw two flocks of wild geese, which came down from the mountains and settled among the Ohelo bushes, near the pools of water. They were smaller than the common geese, had brown necks, and their wings were tipped with the same colour. The natives informed us there were vast flocks in the interior although they were never seen near the sea.'

Breeding Success at Slimbridge 1954

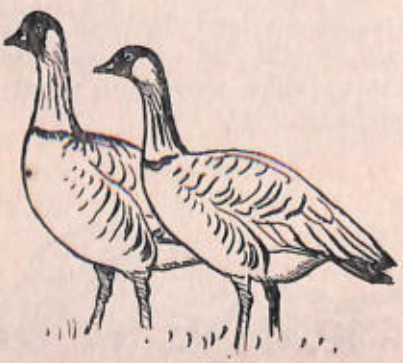
It will be recalled that the Ne-nes at Slimbridge started with a male (Kamehameha) and two females (Emma and Kaiulani) sent from Hawaii. Their names are those of kings and queens of the Sandwich Islands.

The first young birds successfully reared from these parents were nine in 1952. Four young ones were reared in 1953 and four more in 1954 bringing the total to 20, but Emma died, and two of the nine of 1952 which had been sent to another collection were accidentally poisoned. Thus in 1954 there were 17 birds at the New Grounds. (One of these has since died of egg-binding and 5 more goslings have been hatched in 1955 bringing the total in June 1955 to 21.)

The details of the 1954 results are as follows. Of 24 eggs laid, 13 were infertile, three embryos died early and three just before hatching ('Dead in shell'). Five hatched and four were reared.

Four pairs of the nine of 1952 nested at two years old and one pair laid two clutches. A very high percentage of these eggs was infertile, but a male from Emma and a female from Kaiulani produced three fertile eggs from which two goslings were hatched. One of these died at seven weeks. Subsequent post-mortem examination did not reveal any pathogenic condition that could account for this, our first death amongst Ne-ne goslings bred at the New Grounds

Kaiulani had suffered a cloacal prolapse when laying her second clutch in 1953 and the condition was repeated in 1954, but in spite of this she produced three fine goslings. One male has the black feathering on the chin continued almost to the breast. It would be interesting to know whether this plumage variation has been previously recorded.





THE BREEDING SEASON, 1954

By S. T. Johnstone

THE 1954 breeding season has no claim to any records save, perhaps, that for adverse weather conditions.

The relatively small number of eggs laid by the ducks was a reflection of the cold and wet spring. A comparison over the last three years for three common species, of which the numbers of pairs in the collection remained constant, is as follows :

TABLE I

Species	Number of Eggs		
	1952	1953	1954
Pintail	48	40	22
Wigeon	77	50	16
Shoveler	45	70	37

A large proportion of the pens were subjected to flooding in early June and in one night the water rose 18 inches with disastrous effect to the Carolinas and one or two other species that had been left to incubate their own eggs. To our consternation we found that the sitting boxes were under water and as there were at the time over a hundred bantams incubating, we had considerable losses both of incubating eggs and hatching young.

Among the 73 forms to lay, ten did so for the first time (see Table III). Indian Spotbill *Anas poecilorynchа poecilorynchа*, Canvas-back *Aythya valisneria* and Southern Pochard *Netta erythropthalma* were new species to be reared at the New Grounds.

A Baikal Teal *Anas formosa* laid two eggs in the Orchard pen. One egg was fertile and duly hatched, but the duckling was badly deformed and had to be destroyed.

Another interesting species to lay was the Ringed Teal *Anas leucophrys*, but the eggs were infertile as we only had two females in the collection at the time. The arrival in December of a fine male from South America gives hopes for the coming season.

The effect of luteinising hormone on the Ne-ne goose, Emma, in 1953 encouraged us to try our luck with the Brent geese.[1] Accordingly with the kind help of Dr Wynn Jones of Bristol University, two females, one of the light-bellied and one of the dark-bellied form, were treated. After an interval of a fortnight six eggs were laid in the course of a week. In no case was any

[1] Brents have only been recorded once to have bred in captivity, in the collection of Mr R. E. M. Pilcher at Boston, Lincs, in 1953.

attempt made to nest, the eggs being laid on the greensward where they were subjected to the attention of crows, in spite of a dawn to dusk vigil. We hope to renew the experiment in 1955 keeping the particular birds in a relatively small pen where we can exercise greater control.

A mains electricity supply became available in February 1954 and we were able to instal two pumping systems facilitating a greatly improved flow of water through the rearing pens. This improvement in the movement of the water we believe to be a major factor in reducing the number of deaths from the parasitic worm *Acuaria uncinata*. This year those affected were confined to three African Black Duck and some Carolinas. The majority of deaths were attributed to climatic conditions. In a number of cases necrosis of the liver was detected, a condition that may well be associated with a protein deficiency and we propose to increase the content of the mash by some seven per cent.

Table II shows the rearing figures for the years 1950 to 1954 inclusive.

TABLE II

Year	No. of Forms Reared	No. of Cygnets and Goslings	No. of Ducklings	Total No. Reared
1950	39	61	221	282
1951	44	72	338	410
1952	59	111	350	461
1953	51	137	248	385
1954	46	125	144	269

It was felt that the elimination of hens and bantams as foster parents would have distinct advantages, and we were, therefore, anxious to test electrically-heated brooders of a type we had been developing over the last three years. We were able to do so this season, and several species of duck, and a brood of Canada goslings, were reared successfully under these conditions.

After the early days, the broods were allowed to run free with each other in a relatively large pen. Whilst the added exercise seemed to assist the growth and well-being of the birds, there were a number of deaths due to the attentions of vermin, which might have been avoided by the presence of the hens and bantams.

The following species, apart from Mallard, were successful in rearing their own young : Cape Shelduck *Tadorna cana*, Gadwall, *Anas s. strepera*, Chestnut Teal *A. castanea*, European Wigeon *A. penelope*, Cinnamon Teal *A. cyanoptera septentrionalium*, and Ruddy Duck *Oxyura j. jamaicensis*.



Ruddy Duck family

TABLE III

HATCHING AND REARING, 1954

Species	Breeding Pairs	Date of First Egg	No. of Eggs Laid	Infertile	Hatched	Reared
Black-billed Whistling Duck ..	1	11.6.54	6[1]	5	0	—
Southern Red-billed Whistling Duck	3	27.3.54	33	29	0	—
White-faced Whistling Duck ..	1	28.4.54	11	3	4	0
Black Swan	1	14.3.54	4[1]	2	1	0
Coscoroba Swan	1	12.3.54	4	2	2	1
Canada Goose	1	9.4.54	6	—	6	5
Dusky Canada Goose	2	14.4.54	15	8	7	1
Taverner's Goose	2	25.4.54	17	10	5	5
Cackling Goose	2	24.4.54	5	1	4	2
Ne-ne Goose	5	24.2.54	24	13	5	4
Barnacle	4	4.5.54	20	9	11	11
Dark-bellied Brent Goose	2	3.6.54	6[1]	—	0	—
Light-bellied Brent Goose ..	2	11.4.54	12	2	7	5
Swan Goose..	2	12.4.54	11	6	4	3
Bean Goose	2	17.4.54	14	11	0	—
Greenland Whitefront	3	27.4.54	17	9	7	7
Lesser White-fronted Goose ..	3	10.4.54	21	6	14	11
Greylag	1	11.4.54	3	—	3	3
Eastern Greylag	5	10.4.54	38	22	16	9[2]
Bar-headed Goose	2	23.5.54	12	6	6	2
Emperor Goose	4	11.4.54	58	32	19	—
Lesser Snow Goose..	—	—	—	—	—	6
„ white form	—	—	—	—	—	3
„ blue form	4	1.5.54	50	33	16	3[3]
Greater Snow Goose	5	6.5.54	23	6	17	8
Ross's Snow Goose	2	28.2.54	12	—	12	11
Cape Shelduck	1	19.4.54	4	3	1	1
New Zealand Shelduck	1	25.4.54	3[1]	3	0	—
Radjah Shelduck	1	17.4.54	10	1	9	5
Common Shelduck	1	12.3.54	7	1	4	4
Egyptian Goose	1	12.3.54	6	5	0	—
Egyptian Goose Grey Form ..	2	13.3.54	34	4	28	22
Orinoco Goose	1	20.5.54	7	—	4	0
Abyssinian Blue-winged Goose ..	1	9.5.54	5	1	4	0
Ashy-headed Goose	1	26.12.53	6	4	2	0
Cereopsis Goose	2	25.3.54	18	9	1	0
Andean Crested Duck	3	3.5.54	41	17	16	6
Marbled Teal	1	21.3.54	11	1	10	1
Versicolor Teal	2	17.3.54	20	8	7	0
Puna Teal	2	25.5.54	11	6	5	0
Bahama Pintail	4	17.4.54	22	4	18	2
Common Pintail	1	14.6.54	8	3	5	4
Chilean Pintail × Cape Teal (hybrids)	1	22.5.54	4[1]	2	0	—
Sharp-winged Teal						

[1]First at New Grounds.
[2]Also 3 hybrids with Greylag.
[3]Also 2 hybrids with Greylag.

TABLE III—*continued*

Species	Breeding Pairs	Date of First Egg	No. of Eggs Laid	Infertile	Hatched	Reared
Baikal Teal	1	1.6.54	2[1]	1	1	0
Australian Grey Teal	1	10.5.54	11[1]	10	1	0
Chestnut-breasted Teal	3	9.5.54	11	2	9	2[3]
Florida Duck	1	16.4.54	16	16[2]	0	—
Mottled Duck	2	25.5.54	9	5	4	3
Indian Spotbill	2	5.4.54	21[1]	8	11	5
Australian Grey Duck	2	12.3.54	12	6	6	4
Philippine Duck	6	15.4.54	57	12	40	13[4]
South African Yellowbill	2	27.3.54	22	10	10	8
South African Black Duck	1	27.3.54	4	1	3	0
Falcated Duck	1	24.5.54	2	1	1	0
Wigeon	2	16.5.54	16	9	6	1
Chiloe Wigeon	3	26.4.54	34	13	14	13
Cinnamon Teal	5	10.4.54	61	14	35	11[5]
Cape Shoveler	1	23.4.54	18	3	15	0
Common Shoveler	3	15.4.54	37	7	27	6
Ringed Teal	1	—	6	6[2]	0	—
Red-crested Pochard	3	15.3.54	28	4	24	6
Rosybill	3	22.4.54	9	3	5	5
Southern Pochard	1	12.7.54	6[1]	4	1	1
Canvasback	1	27.4.54	8[1]	2	6	1
Redhead	3	18.4.54	36	17	18	1
Tufted	3	30.4.54	21	5	13	7
Scaup	1	2.6.54	7	1	5	2
Mandarin	3	15.4.54	26	18	6	3
Carolina	10	17.3.54	152	63	82	12[6]
Eider	3	27.4.54	15	5	10	4
Barrow's Goldeneye	1	7.5.54	4	4	0	—
Red-breasted Merganser	1	20.5.54	32	29	3[7]	0
Ruddy Duck	3	5.6.54	18	11	7	5[8]

[1]First at New Grounds.
[2]No male in collection.
[3]Plus 1 reared by parents.
[4]Plus many hybrids (× Mallard).
[5]3 reared by parents.
[6]Large numbers lost to *Acuaria*.
[7]2 hybrids × Goosander.
[8]Reared by parents.

PATHOLOGICAL INVESTIGATIONS

By J. A. J. Venn, M.R.C.V.S., D.V.S.M.

Ministry of Agriculture Veterinary Investigation Centre, Langford

DURING the year under review attention was again concentrated on the young stock rather than adults, because it had become only too clear that the mortality rate in ducklings was still much too high. Lack of space at the New Grounds means a temporary overcrowding of the rearing quarters : this, although highly undesirable, must be regarded as inevitable.

In previous reports mention has been made of the heavy losses that have occurred due to infestation with the stomach worm, *Acuaria*. As a result of this, radical alterations were made to the water supplies to the pens designed to ensure a supply of pure water direct from a well in preference to the previous system where surface water from a stream was used.

This system appears to prove effective. Some losses have occurred from *Acuaria* but this in the main is attributable to the temporary breakdown of the pure water supply with the resultant necessity to fall back on the old source.

The virtual eradication of *Acuaria* did not, during the season under review, produce the hoped for effect. Losses continued to occur in many species. Whilst this might be attributed to conditions inherent in the rearing system it is felt likely that there may be a more fundamental cause, namely a dietetic one. Little is known of the fundamental nutritional requirements of the majority of the species reared at the New Grounds. If only this information can be obtained it is the writer's personal opinion that a major handicap to successful rearing under artificial conditions will be removed.

Aspergillosis

From time to time this condition has been mentioned in various reports and in another part of this Report (pp. 133–138) is outlined an investigation into this disease.[1] In view of this it may be of interest to provide a few general notes as a background.

The first published record was by a Richard Owen, who, in 1832, observed a green vegetable mould in the lungs. The disease is regarded as a disease of captivity particularly among waterfowl but isolated instances have been recorded which suggest that birds may be infected when in the wild state. In fact, a wild White-fronted Goose collected from the Dumbles proved to have gross lesions of Aspergillosis in both lungs and air sacs. A further point of interest in this case was that swabs were taken from the pharynx and also from the entrance to the trachea. The former failed to yield *Aspergillus* whilst from the latter swab a number of spores were recovered.

Much work is yet to be done on this condition and whilst the changes that occur in the tissues following natural infection have been studied in detail we

[1] A new three-year study of this disease has recently been started by Mr J. V. Beer at the New Grounds.

know of no definite cure nor have we any means of diagnosing the presence of the disease until it is advanced. The damage caused is so great that death from gross tissue injury is inevitable.

What we need to know about this condition is firstly whether one is justified in the assumption that it is essentially a disease of captivity. May not it be a disease affecting birds in their natural habitat? This can only be determined by examination of birds in their natural surroundings.



ROCKET-NETTING IN 1953 AND 1954

DURING the period covered by this report the capture of over 9000 geese in Central Iceland in July and August 1953 made the major contribution to the Trust's programme of goose-marking. (An account of the 1953 Þjórsárver expedition will be found at pp. 63–98.) Nevertheless, operations with rocket-nets in Scotland and England in the autumn of 1953 and 1954 yielded catches of 1853 (1558 Pinkfeet) and 1572 (all Pinkfeet) respectively, numbers considerably larger than in any previous years. These totals were achieved by substantial increases in the average size of each catch, the number of times the nets were fired being comparatively few (Table I). Table II lists the individual catches. Those of 1952 are included so that, with Table V in the Fifth Annual Report (1951–52), pp. 20–21, this constitutes a complete record of the catches made by the rocket-netting method.

The equipment used has not been subject to any major modifications since the introduction of cordite-propelled rockets in 1952. The increase in average catch results from the use of rather larger nets (60 × 25 yards) and increased skill in the selection of sites and the concentration of geese on the areas chosen.

In 1953 Professor W. H. Elder, of the University of Missouri, accompanied the team in order to examine the geese for the presence of lead-shot, by means of a portable fluoroscope (X-ray) equipment. Professor Elder also initiated the weighing of most of the geese and the determination of sex by the cloacal method. His reports on the examination for shot and on the weights of Pinkfeet and Greylags will be found at pp. 123–126 and 127–132.

Dr W. J. L. Sladen, who had begun a search for the presence of fungal spores in the respiratory tracts of geese in November 1952 and continued it during the Iceland expedition in July and August 1953, made a further collection of material from geese caught in November 1953. Dr Sladen's material has been studied by Mr P. Austwick and their report will be found at pp. 133–138. In 1954 Mr J. V. Beer resumed work on this problem, employing rather different techniques of swabbing and culture. Mr Beer is combining an investigation of the incidence of fungal diseases in wild birds with a study of the pathology of affected birds in the Trust collection.

We continue to be especially indebted to Lt-Col C. F. Tumber of the Royal Military College of Science for the supply of explosives and for technical assistance.

We are also much indebted to two bodies of people, now so large as to preclude individual mention. First, those who have assisted, for longer or shorter periods, in the operation of the nets, especially in the less attractive parts of the proceedings, such as cleaning and mending the nets. Second, the owners and tenants of the farms on which we have attempted to catch geese, who have so readily given us permission and have so often helped us as well.

In previous reports all the ringed geese recovered or recaptured have been listed. But in the last two seasons the number of Pinkfeet reported has become so large that it is no longer practicable to list them in full and only summaries of these recoveries will be found here. Full details are, of course, available at the Trust headquarters, at the British Museum (Natural History) and (for geese ringed or recaptured in Iceland) the Natural History Museum in Reykjavík.

TABLE I

SUMMARY OF CATCHES OF GEESE WITH ROCKET-NETS, 1948–54

Season	Number of Catches	Total Catch	Catch Sizes		
			Smallest	Largest	Average
Feb. 1948	1	31	—	—	31
Feb.–Mar. 1950 ..	5	107	1	71	21
Oct. 1950–Mar. 1951 ..	24	734	2	159	31
Oct. 1951–Feb. 1952 ..	9	580	3	126	64
Oct. 1952–Feb. 1953 ..	18	1289	16	128	71
Oct.–Nov. 1953 ..	11	1853	35	385	168
Oct.–Nov. 1954 ..	8	1572	119	308	197

TABLE II

CATCHES OF GEESE WITH ROCKET-NETS, OCTOBER 1952–NOVEMBER 1954

For all previous rocket-net catches see 5th Annual Report, pp. 20–21 (Table V). For stake-net catches in Iceland see p. 72 for comparison.

Date	Area	Catch			
		Pinkfoot	Whitefront	Greylag	Barnacle
1952					
Oct. 15	Kinross	17	—	—	—
,, 17	Kinross	125	—	—	—
,, 19	Fife	118	—	—	—
,, 20	Fife	82	—	—	—
,, 21	Kinross	39	—	—	—
,, 24	Yorks	51	—	—	—
,, 25	Yorks	97	—	—	—
,, 27	Lincs	49	—	—	—
Nov. 13	Lancs	52	—	—	—
,, 16	Dumfries ..	16	—	—	—
,, 17	Dumfries	60	—	—	—
,, 19	Midlothian ..	118	—	—	—
,, 21	Montrose	14	—	67	—
,, 22	Montrose	70	—	21	—
,, 24	Midlothian ..	95	—	—	—
,, 25	Midlothian ..	128	—	—	—
1953					
Feb. 15	New Grounds ..	—	54	—	—
,, 17	New Grounds ..	—	16	—	—
1953					
Oct. 11	Lancs	91	—	—	—
,, 12	Lancs	35	—	—	—
,, 14	Lincs	38	—	—	—
,, 18	Yorks	345	—	—	—
,, 21	Midlothian ..	385	—	—	—
,, 24	Midlothian ..	169	—	—	—
Nov. 14	Kinross	27	—	218	—
,, 17	Fife	112	—	—	1
,, 20	Kincardine ..	187	—	—	—
,, 22	Dumfries	—	—	75	—
,, 23	Dumfries	169	—	1	—
1954					
Oct. 17	Lincs	284	—	—	—
,, 20	Lincs	300	—	—	—
,, 25	Dumfries	119	—	—	—
,, 26	Dumfries	308	—	—	—
,, 29	Berwicks	134	—	—	—
Nov. 23	Aberdeen	149	—	—	1
,, 26	Perths	140	—	—	—
,, 30	Lincs	137	—	—	—
		4260	70	382	2
		Total number of geese caught 4714			



RECOVERIES OF GEESE

OVERSEAS recoveries of Pinkfeet, marked in Britain or in Iceland, which have been reported between September 1953 and August 1954 are listed in Table I. 39 recoveries 'where ringed' of geese ringed in Iceland in 1953 are omitted, as are the recaptures (155 British-ringed, 108 ringed Iceland 1951) in Þjórsarver 1953, discussed at pp. 76–81.

Recoveries of this species in Britain have been so numerous that it is impossible to publish them in full, but the recent recoveries have been used in the discussion of distribution in Britain at pp. 107–122.

Recent recoveries of Whitefronts are tabulated at p. 16, in the account of the movements of this species as revealed by ringing.

The Greylag recoveries which have been reported since September 1953 are summarised in Table II. None is of especial interest.

TABLE I

RECOVERIES OUTSIDE GREAT BRITAIN OF PINK-FOOTED GEESE RINGED IN BRITAIN AND ICELAND

Reports received September 1953 to August 1954 only. British recoveries too numerous to be listed.

Ring No.	Age	Where Ringed	Date Ringed	Recovered
142418	1st w.	Yorkshire	25.10.52	Hálsaós, S.E. Iceland (64°10′N., 15°43′W.), 2.5.53
142439	Adult	Yorkshire	25.10.52	Holtahot, S. Iceland (64°15′N., 20°20′W), 5.5.54
142773	Adult	Midlothian	19.11.52	Thorsvatn, Central Highlands of Iceland (64° 14′N., 19°00′W.), 22.7.53
144371	Adult	Yorkshire	18.10.53	Tyborön, Jutland, Denmark (56°42′N., 8°13′E.), 6.12.53
144388	Adult	Yorkshire	18.10.53	Wellingtonbridge, Co. Wexford, Eire, 28.1.54
2733	Juv.	Cent. Iceland	26.7.51	Scoresbysund, N.E. Greenland (71°00′N., 25° 02′W.), 28.7.53
21376	Adult	Cent. Iceland	28.7.51	Efra-Sel, S. Iceland (63°56′N., 20°17′W.), –.8.54
11028	Adult	Cent. Iceland	21.7.53	Aase, Rogaland, Norway (58°43′N., 5°33′E.), 15.10.53
11819	Juv.	Cent. Iceland	21.7.53	Terceira, Azores (38°40′N., 27°20′W.), 2.10.53
28484	Juv.	Cent. Iceland	21.7.53	Kvisker, S.E. Iceland (*c.*64°N., 16°30′W.), 12.10.53
28862	Juv.	Cent. Iceland	21.7.53	Botnar, S.E. Iceland (63°39′N., 18°14′W.), 27.10.53

TABLE I—*continued*

Ring No.	Age	Where Ringed	Date Ringed	Recovered
29394	Juv.	Cent. Iceland	21.7.53	Vogsósar, S.W. Iceland (63°52′N., 21°43′W) –.5.54
29836	Juv.	Cent. Iceland	26.7.53	Arrecife, Canary Is. (*c*28°50′N., 13°30′W.), 29.9.53
2100035	Juv.	Cent. Iceland	29.7.53	Cape Borlasse Warren, N.E. Greenland (*c*74° 15′N., 19°00′W.), 17.7.54
210313	Juv.	Cent. Iceland	29.7.53	Hunnebostrand, Bohusläu, Sweden (*c*57°51′N., 12°2′E.), 6.12.53
210672	Juv.	Cent. Iceland	29.7.53	Ålsrode, Jutland, Denmark (56°24′N., 10°53′E.), 8.12.53
210705	Juv.	Cent. Iceland	29.7.53	Framnes, S. Iceland (63°27′N., 19°18′W.), –.5.54
210858	Juv.	Cent. Iceland	29.7.53	Cape Borlasse Warren, N.E. Greenland (*c*74° 15′N., 19°00′W.), 17.7.54
211046	Juv.	Cent. Iceland	29.7.53	Den Bommel, Goerea, Holland (*c*51°49′N., 3°55′E.), 10.10.53
211160	Adult	Cent. Iceland	29.7.53	Gunnarsholt, S. Iceland (63°51′N., 20°12′W.), 1.5.54
211405	Adult	Cent. Iceland	29.7.53	Arnabaeli, S. Iceland (64°00′N., 20°49′W.), 2.5.54
1697	Adult	Cent. Iceland	29.7.53	Ósabakki, S. Iceland (64°04′N., 20°28′W.), 30.4.54
1735	Adult	Cent. Iceland	29.7.53	Arnabaeli, S. Iceland (64°00′N., 20°49′W.), 2.5.54
13164	Juv.	Cent. Iceland	1.8.53	Lough Lene, Co. Westmeath, Erie, 11.10.53
13300	Adult	Cent. Iceland	4.8.53	Lyngby, W. Jutland, Denmark (55°46′N., 12°29′E.), 22.12.53
14097	Juv.	Cent. Iceland	4.8.53	Clooneigh, C. Roscommon, Eire, 15.11.53
14141	Juv.	Cent. Iceland	4.8.53	Svínafell, S.E. Iceland (66°23′N., 15°24′W.), –.5.54

TABLE II

RECOVERIES OF GREY LAG GEESE REPORTED DURING THE YEAR

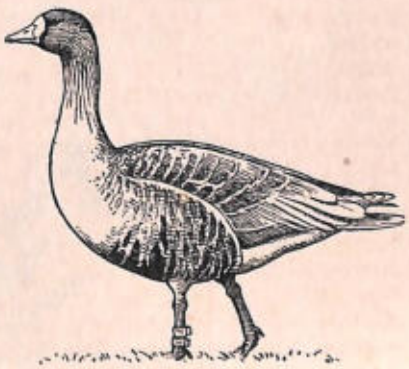
Ring No.	Where Ringed	Date Ringed	Recovered
130010	Kirkcudbright	16.1.51	Móberg, N. Iceland (65°35′N., 20°2′W.), 11.5.53
142827	Angus	21.11.52	Kirkcudbright, 28.12.53
142864	Angus	21.11.52	Perth, 9.1.54
142888	Angus	22.11.52	Thykkvibaer, Rangárvallasýslá, S. Iceland (63°45′N., 20°37′W.), 29.4.53
143201	Kinross	14.11.53	Blönduós, N. Iceland (65°40′N., 26°18′W.), 23.5.54
143209	Kinross	14.11.53	Perth, 12.12.53
143210	Kinross	14.11.53	Fife, 31.12.53
143215	Kinross	14.11.53	Perth, 4.1.54
143218	Kinross	14.11.53	Kirkcudbright, 19.11.53
143223	Kinross	14.11.53	Kinross, –.11.53
143224	Kinross	14.11.53	Kirkcudbright, 2.1.54
143254	Kinross	14.11.53	Co. Down, 15.1.54
143262	Kinross	14.11.53	Perth, 2.12.54
143264	Kinross	14.11.53	Fife, 19.12.53

TABLE II—*continued*

Ring No.	Where Ringed	Date Ringed	Recovered
143265	Kinross	14.11.53	Co: Dublin, 23.2.54
143268	Kinross	14.11.53	Co. Down, 27.1.54
143269	Kinross	14.11.53	Co. Down, 23.1.54
143276	Kinross	14.11.53	Fife, mid.12.53
143281	Kinross	14.11.53	Kinross, –.11.53
143291	Kinross	14.11.53	Wigtown, 28.1.54
143301	Kinross	14.11.53	Kinross, –.11.53
143303	Kinross	14.11.53	Wigtown, 31.12.53
143304	Kinross	14.11.53	Wigtown, 30.1.54
143305	Kinross	14.11.53	Perth, 29.12.53
143315	Kinross	14.11.53	Kinross, 15.12.53
143316	Kinross	14.11.53	Fife, mid.12.53
143318	Kinross	14.11.53	Wigtown, 18.2.54
143345	Kinross	14.11.53	Kinross, mid.1.54
143347	Kinross	14.11.53	Perth, 19.12.53
143356	Kinross	14.11.53	Wigtown, early .2.54
143385	Kinross	14.11.53	Kinross, 25.1.54
143387	Kinross	14.11.53	Kinross, –.11.53
143434	Dumfries	22.11.53	Wigtown, 1.1.54
143443	Dumfries	22.11.53	Dumfries, 15.1.54
143459	Dumfries	22.11.53	Wigtown, 30.1.54

METAL SWEDGING IN RINGS

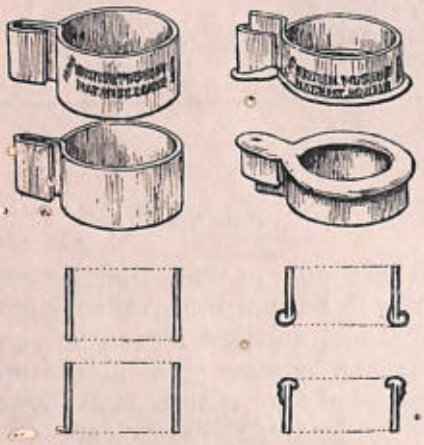
For the identification of particular sex and age groups in White-fronted Geese caught at the New Grounds which were likely to be under observation in subsequent years, certain combinations of dyed and anodised aluminium rings were used in 1953. These involved the carrying by some geese of two rings one above another on the same leg. Recoveries of some of these birds showed that in one year the adjacent edges of the rings, by tapping against each other, had undergone a process described in the United States in this connection as 'swedging.' The drawing shows how the metal 'flows' back on both the



Rings likely to become swedged

outside and the inside of the rings. Already in one year the legend on the outside of the ring was half obliterated, and in another year would probably have been completely covered by the rolled back metal. On the inside, however, there had been a considerable amount of erosion on the 'flange' by the goose's leg, so that the inside diameter had not been reduced to any extent which might have caused damage to the bird. This was in contrast to experience in America where serious reduction in the internal diameter of the ring had been known to cause damage in certain species of passerine birds. The use of such ring combinations on geese, whose legs are constantly in contact with sand, would be likely to cause much greater internal erosion on the ring than on the legs, for example, of arboreal birds.

But even though no damage occurred to the geese or appeared likely to do so, this method of identification is clearly inefficient because of the way in which the phenomenon of 'swedging' alters the shape of the ring and obliterates its legend. The use of two aluminium rings on the same leg has therefore been abandoned.



After one year on the same leg of a White-fronted Goose, two rings of the type shown on the left became swedged as shown on the right. Below the rings are in section.

THE WILDFOWL TRUST'S SECOND EXPEDITION TO CENTRAL ICELAND, 1953

By Peter Scott, Hugh Boyd and W. J. L. Sladen

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FROM AERIAL PHOTOGRAPHS
AND FROM A SKETCH MAP BY
JAMES FISHER



SUMMARY

Accurate measurements of the population of the Pink-footed Goose *Anser brachyrhynchus* by the marking and sampling method required ringing of these geese on a much larger scale than had previously been achieved. The success of the Trust's 1951 expedition to the Pinkfoot breeding-colony in Þjórsárver, near the Hofsjökull icecap, suggested that techniques of capture then discovered might be very successful if developed and used throughout the period of about four weeks when the adult geese are flightless through moult and the young have not yet grown their wings. A party of eight, including three Icelanders, spent 29 days in this oasis of vegetation in the central highlands. 4144 adult geese and 4861 goslings were caught. 260 of the adults carried rings put on in previous years and marking methods are described in some detail. The size of the breeding colony in mid-July 1953 is estimated from local recapture data at 8200 adults and 10,200 goslings.

Recaptures provide evidence that comparatively few one-year-old geese were captured, and that two-year-olds were present in numbers and distributed throughout the colony, rather than assembled in non-breeding flocks, but it is considered unlikely that two-year-olds breed successfully.

The numbers of predators present in the area in 1953 was smaller than in 1951. Attempts to measure gosling losses are described. None of the methods used is very precise, but it appears that in both 1953 and 1951 the losses between hatching and entry into the measurable British population in mid-October amounted to about three-fifths of the goslings hatched. The casualties occur mainly in the first two or three weeks of life and immediately on arrival in Britain (in late September and the first week of October). Losses of this magnitude are consistent with the estimated replacement rate necessary to maintain the species at its present level of numbers.

The length of the flightless period is thought to be rather shorter than was previously believed—about 25 days. A number of abnormal geese which were caught are described.

Examination of some birds for evidence of fungal respiratory disease was negative.

Three new species of birds were added to the list of 32 seen in the area in 1951, and 44 new species of plants to the list of 108 then found. A collection of plants was preserved for the British Museum (Natural History).

INTRODUCTION

During the summer of 1951 a Trust expedition consisting of five people had visited the Central Highlands of Iceland and found there, in the oasis of Þjórsárver við Hofsjökul[1], the largest known breeding colony of Pink-footed Geese. As described in the Fifth Annual Report (pp. 79–115), the party marked 1151 of the geese during the period of about a month in July when the goslings are old enough to ring but cannot yet fly and the adults have moulted their flight feathers and are themselves flightless. The most efficient method of capturing the geese for marking—by rounding them up at the top of a hill and herding them into a net—was only discovered during the last few days of the 1951 expedition, when on one occasion 267 geese were captured in a single drive.

As the Trust's population study of the Pinkfoot progressed it was realised that accurate population measurement demanded marking on a much larger scale than had hitherto been attained. It was thought that if the method used during the last week of the 1951 expedition could be employed during the whole of the three to four weeks of the flightless period, and even, perhaps, improved upon, a really useful number of geese could be marked, and the inaccuracies arising from samples which are too small could be greatly reduced.

Accordingly special nylon stake-nets were made and an expedition of eight was planned for the summer of 1953—two seasons after the previous one. Once more it was supported mainly by grant from the Royal Society. Further grants were made by the Zoological Society of London, the Bristol, Clifton and West of England Zoological Society, the British Museum of Natural History and the Wildfowl Trust. The party of five from England consisted of the authors, Arthur Mansfield and Christopher Sellick. In Reykjavík, Kjartan Kjartansson, a student on vacation, joined the expedition as interpreter. We set off in two vehicles, a bus and a truck, on 7 July, travelling first along roads to Hvitavatn and the Kerlingarfjöll Hut (Ásgarð) and then across country. The vehicles were driven by the well-known Icelandic travellers Guðmundur Jónasson and his brother Jón Jónasson. After frequent delays during the crossing of a pass with snowdrifts, an extensive lava flow, marshes and soft sand, across all of which no road of any kind existed, the site for the Base Camp, which had been selected in 1951, was finally reached two days later on 9 July. The same afternoon the cavalcade of ten riding ponies arrived by a different route, having followed the Þjórsá; they were in the charge of Valentinus Jónsson (a member of the 1951 expedition) and Árni Magnusson. The new camp site was about a mile from Bolstaður, the Base in 1951, and had the advantage of a series of cold springs and a small stream which arose from them.

[1] Pronunciation of Icelandic names:

Þ, þ = th as in thin.
Ð, ð = th as in then.
Á, á = ou as in thou.
f = v
j = y
ll = tl as in Bootle.
ó = as in blow.
ö = er as in her.

Thus:—Þjórsá = Thyorsou (The affix á = river).
Hofsjökull = Hŏfsyerkootl (-jökull = glacier).
Þjórsárver við Hofsjökul = Thyorsourvair vith Hŏfsyerkool (-ver = meadows and the whole phrase therefore means "The meadows of the River Þjórsá at the Hofsjökull icecap." In this phrase the word Hofsjökull is in the dative and has only one concluding l so that the t sound is absent.)

Between 10 July and 6 August flightless geese were rounded up in 36 drives which resulted in 8745 being newly ringed while a further 260 were caught which had been ringed in previous years, giving a total of 9005.

During the four weeks the technique of round-up was carefully studied and developed so that many of the later catches were of considerable size. After one round-up 3167 geese were assembled on the top of a low hill, and in a different area 3115 were walked into the nets. Very great pains were taken to avoid any injuries or losses which might have resulted from the drives ; the goslings were fed while waiting to be marked, and every effort was made to reduce to the minimum the splitting-up of families. The number of known deaths attributable directly or indirectly to the activities of the ringing-party was 13 goslings and one adult—0·16% of the geese handled.

By 21 July it was apparent that the 7000 rings originally taken in by the expedition were likely soon to run short. It was therefore arranged by radio that a further 3000 (the last remaining in Iceland of the appropriate size) should be flown in by light aeroplane, which duly landed on one of the two landing-strips laid out by the expedition. These had been marked so as to be visible from the air by riding the ponies in single file round the perimeter of the selected strips of desert some three miles from the Base camp.

The throats of 254 of the geese were swabbed by Sladen for evidence of a fungus infection. The results are discussed in a separate paper by Sladen and Austwick (pp. 133–138). Sladen also made an extensive collection of botanical specimens, now in the British Museum (Natural History). Lists of the species of flowering plants and mosses will be found at pp. 93–97.

By 6 August most of the geese were able to fly again and the party returned to Reykjavík in a single truck on 7 August, while the ponies made their way down by way of the Þjórsá route.

The present paper may be regarded in part as an addendum to Scott, Fisher and Guðmundsson (1952)—5th Annual Report, pp. 79–115. As, on this second occasion, all eggs had hatched some time before the expedition arrived in the oasis, no new observations on nesting geese were made, but in other fields it was possible to make useful comparisons between the two seasons and, in addition, some new discoveries were recorded.

During the expedition Scott and Sladen recorded the methods of capture and marking on ciné-film. The material obtained has been combined with shots of rocket-netting to produce a 16 mm. film illustrating ' A Population Study of the Pink-footed Goose.'



THE OASIS

The Þjórsárver við Hofsjökul—the area in which the geese breed—is about 13 miles long by 7 miles wide at 2000 feet above sea level. It is a patch of rich vegetation surrounded on three sides by lava desert and bordered on the fourth by the terminal moraine of the Hofsjökull ice-cap. The bulk of the vegetation consists of four species of dwarf willow, and extensive areas of sedge and cotton grass, but more than 150 other species of plants are represented. There are many tributaries leading from the ice-cap into the Þjórsá, often running in 'braided channels' across broad levels of black shingle. There are also several shallow lakes and large numbers of pools in the more marshy parts of the oasis.

During the 1953 expedition the good weather raised the level of the milky water in all the glacier rivers with the result that the Þjórsá could not be forded, as it had been in 1951. The party was therefore confined to the north-west side of the big river.



CATCHING METHODS

It might be thought that the publication of a detailed description of the method by which such large numbers of geese can be captured held the elements of danger that it might be used for their destruction or in some other way detrimental to their welfare. This aspect has been most carefully considered and we believe that the danger is not very great for the following reasons.

Icelandic farmers, some of whom (our guides) are now intimately acquainted with the technique, are, in our view, extremely unlikely to use it for the capture of geese for food because they do not face starvation as their forefathers did in ancient days. Canned food is easier and cheaper to get and more tasty than dried goose-meat.

Secondly, the Icelandic Government, at the suggestion of the Trust, is in the process of declaring sanctuaries in all the Pinkfoot breeding colonies in Iceland. Although it might be possible for unauthorised persons to visit the Þjórsárver við Hofsjokul late in the season, a large expedition with ponies and the necessary equipment could not be prepared without Government permit, and drives on the scale here described could not be undertaken except by a large expedition.

We believe therefore that, although marking on this scale should not be necessary again for several years, it is desirable for any future expedition to be able to obtain the best results with the least disturbance to the geese, rather than have to learn the technique all over again by experience—which in this case took two seasons to acquire.

In 1951 the method of rounding-up the flightless geese into a gaggle on top of a hill and then driving them into a corral or pen of netting was only discovered during the last week of the expedition. That year the expedition consisted of five people, though for one major drive it was reduced to four by the fact that James Fisher had sprained his ankle.

In 1953 the number was increased to eight. Ten might perhaps have been better, indeed of people who know the technique there could hardly be too many. On the second expedition only two members of the party, Scott and Valentinus Jónsson, had had the 1951 experience, and the remainder had to learn the details of the method from the early catches.

The technique was the product of two observations in 1951 : first that, when flightless, Pinkfeet tend to run up-hill, and secondly that when they get to the top they pause, looking all round, as though loth to leave the summit. In 1951 and in the early catches in 1953 the tactics were to place ' backstops ' behind a suitable hill bordering a feeding marsh, and then drive the geese towards the hill, closing in behind them when they reached the top. The distribution of the geese in the oasis is irregular but there are certain areas in which the feed is evidently good and here geese are usually to be found. It may be only a few hundred yards to the nearest hill-top. Such drives could muster several hundred birds, but were directly dependent on the topography. Certain hills lent themselves much better than others to the unseen approach of the backstops.

But as the bigger drives were thought out and attempted a new method developed. This involved selecting any hill or mound—however small—in the middle of a large feeding area, spacing the team all round it, and as nearly as possible equidistant from it, and moving in simultaneously (to a prearranged timetable) towards the centre, in slow time. This was satisfactory as it gave the birds plenty of time to move forward, and indeed it was an essential part of the technique that they should not be hustled. Superimposed upon this simple plan were the main physical features of the oasis—the glacier tongues with their jumbled moraines and the Þjórsá. Neither the moraines nor the river formed any barrier to the geese, indeed they were an ideal source of escape, but the mounds of soft grey shingle were virtually impassable to men and horses and the Þjórsá was equally uncrossable. Between these two boundaries the tributary streams running from the glaciers to the Þjórsá were, most of them, only crossable even on horseback at certain selected fords. Thus the big round-ups were also to some extent circumscribed by the topography.

Nevertheless these big round-ups of 1000–3000 geese were obviously by far the most rewarding and did not seem to be any more disruptive to the goose-flocks than the smaller ones. With the knowledge and experience we now possess, it would probably have been possible to mark the same number of geese in, say, four big drives and perhaps four or five smaller drives of outlying arms of the oasis (instead of 36). Such a programme could have been carried out in 14 days between 18 and 31 July. Had a crossing of the Þjórsá been possible a further four days would have been needed extending the period to 18 days, say from 16 July to 2 August. The time taken in between drives is dictated by the necessity for resting the ponies (and incidentally the men). Icelandic ponies can maintain their strength on the available grazing in the oasis, if given every third day off for rest and feeding.



From the time that a gaggle of geese is gathered together on a hill-top, it acquires (provided that there are more than 50 birds) a type of cohesion based on the security which the birds feel once they are part of a flock. This is familiar in most species of herd animals and in many respects the rounding-up of geese resembles the rounding-up of sheep. Thus when surrounded by four or five of the team a flock of even 3000 geese could be held in a state of equilibrium. In this state the goslings and sometimes the adults would feed, preen, sit down and even sleep. The general lack of panic, even of any signs of fear, was most remarkable at such times. The fact that birds perfectly capable of flight often remained with the gaggle until after they had been herded into the corral illustrates the curious sense of security apparently derived from being with the mass of other geese.

In 1951 until the last catch the nets had been staked out *before* the drive began (in some cases several days before) but on 1 August 1951 the geese were rounded-up first and the nets put out afterwards, while the birds were held by the rest of the party. This method was exclusively used in 1953.

The earlier arrangement required a considerable amount of netting with long ' wings ' leading to a horseshoe-shaped pen. But the new method needed only the pen and a short guiding wing.

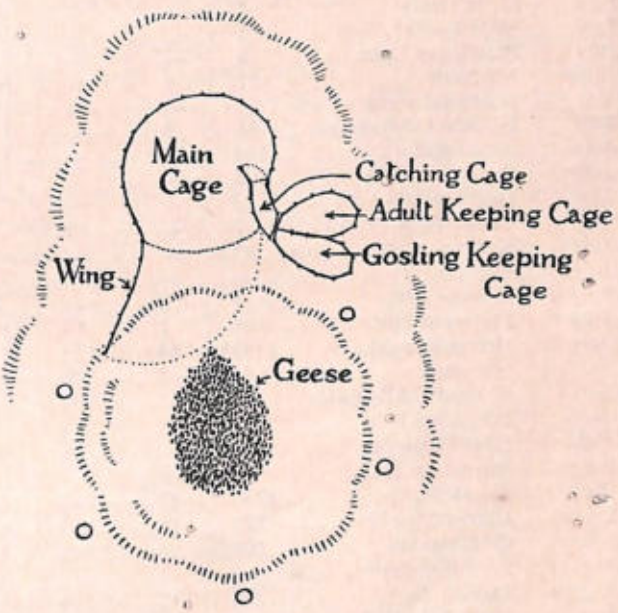
In 1953 three nets totalling 120 yards in length, three feet high and of half-inch mesh (knot to knot) were made of 210-6-ply nylon. This was to be supported every six feet by a four-foot greenhart stake. Unfortunately it was found at an early stage that the six-ply nylon was not really strong enough. The geese made frequent holes and were able to escape until the netting was doubled, which reduced the operative length of netting to 60 yards. Furthermore it was found that the stakes should be not more than three feet apart. Since some of the stakes broke, and others had been used for various important improvisations round the camp, we were glad of the cache of rather shorter but still serviceable stakes which had been left in the Kofi (stone and turf shepherd's hut) near the base camp at Bolstaður in 1951. Three nets of 40 yards each would have been adequate had they been made at least of 210-9-ply, and perhaps ideally of 210-12-ply, and we should have taken with us at least 150 greenhart stakes, though aluminium angle or tube would have been even better. The chafing of the thin netting on the stakes during a catch wore a great many holes.

In 1951 the nets had been laid out first, then the stakes had been driven in and the nets attached to them. It was discovered in 1953, however, that the nets could remain permanently attached to the stakes, and that this actually reduced the chances of tangling.

Having rounded-up the geese the pattern of the later stages of the catch was as follows : while the birds were held on the hill-top by five of the party, three others would unload the nets from the pack pony ; having selected a suitable place some 40–50 yards away (as free as possible from stones on which the geese tend to damage their toe-nails) they would proceed to set up the pen, two of them paying out the net from the bundle of stakes and netting, the third hammering in the stakes with the tent mallet. The shape of the main pen at the outset was a horseshoe and we found that it was adequate for one side of the mouth to have a short wing, only four or five yards long. At the other side the netting was doubled back inside to form a small ' catching cage ' about 4 yards long by 1½ yards wide. If sufficient netting was available two additional ' keeping-cages ' were set up, one for adults, one for goslings, in order to keep families together for simultaneous release without the risk of the goslings being

trodden on by the heavier adults. When the gaggle had been moved slowly down into the main pen, the wing was brought across to close the circle. The size of this circle varied with the size of the catch (which was usually underestimated by eye). For a catch of up to 600 geese a circle of 10–12 yards diameter was found suitable, but the two catches of over 3000 required all 60 yards of our doubled netting, making a circle of about 20 yards diameter.

Once the geese were enclosed the rings were unpacked and the strings of 100 each were laid out in numerical sequence, the ponies were taken down into the marsh to graze, sedge was brought up in sacks to feed the geese while they were waiting to be ringed, and the party had lunch (for after a big drive it was usually three or four o'clock in the afternoon and there were many hours of work ahead). The captured geese remained extraordinarily quiet, many goslings falling asleep, while others fed. It was therefore about 45 minutes before ringing began. Then groups of between 30 and 50 geese were gently edged round into the small ' catching-cage.' We found it possible to segregate the goslings to a large extent at this stage so as to avoid the possibility of the adults treading on them.



Arrangement of nets. The main cage and wings can be made of one length of net. The keeping cages are made from a separate length.

Three members of the team stood inside this catching cage with the birds within reach near their feet, which obviated any chasing before picking them up and saved a great deal of time. They picked the geese up either two or three at a time and held them so that three others standing outside the cage could put on the rings. Each ringer had two current strings of 100 rings, one slung round his shoulder, the other hanging on a stake of the net. From one string he ringed adults, from the other goslings, and he was, we found, able to deal with about 120 birds per hour including the time taken to bring a fresh group into the catching cage. The seventh member of the team wrote down the ring numbers of repeats and recaptures[1] and recorded whenever a ringer started on a new

[1] A *repeat* is a bird taken in the same area as that in which it was ringed and within one month. A *recapture* is any other bird caught which is already carrying a ring. (A *recovery* is a dead bird whose ring has been recovered.)

TABLE I

List of Catches made in Þjórsárver, July–August 1953

Date	Locality	Adults			Goslings		Total Catch	Total Newly Ringed
		Newly Ringed	Recaptured*	Repeats	Newly Ringed	Repeats		
10 July	Ptarmigan Lake ..	3	1	—	9	—	12	12
10 July	Nautalda	5	—	—	11	—	16	16
11 July	N. crest Oddkelsalda	9	1	—	14	—	24	23
13 July	Snowy Owl Ground	—	—	—	1	—	1	1
13 July	Hnifá Airport ..	2	—	—	16	—	18	18
13 July	Nr. S'd'per Lake ..	1	—	—	—	—	1	1
13 July	Sandpiper Lake ..	3	—	—	4	—	7	7
14 July	Bolstaður Hill ..	3	—	—	11	—	14	14
14 July	Round-up Hill ..	1	—	—	8	—	9	9
14 July	Little Hnifá ..	4	—	—	25	—	29	29
14 July	Near Hnifá.. ..	3	—	—	10	—	13	13
16 July	Ptarmigan Lake ..	6	—	—	8	—	14	14
16 July	Nautalda	57	1	—	101	—	159	158
16 July	Nauthagi wave ..	2	—	1	14	1	18	16
17 July	N. crest Oddkelsalda	61	5	—	112	—	178	173
17 July	Arnafellsalda ..	244	23	—	270	—	537	514
19 July	Round-up Hill ..	5	—	—	16	—	21	21
19 July	Hnifá mouth ..	2	—	—	6	—	8	8
19 July	Little Hnifá ..	7	—	1	9	2	19	16
19 July	Krókur	23	—	—	41	1	65	64
19 July	Eyvafen	—	—	—	8	—	8	8
19 July	Penseur Hill	3	2	—	21	—	26	24
20 July	Philsvatn Hill	90	7	13	109	18	237	199
21 July	Hjartarfellsalda ..	1293†	84	137	1535	117	3167†	2828†
25 July	Nautalda	34	2	20	37	25	118	71
26 July	N. crest Oddkelsalda	164	17	104	293	97	675	457
28 July	Bolstaður Hill ..	8	1	—	13	1	23	21
28 July	Near Bolstaður ..	—	—	—	3	—	3	3
28 July	Round-up Hill ..	7	—	—	42	12	61	49
29 July	Arnafellsalda ..	1360	77	245	1233	200	3115	2593
1 August	Hjartarfellsalda ..	127	16	160	275	428	1006	402
2 August	Oddkelsalda ..	101	6	196	150	268	721	251
3 August	S. of Söðulfell ..	2	—	—	21	5	28	23
4 August	Gaesapufa	245	17	769	386	475	1892	631
5 August	Round-up Hill ..	9	—	1	47	6	63	56
6 August	Round-up Hill	—	—	—	2	2	4	2
	Total	3884 (+1)	259	1647	4861	1659	12310	8745 (+1)

Recoveries	259
Total number of individual Geese handled	9,005

*Birds in this column were ringed before the expedition (either in Britain or in Iceland 1951). Repeats are birds ringed earlier in the expedition.

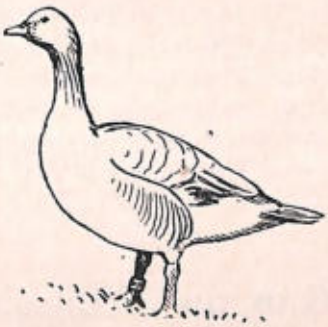
† Plus one Barnacle Goose.

string ; and the eighth moved round the main pen to see that pressure did not build up against the net at any place so that there was danger of birds being trampled on, or getting their heads stuck through holes in the net.

After being ringed the geese were put down in the ' keeping-cages '—adults in one, goslings in the other, and released from time to time in groups of 200 or so. There was not always sufficient netting for these ' keeping-cages ' and indeed it is doubtful whether they were really necessary. The goslings on being released outside the main pen usually hung around trying to get in again for some time, and then wandered down into the marsh below and began to feed. Here, when the adults were also released, a most efficient sorting process took place, in which it appears, from the recaptures made both in Iceland and in Britain, that a high proportion of families were reunited. Those goslings which did not find parents banded themselves into crèches and went about in company. They were well enough grown at this stage to be completely independent of brooding by the female.

MARKING METHODS

In 1951 wing-tags, which clipped through a part of the patagium on the leading edge of the wing, were used to mark small goslings whose legs were not yet large enough to carry rings. The recapture and recovery rates of the tags although at first comparable with those of rings fell off more rapidly, indicating that the tags did not last so well. In addition, when dealing with large catches of geese it was found difficult to be certain that no wing-tags had been overlooked. Finally serious corrosion had obliterated some of the numbers on one tag which was recovered. For all these reasons and also because it was thought that the tags might be a source of irritation to the birds, it was decided that no further wing-tags should be used in 1953.



In any event the arrival of the expedition had been so timed that the majority of goslings could be marked at once with rings, and in only a very small number of late hatched goslings were the legs still too small for ringing.

The rings used in 1951 which bore the legend ' Mus. Nat. Reykjavik, Iceland ' had been made in Sweden and were of rather thin gauge aluminium with a clip. Several of these on geese recaptured in 1953, after only two years wear, were already badly eroded, and in others the softness of the metal had allowed the clips to loosen, so that the rings looked likely to fall off. The numbers and address remained quite legible but it looked as if some rings might already have been lost altogether.

For the 1953 expedition 5000 rings were made in England to the same pattern as those used during rocket-netting, but bearing the Icelandic address, and a series of numbers allocated by Dr Finnur Guðmundsson. These rings were of the non-clip type in which the metal was believed to be thick enough and hard enough not to open when once it had been closed round the bird's leg and the two edges carefully butted against each other. It has since been discovered that at least some of these rings are lost by the geese, presumably by opening, but the proportion cannot be at all high.

In addition to these 5000 rings the expedition took in a further 2000 Icelandic rings which had been made in the United States, and later 3000 more of these American rings were flown in. They were of slightly larger diameter than those made in England and the metal appeared to be a trifle harder. Because the legend was printed in smaller type the abbreviation 'Mus. Nat.' had been expanded by the manufacturers to 'Museum Natural' (which bears no relation to the correct Icelandic or Latin). These rings had very sharp edges and minor abrasion was observed on the hind toes of some of the goslings which were recaptured after wearing the rings for a week or so. Thereafter the lower edge was chamfered off with one of the handles of the pliers before being put on. Birds which had shown abrasion from sharp-edged rings were found to have suffered no permanent injury when recaptured in Britain the same autumn. By then erosion had worn the sharp edge off the ring and there were no signs of any damage to the hind toe even in the form of a callous or a scar. Nevertheless it is desirable that the process by which the metal is cut for making rings should not leave a sharp edge on the inside.

Rings put on in earlier years were at first replaced if they showed any signs of wear. Later, however, it was decided to add a new ring to the other leg in such cases, in the hope that some measure of the rate of loss of earlier rings might be obtained. It was in fact this latter technique which disclosed the loss of non-clip rings. Certain individuals were later recaptured on which the older clip-type ring remained, but the newer non-clip ring was missing. Recaptures of birds which do or should carry two rings have now been sufficiently frequent to indicate the incidence of ring loss, which may be of the order of 5% although there are insufficient data to enable these losses to be properly understood (there is no evidence as yet of increasing rate of loss with time, as has been found for rings used on several kinds of sea-birds). It still cannot be explained how such losses occur without damage to the bird's leg, but the fact remains that they do.

THE SIZE OF THE BREEDING COLONY

In 1951 attempts were made to estimate the number of nests in the colony from sample transects. These were not repeated in 1953. The late date of arrival of the expedition would have added to the uncertainties of the method, because it was difficult in some cases to decide whether the nests found had been used in 1953, and the achievement of a reliable result would have needed more time than could be spared from the principal object of goose-catching. For the determination of colony size, therefore, only information from ringing and recaptures is available, although this is much greater in quantity than in 1951. 4144 adults and 4861 goslings were captured during the expedition. These numbers provide lower limits for the colony size. There were 1646 adult and 1661 gosling repeats during the expedition. (A *repeat*, in this context, is

a second capture of a goose in the course of the expedition, to be distinguished from a *recapture* of a goose ringed in the colony in 1951, or in Britain in 1950–52.) Several different techniques for employing these repeats to estimate the numbers of geese in the colony have been tried, but none has proved entirely satisfactory. The difficulty is due to the incomplete mixing of marked and unmarked geese and of geese marked at one point with geese marked at other places. The successful employment of capture-recapture methods requires either that no immigration or emigration is occurring or that the rates of movement remain unchanged and these requirements are not met. There is no evidence of either immigration or emigration from the colony as a whole during the course of the catching period, but the repeats encountered in successive catches in particular areas show that the probability of repeating is not equal for all individuals.

In the circumstances the best measure of colony-size appears to be given by using the ' Lincoln index ' relation (discussed in Scott, Fisher and Guðmundsson 1952 (p. 98), with respect to the 1951 data) applied to groups of catches. If a individuals are caught, marked and released at time t_1 and n are caught at time t_2, of which r were marked on the first occasion, then the maximum-likelihood estimate ($\hat{x}$) of the total population (x) at time t_1 is $\hat{x} = \frac{an}{r}$. The results of applying this relation to the grouped data are shown in Table II. Adults and goslings are treated separately, because they are not equally liable to capture, or recapture. Various other groupings of the catches, and single catches, have been used to give alternative estimates. These range from 4800–15,600 for the adult population and from 6500–19,700 for the number of goslings. The theoretical estimates of the variances of many of the estimates are quite small, but the wide range of the subsidiary values of x shows that these theoretical estimates are inappropriate.

TABLE II

Estimation of the Pinkfoot Population at Þjórsárver við Hofsjökul, July 1953, from repeats of marked geese

(t_1) = all catches from 10 to 21 July, inclusive.
(t_2) = all catches from 29 July to 4 August, inclusive.

	Marked at t_1	Caught at t_2	Repeats	Total Population at t_1
	a	n	r	$\hat{x}$
Adults	1751	2612	558	8200
Goslings	2359	2970	686	10,200

Both the adult and the gosling figures are higher than the corresponding estimates for 1951 (adults 8200 in 1953, 5500 (or 6700 from repeat data only) in 1951 ; goslings 10,200 in 1953, 7500 in 1951), but the lack of precision of all the estimates does not justify any inferences about changes in colony size, except that the actual numbers of geese are most unlikely to have decreased in the two-year interval. The question of the proportion of non-breeding

birds amongst the adults is considered at p. 78. It may be noted that the assertion made in 1951 that the adult population estimate from repeats was too high because of the 'trap-shyness' of once-caught birds was found to be unjustified in 1953, when adults were found to repeat slightly more readily than goslings. The date to which the population estimate refers is (approximately) 18 July. Adult deaths on the breeding ground are apparently very few (one British ring was found with 26 gosling rings at the fox-earth in Oddkelsver, but no dead adults were encountered elsewhere), so that the use of a precise date for this class is unimportant.



PINKFOOT NESTS

In 1951 16 nests of the season were found in an area of about 40 acres round the Base Camp at Bolstaður. More than half of these were already hatched when the party arrived on 26 June, but six still had eggs which were on the point of hatching. Three of these deserted owing to the proximity of the camp which had been pitched before it was known that the goose nests were so close. Of these three deserted nest sites two had evidently not been used since though the third one had. All the remaining nest sites revisited (about a dozen) had been occupied in 1953. Another nest some distance away which had been deserted in 1951 had also apparently not been used since. Thus of four desertions three sites were still unused two years later. In view of the prevalence of the habit of nesting in traditional nest sites many of which have evidently been used for generations it is of interest that two new nests were found in places where the position of nests had previously been particularly noted. Beside the ruined wall of one of the old goose folds there had been in 1951 two occupied nests about four yards apart. Now in 1953 a third was placed so as to form an equilateral triangle. Beside the hot springs at Nauthagi, which were carefully mapped in 1951, there were then only two nest sites, but in 1953 there were three.



LOCALISATION AND MOVEMENTS OF RINGED BIRDS

The persistence of traditional nest-sites encourages the belief that breeding geese return to their 'own' sites year after year and might be expected to become attached to particular 'neighbourhoods' within the oasis. Unfortunately, the method of catching geese by relatively long-distance drives employed in 1953 is most unsuitable for learning about behaviour of this kind. The early, small, catches, which were most likely to produce striking results did not really do so. An adult (Ring No. 2813), ringed at the south-east of Philsvatn on 29 July 1951

was recaptured by the same lake on 20 July 1953, and seven geese ringed on Arnarfellsalda on various dates in 1951 were recaptured there on 17 July 1953, but seven other recaptures in the early drives (before 20 July) were far from the places where they had first been marked.

The big catches of 21 July and after can only provide rather gross information on the localisation of marked geese, and the very large numbers of repeats obtained in 1953 do not enable any satisfactory picture of the normal wanderings of geese about the oasis to be drawn. But if all the recaptures of 1951-ringed geese are examined some points of interest emerge. The results of the Arnarfellsalda catch of 17 July noted above indicate the probability that homing to limited areas within the colony does take place. Since nearly two-thirds of the geese ringed in 1951 were caught on or near Oddkelsalda or Arnarfellsalda, our information about homing relates largely to these two localities, which, though only about three miles apart, were the collecting points for geese driven mainly from more remote areas. Table III summarises the distribution of recaptures. The numbers of recaptures from Oddkelsalda and Arnarfellsalda bear a similar proportion to the numbers marked in these localities. Only 7 of the 65 Oddkelsalda-ringed recaptures were from that area, while 27 of the 37 Arnarfellsalda-ringed birds were found there again. But, looking at the column totals, we see that 7 of 13 recaptures at Oddkelsalda were of geese ringed there, a greater proportion of ' residents ' than at Arnarfellsalda (where there were 27 in 64). The interpretation of these results is complicated by the different numbers of adults caught at Arnarfellsalda (2880) and Oddkelsalda (664) in 1953. If allowance is made for this, it appears that the chance of recapture ' where ringed ' was very similar for both localities, and that this chance was substantially greater than for birds marked at other places. Thus the evidence supports the idea that geese tend to return to, and remain in, relatively limited parts of the oasis.

TABLE III

Recaptures in Þjórsárver in 1953 of Pinkfeet marked there in 1951. 108 Geese were recaptured: the total of records is larger because some were caught several times and each recapture has been used

Where Ringed	No. Ringed 1951	Recaptured 1953			Total Recaptures
		Oddkelsalda	Arnafellsalda	Other Localities	
Oddkelsalda ..	420	7	21	37	65
Arnafellsalda ..	299	1	27	9	37
Other localities ..	452	5	16	1 where ringed 10 elsewhere	32
Total ..	1151	13	64	57	134

The proportion of recaptures from marking elsewhere is substantially smaller. This is probably due to the different catching sites used in 1951 and 1953. For example, in 1951, 55 geese were caught in Þufuver, on the east bank of the Þjórsá, which remained unvisited in 1953, because the expedition could not cross the river. Accordingly, these recaptures in many different areas are of little value in determining degrees of localisation.

WHEN DO PINKFEET FIRST BREED?

The age at which sexual maturity is attained by the Pinkfoot is not yet known. If analogies with other species may be relied on, it is probably three years in most cases, though some individuals may breed at two years old. This is the case with several species of *Anser* and *Branta* in captivity. Kossack (1950) found that at least one-fifth of the two-year-olds in a semi-captive flock of Canada Geese nested. More recent studies of wild Canada Geese nesting in California (Naylor 1953, Naylor and Hunt 1954) and Wyoming (Patterson and Ballou 1953), have led to the belief that " some of the non-breeders pair in their second year of life but do not breed until the third year " (Naylor *loc. cit.*). Observations on White-fronted Geese have led to rather similar inferences (Boyd 1954 and unpublished notes). For example, in January, 1952 some three-fifths of the second-winter Whitefronts at Slimbridge were paired ; but no two-year-old parents with families have yet been found in winter flocks.

Since few people have ever visited the breeding places of the Pinkfoot early in the breeding season, it is scarcely surprising that no direct observations on birds of known age are available. The members of the 1951 expedition reported in the following terms : " Yearlings and two-year-olds which are not yet sexually mature may be found in the breeding area, although in this case so few as to indicate a separate moulting area for sexually immature birds " (Scott, Fisher and Guðmundsson 1952). This generalisation was based on the relatively small numbers of adult geese seen in flocks without goslings, together with the fact that one of two British-ringed birds recaptured had been in its first winter when caught in December 1950. In 1953 flocks of full-grown geese without accompanying goslings were again infrequent and small (those seen totalled about 750) ; but the number of recaptures of marked birds was much greater and more informative than in 1951. These recaptures consisted of 108 birds ringed in Iceland in 1951 and 155 British-ringed birds, classified by date of first capture and age at ringing in Table IV. For the present purpose the very low proportion of one-year-old recaptures is not important, although it confirms that geese of this age-class may not all return to, or do not remain throughout the summer in, the breeding colonies. The proportion of two-year-olds (i.e. geese ringed in 1951) is the chief point of interest. There is an apparent conflict between the return of Iceland-ringed and British-ringed birds. In considering the number of recaptures to be expected from each age-class, it is convenient to use the symbols e for the annual adult survival factor, e_1 for the first-year survival factor of birds ringed in their first autumn, e_g for the survival factor of goslings between marking in July and entry into the British population in October, and m_a for the number of marked geese in any class. Then if all surviving marked geese were equally liable to recapture the expected numbers in each class would be proportional to their different rates of survival, as indicated in Table IV. Evidently, the marked birds are *not* all equally likely to occur in Þjórsárver : the proportion of 1951-marked adults marked in Þjórsárver and recaptured there is three times as great as that of adults marked in Britain in the same year. It may be supposed that the ratio $\frac{\text{2 year-old}}{\text{more than 2 years old}}$ in the recaptures of British-ringed birds was determined by the ratio $\frac{e_1 e}{e^2}$, or $\frac{e_1}{e}$. Using $e = 0{\cdot}74$, $e_1 = 0{\cdot}59$ (the values of the annual survival factor obtained

TABLE IV

Recaptures in Þjórsárver, 1953, of Pink-footed Geese ringed in Þjórsárver, 1951, and in Britain 1950–52

Where and when ringed	Þjórsárver 1951		Britain 1950–Mar. 1951		Britain 1951		Britain 1952	
Age at marking	Adult	Gosling	Adult	First Winter	Adult	First Winter	Adult	First Winter
Total marked	382	769	354	275	384	141	903	226
Number of recaptures	71	37	32	21	23	7	68	4
$\frac{\text{Recaptured}}{\text{marked}}$ %	18·3	4·7	9·0	7·6	6·0	5·0	7·5	1·8
Expected proportion of recaptures	me^2	$m\,e_g\,e_1\,e$	me^2	$me_1\,e^2$	me^2	$me_1\,e$	me	me_1

from recoveries (see pp. 102–103)) the value of $\frac{e_1}{e}$ is found to be 0·80. This is in quite close agreement with the values obtained from the recapture ratios $\frac{\text{marked as first winter}}{\text{marked as adults}}$ both for the 1951 sample $\left(\frac{R_1}{R} = 0{\cdot}83\right)$ and that of 1950 $\left(\frac{R_1}{R} = 0{\cdot}84\right)$, from which it may be concluded that two-and three-year-olds are as likely to be found in the captures on the breeding-grounds as birds of older age-groups. By analogy, amongst the recaptures of Iceland-ringed birds $\frac{R_1}{R}$ should be approximately equal to $\frac{e_g e_1}{e}$. If $e_g = 0{\cdot}65$ (see pp. 82–87) $\frac{e_g e_1}{e} = \frac{0{\cdot}65 \times 0{\cdot}59}{0{\cdot}74} \simeq 0{\cdot}52$, whereas $\frac{R_1}{R} = 0{\cdot}26$, from which it appears that only about half the expected number of Iceland-ringed two-year-olds were recaptured. The reconciliation of these two findings seems to require either that the $\frac{R_1}{R}$ ratio for the British 1951 ringing be rejected (perhaps on the ground that the number of first-winter geese marked was very small), or that the estimated value of e_g be reduced to about 0·32, or that some biological reason be found for the discrepancy. The rejection of the 1951 British $\frac{R_1}{R}$ ratio seems unreasonable, in view of its agreement both with expectation and with the 1950 data. It is unlikely that the gosling losses from marking to arrival in Britain were as much as 68% in 1951, since the results from the 1953 ringing appear to agree with those of 1951 in suggesting losses of only half this amount. But there is a possible resolution of the discrepancy on biological grounds, although it can only be regarded as tentative. Pair formation in geese takes place in the autumn and winter as much as in the spring and so occurs away from the breeding-grounds. Since in its winter range members of the species from many breeding colonies occur in the same flock it is quite likely that the prospective mate is

selected from amongst geese bred elsewhere. Pairs once formed normally persist throughout life (although there is evidence of merely temporary alliances between some birds in their second year, at least in *A. anser* and *A. albifrons* (K. Lorenz personal communication ; Boyd 1954 and unpublished notes)) and recently-paired birds may be assumed to return to the breeding-place of one of them. The effect of any considerable proportion of Þjórsárver-bred birds pairing with, say, Greenland birds in their second winter would be to reduce the return-rate of these birds to Þjórsárver in the following summer. But no comparable reduction in the occurrence there of British-ringed two-year-olds would be anticipated if pair-formation does take place as suggested. In support of this explanation it may be noted that in other colonial-nesting species it has generally been found that extra-colonial matings are frequent, so that although individuals that have once bred in a colony will continue to return, birds hatched there are relatively unlikely to return.

Further evidence on the occurrence of two-year-olds in breeding colonies is provided by the distribution of recaptures amongst the various catches made

TABLE V

Occurrence of Two-year-Old Pink-footed Geese amongst Recaptures in Þjórsárver, July–August 1953. (Geese captured in more than one locality are listed wherever found)

Locality	Ringed Iceland 1951		Ringed Britain 1950–51		Total		2 Years Old
	2 Years Old	More than 2 Years Old	2 Years Old	More than 2 Years Old	2 Years Old	More than 2 Years Old	Total %
Arnarfellsalda	16	23	4	35	20	58	25·6
Gæsaþaufa	7	16	5	17	12	33	26·7
Oddkelsalda	4	9	0	17	4	26	13·3
Hjartarfellsalda	18	40	2	29	20	69	22·5
Others	1	2	0	6	1	8	11·1
Total	46	90	11	104	57	194	22·7

Date	Iceland-ringed		British-ringed				2 Years Old
	2 Years Old	More than 2 Years Old	2 Years Old	3 Years Old	More than 3 Years Old	More than 2 Years Old	Total %
11–17 July	5	9	1	1	3	9	25·0
19–21 July	12	32	2	8	18	34	17·5
25–26 July	2	4	0	4	3	9	13·3
29 July	10	20	3	5	12	29	21·0
1–4 August	10	30	5	11	10	25	21·4
Total	39	95	11	29	46	106	20·0

in different parts of Þjórsárver in 1953. The relative frequency of two-year-olds and of older birds shows no significant variation either with locality or by date (Table V). Thus there does not seem to be any justification for asserting that two-year-olds are especially likely to be found in non-breeding flocks. Indeed the relative homogeneity of their occurrence indicates the opposite, that they are scattered through the colony in the same way as older birds. This makes it possible that these birds breed, but is not evidence of their doing so. The problem can only be solved by the examination of the reproductive systems of a large series of two-year-old females. This can perhaps be achieved in the autumn of 1955, when the goslings marked in 1953 will be of appropriate age.



PREDATION ON PINK-FOOTED GEESE

In 1951 we had been surprised that so large a colony of breeding-geese should have attracted so small a number of predatory animals. In 1953 predators were even less in evidence, but the fact that fewer Great Black-backed Gulls and Iceland Falcons and no White-tailed Eagles were seen may perhaps have been due to the much later arrival of the party in the oasis. In 1951 we had arrived on 26 June whereas in 1953 we arrived on 9 July. By that date most of the goslings were at least two weeks old, and it may well be that predatory birds like the gulls not tied to the oasis by nests or young move away as soon as the goose's eggs are hatched or at least as soon as the goslings are capable of escaping.

A comparison of the numbers of predatory species is shown in Table VI.

TABLE VI

Species Predatory on Pink-footed Geese in Þjórsárver

Species	1951	1953
White-tailed Eagle ..	One	None
Iceland Falcon	One or two pairs. Individuals seen on at least 12 occasions	Individuals seen only twice
Arctic Skua	*c.* 10 pairs	*c.* 10 pairs
Great Black-backed Gull	*c.* 40	Less than 10
Snowy Owl	Probably one seen twice ..	Probably one seen five times, but possibly two
Raven	None	One only, seen once
Arctic Fox	One seen, one heard ; no earths occupied	Vixen and one cub seen at earth (11 July).



Arctic Skua

The role of the Arctic Skua as an enemy of unattended goslings was clarified. It seems that healthy goslings without parental protection can be killed by these Skuas. Attacks which would have resulted in the destruction of a gosling but for human intervention were observed on two occasions.

Because the geese are very much more numerous than other birds in the Þjórsárver oasis it has been suggested that their dominance limits the number of prey species and hence of predators, but this effect has not been established.

GOSLING MORTALITY

The 1951 expedition found brood size at hatching (late June) to be 4·5 (19 broods), the mean of ten broods in the first half of July to be 4·4, and that of eight on 21 July to be 4·2. These figures indicated a low mortality rate during the first month. In 1954, Blurton Jones and Gillmor (see p. 153), found the mean brood-size of families in the Ásgarð area, north-west from Þjórsárver, to be 3·1 in the period 20 August–1 September. There was no observable decline in size during this period and it appears that mortality in that interval must have been small, but the difference between this mean of 3·1 and that of 4·5 at hatching in 1951 suggests that losses during the fledging period may be considerable. Brood counts made by Løvenskiold (1954) in Spitsbergen in 1952 help to confirm this. The mean size of nine broods seen between 7 and 11 July, soon after hatching, was 3·6. By 17 July the mean of 11 was 3·0. Five broods on 14 and 18 August again averaged 3·0.

Brood counts are not a very satisfactory measure of gosling losses, unless large numbers of families can be seen, and where this happens, as in Þjórsárver, the tendency of families to aggregate in large flocks makes it impossible to distinguish reliably between broods, especially as it is common for goslings to attach themselves to broods other than their own at any time during the fledging period. The 1953 expedition abandoned the attempt to count broods after 14 July. Between 8 and 14 July 94 goslings in 22 families had been seen, with a mean brood size of 4·3.



Another, rather similar, method of estimating losses is to compare the ratio of goslings to adults in successive catches. On the assumption that adult mortality and emigration in July and August are negligible, the rate of fall of the proportion of goslings should indicate the magnitude of the losses during fledging. Captures made by chasing family groups, used for most of the 1951 expedition, must be excluded from consideration, because this technique often results in the escape of the adults, leading to quite unrepresentative gosling/adult ratios. The data in Table VII are restricted to the large catches made between 16 July and 6 August 1953. No steady trend is apparent. The preponderance of adults in the catches of 29 July and 4 August was probably due to the presence of flocks of non-breeders in the areas driven. By grouping the early and late catches as shown, a decrease in the proportion of goslings is indicated, but the magnitude of this decrease can be considerably altered by regrouping the data. The choice of groups is quite arbitrary, so that the method fails to provide a satisfactory measure of gosling loss, but it suggests that losses in *late* July are comparatively slight.



TABLE VII

Gosling : Adult Ratios in Large Catches of Pink-footed Geese, Þjórsárver, July–August 1953

	Date of Catch									
	16 July	17 July (2)	21 July	25 July	26 July	29 July	1 Aug.	2 Aug.	4 Aug.	Total
Goslings	101	382	1652	62	390	1433	703	418	861	6002
Adults	58	333	1515	56	285	1682	303	303	1031	5566
Goslings per 100 Adults	174	115	109	111	137	85	232	138	84	108
	←124→			←133→			←121→			
	←112→					←103→				

Gosling mortality may also in principle be estimated from repeats in Þjórsárver by means of capture-recapture methods, using chains of three or more samples, but in practice these methods cannot provide even an indication of the order of magnitude of gosling losses. This is because the methods do not distinguish between deaths and emigration or births and immigration. Though there is probably no large-scale emigration from the colony as a whole before mid-August, the movements of flocks about the oasis produce nonsensical results from the data, (such as large apparent birth-rates at a time when all goslings are at least three weeks old).

A possible method of computing gosling losses is by comparing the recoveries in Britain in winter of goslings ringed early in July with those of goslings not ringed until August. For, although the age at marking is not known, the

average age of goslings first marked on (say) 16 July must have been less than the average age of those marked on 4 August. Thus, other things being equal, if mortality between these dates was substantial the proportion of early-marked goslings found subsequently in Britain should be less than the proportion of late-marked ones. The data on this point from both the 1951 and the 1953 expeditions are set out in Tables VIII and IX.

TABLE VIII

Numbers of Recoveries and Recaptures in Britain and Iceland of Goslings marked in Iceland, June–August 1951

Date of Marking	Number Marked	Number since Reported	Reported / Marked %
28 June–7 July	56	7	12·5
11–15 July	55	11	20·0
17–22 July	99	18	18·2
25–26 July	189	50	26·5
28 July	177	36	20·3
31 July–1 August	187	46	24·6
Total	763	168	22·0

TABLE IX

Numbers of Recoveries and Recaptures in Britain, 1953–54, of Goslings marked in Iceland, July–August, 1953

Date of Marking	Number Marked	Recovered	Recaptured	Total Reported	Reported / Marked %
10–18 July	614	32	11	43	7·0
19–21 July	1745	113	46	159	9·1
25–26 July	330	24	7	31	9·4
29 July	1233	87	36	123	10·0
1–3 August	446	31	10	41	9·2
4–6 August	435	32	8	40	9·2
Total	4803	319	118	437	9·1

Some grouping of smaller catches has been used. The argument for determining losses in the second half of July is as follows :

$$\frac{[(\text{early-ringed})-(\text{deaths before late ringing})]-(\text{deaths before arrival in Britain})}{(\text{late ringed})-(\text{deaths before arrival in Britain})} = \frac{\text{British recoveries of early-ringed}}{\text{British recoveries of late-ringed}}$$

On the assumption that the proportion of casualties after the last ringing date and before arrival in Britain is the same for both groups, the equation may be rewritten as :

$$[(\text{early-ringed})-(\text{deaths before late ringing})] = \text{late-ringed} \times \frac{\text{early-ringed recoveries}}{\text{late-ringed recoveries}}$$

Substituting the rather small numbers of recoveries of 1951–ringed goslings in this equation we find from the first two rows of Table VIII (markings in 28 June–7 July and 11–15 July) that losses of marked goslings in the first half of July may have been of the order of one-third, although additional losses in the second half of July may not have exceeded one-sixth of the survivors at the middle of the month. If we assume that losses in the last week of June were at the rate indicated for early July and that those in August, up to fledging, resembled those in late July, the estimated total losses of goslings during the fledging period in 1951 were of the order of three-fifths of the number hatched. (From evidence to be discussed later, there is no good reason to think that the losses were due to the activities of the expedition.)

The much larger number of goslings marked in 1953 might be expected to produce more reliable results. Table IX shows that there is a difference between the recovery-rates of goslings ringed 10–18 July and those marked later. This difference is statistically significant. It appears that few deaths can have occurred in the last ten days of July or in early August but that earlier in July the weekly rate of loss may have been as high as one-quarter. If such a rate was sustained throughout the first three weeks of the fledging period it would, together with the small number of later losses, result in the death of almost three-fifths of the goslings hatched. The interpretation of the discrepancy in the proportion of subsequent recoveries in terms of rate of loss is much hampered by the necessity of grouping the early-ringed birds in order to provide a large enough sample for comparison with the later catches. If, as appears, the rate of loss decreased rapidly in the middle of July the choice of groupings may importantly affect the estimated rate of mortality. Examination of the recoveries from each catch shows that chance variations in the reporting of recoveries are sufficient to obliterate any differences in British recovery-rates resulting from losses between 10 and 20 July.

Ten of the 39 ringed goslings found at the fox-earth in September or by the expedition in August were birds ringed before 20 July, a proportion significantly greater than would be expected from the comparatively small numbers marked by that date. This supports the hypothesis that losses (to predators, from bad weather and by accidents) are heavier in the first half than the second half of the fledging period.

In an investigation of the dynamics of the British Pinkfoot population (Boyd, in press), the model for the estimation of first-year death-rate included a factor affecting the expectation of recovery of goslings ringed in Iceland in July 1951 as compared with that of juveniles ringed in Britain in October 1951. The evaluation of this factor led to the conclusion that the losses of goslings between marking in Iceland and entering the British population were about 35%. Losses of the same order in 1953 are indicated independently by two different methods.

The first method uses the relative proportion of goslings and adults marked in Iceland and caught again in Britain in October 1953. On the assumption that marked adults and goslings were equally liable to capture, the following relation should hold :

$$\frac{\text{number of Iceland-marked goslings recaptured in Britain}}{\text{number of Iceland-marked adults recaptured in Britain}} = \frac{\text{number of goslings marked}}{\text{number of adults marked}} \times \frac{\text{gosling survival factor (Aug.–Oct.)}}{\text{adult survival factor (Aug.–Oct.)}}$$

On the assumption that all the marked adults survived until mid-October (when rocket-net catching began), the estimated gosling survival factor is

$$\frac{\text{86 goslings recaptured}}{\text{92 adults recaptured}} \times \frac{\text{3,884 adults marked}}{\text{4,861 goslings marked}} = 0{\cdot}75$$

The adult survival factor will certainly not have been 1·0. However, there are very few adult recoveries in August and September and, even allowing for the fact that losses on the breeding-ground and on migration are relatively unlikely to be reported, it seems improbable that the adult survival factor for August-October is less than 0·90. The reduction of the adult survival factor to this lower limit would result in a corresponding reduction of the gosling survival factor, from 0·75 to 0·67. Thus these 1953 recapture data suggest gosling losses in the period between marking and recapture in Britain of between one-third and one-quarter of the total marked.

The recaptures in October 1953 of Iceland-ringed goslings also provide the second method of estimating losses between July and mid-October, the use of the Lincoln index. This is a method of estimating total numbers at the time of first capture (t_1) from the proportion of recaptures on a second occasion (t_2) of birds marked at t_1. (This method is discussed briefly in an earlier section of this paper dealing with the estimation of the size of the Þjórsárver colony.) The special condition for its use in this context is that goslings marked in the summer of 1953 should have had the same probability of being caught in Britain in October 1953 as all other goslings bred in Iceland and Greenland. The ratios of $\frac{\text{marked goslings}}{\text{unmarked goslings}}$ found in the different catches in October varied, but not more than might be expected in random sampling. Thus it seems justifiable to use the relation

$$\frac{\text{total gosling population summer 1953}}{\text{goslings marked in summer 1953}} = \frac{\text{number of goslings caught in October 1953}}{\text{number of marked goslings caught in October 1953}}$$

to estimate the gosling population of Iceland and Greenland in mid-July 1953 at $4861 \times \frac{363}{69}$, or about 25,600. The juvenile population in Britain at the end of October 1953 was estimated at about 15,300 (Boyd, in press) suggesting losses between July and late October of 10,300 or about two-fifths. The two latter measures of gosling casualties before entering the British population assume that the marking in each summer was carried out in one operation, instead of over a period of several weeks. The measures used earlier indicate that losses in late July and early August are comparatively small. Thus it seems likely that many of the casualties detected by these recapture methods occurred on migration or after arrival in Britain but before rocket-netting began, rather than on the breeding-grounds.

Reviewing the results of these various estimates, we find that they are not wholly consistent. This is not surprising, in view of the practical difficulties in the observational methods and the sampling hazards inherent in the indirect ones. Brood counts indicate losses of 6·7% in the first 3½ weeks in 1951, of perhaps 31% in the whole fledging period in 1954, and of 16·7% in the fledging period in Spitzbergen in 1952. The $\frac{\text{gosling}}{\text{adult}}$ ratios in the catches in Þjórsárver

in 1953 yield estimates varying from about 1% to 4% per week in late July, confirming that losses in this period are relatively small, but providing no information on losses in the critical first three weeks. The method of comparing British recovery-rates of early and late-ringed goslings suggests total losses during the fledging period of about 60% in both 1951 and 1953. The comparison of calculated first-year death-rates for Iceland-ringed goslings and British-ringed juveniles shows a loss of about 35% between marking in Iceland and recapture in Britain in October 1951 : and the two indirect methods applied to the 1953 marked goslings show losses of similar magnitude (about 30%, and about 40%) in the corresponding interval in that year.

It may be concluded with confidence that gosling mortality must be substantial. The proportion of losses sustained may well vary considerably from year to year, and differ in the smaller colonies elsewhere in Iceland and Greenland from that in Þjórsárver. Losses in some of the small colonies are probably substantially greater, because predators are more numerous there. But the provisional use of the estimate from this colony as representative seems justifiable, especially since it probably contributes at least two-fifths of the annual increment to the British population. For the purpose of calculation, the annual mortality of goslings between hatching and entering the measured British population (i.e. to mid-October) will be taken to be 60%. It seems unlikely to be less than 50% and may be as much as 70%. About a quarter of these losses probably occur after fledging, either on the first southward migration or immediately on arrival in Britain. (Many geese will have been ' at risk ' in Britain for several weeks before catching begins in October.)

Very little is known about gosling mortality in other species. Hanson (in Hanson and Smith 1950) writes that juvenile mortality in Canada geese ' appears to be small,' but his evidence was derived from brood counts and recent intensive studies have shown this method to be valueless for that species (e.g. Munro 1948, Miller and Collins 1953, Naylor and Hunt 1954). Almost all other nidifugous species—ducks, gulls, terns, gallinaceous birds, waders, coots—which have so far been studied suffer severe losses between hatching and fledging (Lack, 1954). It would be surprising to find an Arctic-breeding species like the Pinkfoot providing an exception.

In a correspondence in *The Times* in the autumn of 1953 several critics, dismayed by the success of the expedition, asserted that the mass capture of goslings must have produced very large numbers of casualties. It now seems clear that no large losses resulted from the goose-drives. As already noted, few dead goslings were found in Þjórsárver. There is a more striking confirmation of our belief that the assertion of harm caused by ringing was quite unjustified. Since the Þjórsárver colony contributes at least two-fifths of the total juvenile population in Britain, the effects of mass destruction there would surely have been apparent in a fall in the proportion of juveniles in the autumns following the expeditions of 1951 and 1953. The proportion of juveniles in each year from 1951 to 1954 is known from rocket-netting catches. In 1951 and 1953 the proportions of juveniles were 27·0% and 32·5% of the catch. For the years 1952 and 1954 (i.e., those when the colony was undisturbed by ringing operations) the proportions were 19·9% and 32·8%. Clearly, the proportion is highly variable but, equally clearly, there is no ground for belief that disturbance of the Þjórsárver colony led to abnormal losses of goslings.



Flightless Pinkfoot

WING-MOULT

Some adult geese were already flightless when the party arrived on 9 July 1953, but not many. (In 1951 the first flightless adults had been seen on 4 July.) The first flightless adult was *caught* on 10 July (12 July 1951). On 15 July, however, so many adults could still fly that the drives were not satisfactory, and they only became really effective on 17 July. The last bird was seen flying on old primaries on 26 July and the first on new primaries on 28 July, (the same date as in 1951). By 4 August it was noted that 60% of the adult geese, in a catch which included 1049 adults, were able to fly on release after ringing. By 6 August most of the geese in the oasis could fly. These dates conform very closely with similar observations in 1951 yet the larger samples enable a clearer picture to be obtained and it is felt that the estimate of 28 days of flightlessness for any individual goose may be too long. It seems possible that the average flightless period may be as little as 25 days.

That it was possible on 4 August to drive 60% of the adults (some 600 geese) which could in fact fly into nets which were only three feet high, and keep them there for several hours needs some explanation. These birds had flight feathers which were not yet completely grown out, and could therefore only fly with an effort if hard pressed. During the assembly of the geese no such pressure was exerted, and once the birds had formed a tight gaggle the necessary space to spread wings and take a long run was not available to them. In addition they evidently found some sense of security from being in the gaggle and were not particularly anxious to leave it. Furthermore once the netting circle had closed around them there was not a long enough run for take-off while their primaries and secondaries were not yet fully developed. But on release, with space for a long run, they were able to achieve flying speed and subsequently to rise quite high into the air.

As an example of the reluctance of birds to leave the gaggle (or their families), during the big catch of 21 July one bird, which had not yet moulted and retained



New wing feathers beginning to grow

the *full* powers of flight, remained with the gaggle for six hours when it suddenly decided to fly out of the pen, which it had, of course, no difficulty in doing. After 11 hours, and when the last birds were being handled a second goose decided to do the same thing.

Once more it was noted that geese became unable to fly before the flight feathers were actually cast. On 14 July in a small drive four adult geese were caught. Three of these had complete flight feathers. Before capture they made no attempt to fly, but after release they flapped off with the advantage of a moderate breeze blowing up the bare slope of the hill. In spite of that, however, *they were unable to become airborne.* Under similar conditions at another drive on the same day a bird which flapped away shed its flight feathers as it went, whereas on the previous day a bird already lacking several primaries had successfully taken off from a hill-top. Loss of the power of flight before the actual loss of wing area is difficult to explain. Even if the bird knew by the feel of the feathers that flightlessness was imminent, it could still fly off low without danger of any serious injury should the feathers be cast in flight. It is possible that some pain is involved and that the bird dare not put full weight behind the wing beats because of this, but it would be surprising if such a consideration were to take precedence over the escape urge. The arrangement of the overlapping primaries and secondaries do not allow the possibility of each feather twisting and thus 'spilling' the air, nevertheless we are forced to the conclusion that when the feathers are loose a few hours before they are actually cast some mechanical weakness in the structure of the wing prevents the bird from obtaining lift from it.

In 1951 it appeared that non-breeders moulted their flight feathers about a week earlier than the parents of broods. The flocks of non-breeders seen in 1953 were mostly capable of flight by 29 July when few parents were yet flying. A similar phenology has been observed in at least four other species of geese.

The conclusion reached from observations in 1951 that female Pinkfeet moult before the ganders was perhaps premature. In 1953 some families were seen in which the females were flightless while the ganders could still fly. But a number of adults caught in the period 17–20 July were sexed and this sample (admittedly small) failed to confirm this distinction. 13 of 14 ganders were flightless, but only 16 of 24 females were unable to fly. The point needs further study, because it is possible that these figures are influenced by a greater willingness of ganders to desert their families when being pursued.

VARIATIONS

In a sample of 9000 birds it is not surprising that several abnormal or freak specimens were found. The most striking was a biscuit-coloured gosling (Ring No. 14000). The markings were dimly discernable, but there was evidently a shortage of black pigment. The irides were normal but the bill and legs were already pink, whereas in normal goslings of this age they were still slate grey. This particular abnormality is well known in this species, and in most winter seasons at least one such bird has been observed in Britain. The degree of paleness seems to vary, some specimens being rather whiter than this gosling, some darker. In one season (1940–41) no less than three such leucistic Pinkfeet were present in one flock, indicating that they were probably fairly closely related.

Four goslings showed schizochromic plumage, with patches of white. One



Schizochromic Pinkfoot

(Ring No. 27362) had these patches on the scapulars but as these were the only feathers yet grown it might have shown greater extents of white later. A second (Ring No. 14350) had a large white patch under the chin. (This bird was shot in Kinloss in November 1953.) The third (Ring No. 26795) had its right wing-tip completely white, the first two primaries of the left wing white, and a white patch mainly on the right side of the breast. The fourth (Ring No. 28979) was not noticed as abnormal in Iceland, but was found to have a white left wing-tip and a white bar across the breast when recaptured four months later in Scotland on 23 November 1953.

Two others aslings captured together on 1 August (Ring Nos. 13400 and 211500) were found to have no webs to their feet—evidently a congenital deformity which has been observed now four times in the 14,800 Pinkfeet examined. One, caught in October 1954 in the rocket-nets, is now in the Trust's collection. Of the adult geese at least three had bright orange legs and bill markings instead of the usual pink. This is not to be confused with the yellowish legs of some immatures, nor with the orange stain which sometimes gives a yellowish suffusion to the skin of the leg and foot, but is a definite bright orange pigmentation invariably associated with a similar bill colour. Others may have been overlooked as some of the adults in the large catches were handled in twilight. This is an abnormality which has been seen five times in the 8040 adult birds handled. The Icelandic examples were Ring Nos. 12673, 27204 and 27769. The two British captured specimens are now in the Trust's collection.



Foot of Henfooted Gosling

NOTES ON THE BIRDS OF ÞJÓRSÁRVER VID HOFSJÖKUL

A full list was given in Scott, Fisher and Guðmundsson (*loc. cit.*) of the birds seen in 1951. Only three species were added to this list in 1953 :

Mallard (*Anas platyrhynchos*)

A pair was seen in the marsh just north of Arnarfellsalda on 29 July, and a single bird in flight at the same place on 4 August.



Merlin

Merlin (*Falco columbarius*)

A male was seen in Tjarnarver on 10 July and the call was heard from the Base Camp on 12 July.

Raven (*Corvus corax*)

One was seen and heard near the Base Camp on 9 July.

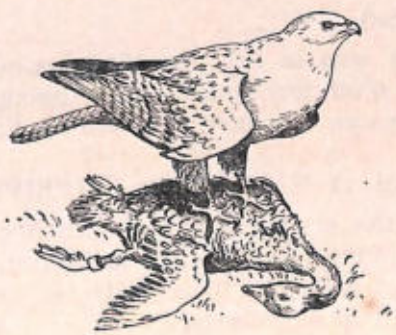
Apart from these new species some further observations were made of birds recorded in 1951.

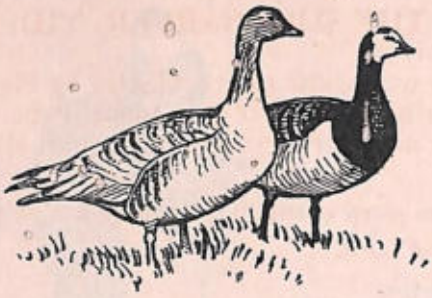
Snowy Owl (*Nyctea scandiaca*)

An adult male was seen on 9, 13, 19 July and 4 and 5 August. It was in the same area near the Hnifá (where one was also seen in 1951) on four of the dates, but on 4 August one was seen some six miles away and may perhaps have been a different bird.

Iceland Falcon (*Falco rusticolus*)

This species was seen only twice (substantially fewer times than in 1951). On 16 July in the early morning an Arctic Skua mobbed a falcon and the two passed directly over the Base Camp. The falcon was quite unconcerned at the skua's attacks and flew straight as a die towards the Kerlingarfjöll. On 19 July an Iceland falcon was sighted eating a gosling near the mouth of the Hnifá. As the party approached it tried to carry away its prey but could not quite lift it. Instead it stayed with it until we were about 50 yards away, then flew to a nearby mound where it looked superb against a background of the blue waters of Þjórsá and Hnifá at their junction. After that it flew round four times, its yellow legs shining in the sun. The plumage was beige-grey and there appeared to be no trace of moustaches. Its victim was a gosling ringed nearby a few hours earlier.





Barnacle Goose (*Branta leucopsis*)

A single Barnacle gander was rounded-up in the three thousand catch on 21 July and ringed No. 29142. Part of this drive passed close to the place where on 29 June 1951 a Barnacle gander was found mated to a female Pinkfoot sitting on four eggs. It seems possible therefore that this was the same bird. No goslings in the catch could be identified as hybrids, though the differences in colour or markings would not have been great at that stage of plumage development. No such hybrids have been seen since—although a Barnacle × Whitefront hybrid was seen in the winter of 1953–54 at Slimbridge and another (almost certainly a different bird) in Wexford. The Slimbridge bird reappeared in the winter of 1954–55 (see p. 19). It is probable therefore that a brood of hybrid Barnacle × Pinkfoot goslings would have been identified during the winter, had they reached Britain.

Arctic Tern (*Sterna macrura*)

Only a very few pairs were seen in 1951 but in 1953 there appeared to be a marked increase. Whether these birds had been breeding it was not possible to establish but the species was certainly substantially more numerous than it had been two years before.

Great Black-backed Gull (*Larus marinus*)

In 1951 it was estimated that between 30 and 40 were living in the oasis, feeding on the eggs and goslings of the Pinkfeet, though they were thought not to be breeding in the area. In 1953 the bird was seen even less frequently and it is thought that there were not more than ten of them in the oasis. On the other hand it is possible that there had been more during the incubation and hatching periods of the geese when food was plentiful, and that they had departed before the arrival of the expedition (about 17 days after the probable peak of the hatching date).

Ptarmigan (*Lagopus mutus*)

Only three broods were seen in 1951 but 1953 was evidently a 'Ptarmigan year.' The species was much more numerous. Although no record was kept of the number of broods seen, it cannot have been less than 15.

HOT SPRINGS AT NAUTHAGI : A CORRECTION

In the sketch map of this system of springs (5th Annual Report, p. 111) a scale is given at the left of the map of a distance described as 'about a hundred yards.' The distance was paced and found to be 140 yards. The sketch map should therefore be scaled up accordingly.

PLANTS OF THE ÞJÓRSÁRVER VIÐ HOFSJÖKUL

A LIST of 108 species of vascular plants collected by Finnur Guðmundsson in 1951 was given in the previous paper (5th Annual Report, p. 112). With this list as a guide Sladen made a further collection which also included 37 mosses and 8 liverworts.

The following plants given in the 1951 list were not refound :—

Stellaria crassifolia Ehrh.
Ranunculus reptans L.
Empetrum nigrum L.
Erigeron boreale (Vierh.) Simm.

It seems probable that the record of *Ranunculus reptans* was a misidentification and that the species was in fact *R. hyperboreus*, since the latter was found at specific sites from which the former had been recorded. *Empetrum* was abundant, but only one voucher specimen was collected in 1953 and this proved to be *E. hermafroditum*. *E. hermafroditum* and *E. nigrum* were probably both present.

Altogether 44 species, 5 varieties and 5 hybrids of vascular plants new to the area were found. Some of these (e.g. *Catabrosa*) being late flowers and found only during the last few days of our stay, might have been more widely distributed in the area than indicated by the frequency symbols. The list now represents over one-third of the total of vascular plants on the Iceland list.

No attempt was made at an exhaustive collection of the mosses and liverworts. They were collected from typical habitats and for their associations with the vascular plants.

The plant ecology of the area will be the subject of a more detailed paper to appear shortly in the Proceedings of the Linnean Society of London. The specimens collected, which represent every species, variety and hybrid listed below have been presented to the British Museum of Natural History, London.

PLANTS OF THE ÞJÓRSÁRVER VIÐ HOFSJÖKUL, JULY-AUGUST, 1953


Botrychium lunaria

*Not on 1951 list.
Frequency symbols:
a abundant.
f frequent.
o occasional.
r rare.
vr very rare (i.e., only seen once or twice).

	Frequency
Ophioglossaceae	
1. *Ophioglossum vulgatum* var. *polyphyllum* A.Br. ..	vr
2. *Botrychium lunaria* (L.) Sw.	o
Polypodiaceae	
*3. *Cystopteris fragilis* (L.) Bernh.	vr

		Frequency
	Equisetaceae	
4.	*Equisetum arvense* L. ..	a
*5.	,, *pratense* Ehrh. ..	vr
*6.	,, *palustre* L. ..	vr
*7.	,, *variegatum* Schleich. ex Weber and Mohr ..	f
*8.	,, *hyemale* L. ..	vr
	Selaginellaceae	
9.	*Selaginella selaginoides* (L.) Link	vr
	Potamogetonaceae	
10.	*Potamogeton alpinus* Balb.	vr
	Gramineae	
*11.	*Anthoxanthum alpinum* A. & D. Löve (*A. odoratum* s. Stefansson, pro parte)	vr
*12.	*Alopecurus aequalis* Sobol.	vr
13.	*Phleum commutatum* Gaud.	f
*14.	*Hierochloë odorata* (L.) Beav.	o
*15.	*Milium effusum* L.	vr
16.	*Agrostis stolonifera* L. ..	f
17.	*Calamagrostis stricta* (Timm.) Koel. (*C. neglecta* (Ehrh.) G., M. & Sch.)	f
18.	*Deschampsia alpina* (L.) Roem. & Schult. ..	f
*19.	,, *flexuosa* (L.) Trin. ..	r
20.	*Trisetum spicatum* (L.) Richt.	f
*21.	*Catabrosa aquatica* (L.) Beauv.	vr
22.	*Poa glauca Vahl.*	f
23.	,, *alpina* L.	f
	Var. *vivipara* L.	f
*25.	,, *pratensis* L. subsp. *alpigena* (Fr.) Hiit. ..	o
*26.	,, *subcaerulea* Sm. ..	o
27.	*Festuca rubra* L.	f
*28.	,, var. *mutica Hartm.*	a
29.	,, *vivipara* (L.) Sm. ..	f
	Cyperaceae	
30.	*Eriophorum scheuchzeri* Hoppe ..	a
31.	,, *polystachion* L. (*E. angustifolium* Honck.)	f
32.	*Kobresia myosuroides* (Vill.) Fiori & Paol.	f
*33.	*Carex maritima* Gunn. ..	o
34.	,, *curta* Gooden. (*C. canescens* auct.) ..	o



Carex rariflora

		Frequency
35.	*Carex lachenalii* Schkuhr ..	r
36.	,, *rariflora* (Wahlenb.) Sm.	a
37.	,, *rostrata* Stokes ..	f
38.	,, *saxatilis* L.	o
39.	,, *nigra* (L.) Reich. (*C. Goodenoughii* Gay.)	a
40.	,, *lyngbyei* Hornem. ..	o
41.	,, *bigelowii* Torr. ex Schwein. (*C. rigida* Good.) ..	a
*42.	,, *rufina* Drej.	vr
*43.	,, *bigelowii* x *nigra* ..	o
*44.	,, *lyngbyei* x *nigra* ..	o
*45.	,, *bigelowii* x *lyngbyei*	vr
*46.	,, *bigelowii* x (hybrid)	vr
	Juncaceae	
47.	*Juncus arcticus* Willd. ..	f
*48.	,, *trifidus* L.	f
*49.	,, *triglumis* L. ..	o
50.	,, *biglumis* L.	f
51.	,, *articulatus* L. ..	vr
*52.	,, *bufonius* L.	vr
53.	*Luzula spicata* (L.) DC. ..	f
54.	,, *arcuata* Sw. ..	o
*55.	,, *confusa* (Hartm.) Lindeb.	o
*56.	,, *multiflora* (Retz) Lej	vr
	Liliaceae	
57.	*Tofieldia pusilla* (Michx.) Pers.	f

		Frequency
	Orchidaceae	
*58.	*Gymnadenia albida* (L.) Rich. (*Leucorchis albida* (L.) E. Mey.)	vr
59.	*Coeloglossum viride* (L.) Hartm.	o
	Salicaceae	
*60.	*Salix glauca* L.	a
61.	,, *lanata* L.	a
62.	,, *herbacea* L.	a
63.	,, *phylicifolia* L. ..	a
*64.	,, *herbacea* x *lanata* ..	r
	Betulaceae	
65.	*Betula nana* L.	o
	Polygonaceae	
66.	*Rumex acetosa* L.	f
67.	*Oxyria digyna* (L.) Hill. ..	o
68.	*Koenigia islandica* L. ..	a
69.	*Polygonum viviparum* L. ..	a
	Caryophyllaceae	
*70.	*Montia fontana* L. (*M. lamprosperma* Chamisso) ..	vr
71.	*Cerastium cerastoides* (L.) Britton ..	f
72.	,, *alpinum* L. ..	a
*73.	,, var. *glabratum* Retz.	vr
*74.	,, *holosteoides* Fr. (*C. caespitosum* Gilib.) ..	vr
75.	*Sagina intermedia* Fenzl. ..	vr
*76.	,, *procumbens* L. ..	o
77.	*Minuartia rubella* (Wahlenb.) Hiern. (glandular and glabrous forms) ..	f
78.	,, *biflora* (L.) Schinz. and Thell. ..	o
*79.	,, *stricta* (Sw.) Hiern. ..	vr
80.	*Arenaria norvegica* Gunn...	f
81.	*Viscaria alpina* (L.) G. Don	f
82.	*Silene maritima* With. ..	a
83.	,, *acaulis* (L.) Jacq. ..	a
	Ranunculaceae	
84.	*Ranunculus acris* L. ..	f
85.	,, *pygmaeus* Wahlenb. ..	o
*86.	,, *hyperboreus* Rottb. ..	o
*87.	,, *confervoides* (Fr.) Fr. ..	vr
88.	*Thalictrum alpinum* L. ..	a

		Frequency
	Cruciferae	
*89.	*Draba norvegica* Gunn. (*D. rupestris* R. Br.).. ..	o
90.	*Cardamine polemonioides* Rouy (*C. pratensis* s. Stefánsson)	f
91.	,, *bellidifolia* L. ..	vr
92.	*Arabis alpina* L.	o
93.	*Cardaminopsis petraea* (L.) Hiit.	a
	Crassulaceae	
*94.	*Sedum acre* L.	vr
95.	,, *villosum* L... ..	o
96.	,, *rosea* (L.) Scop. ..	f



Saxifraga cernua

	Saxifragaceae	
97.	*Saxifraga cespitosa* L. ..	f
98.	,, *hypnoides* L. subsp. *borealiatlantica* Engl. & Irmsch. ..	vr
99.	,, *cernua* L. ..	r
100.	,, *rivularis* L. ..	r
101.	,, *oppositifolia* L...	f
102.	,, *hirculus* L. ..	f
103.	,, *nivalis* L. ..	o
104.	,, *tenuis* (Wahlenb.) H.Sm. ..	o
105.	,, *stellaris* L. ..	f
106.	*Parnassia palustris* L. ..	o
	Rosaceae	
107.	*Sibbaldia procumbens* L. ..	o
108.	*Potentilla palustris* (L.) Scop. (*Comarum palustre* L.)	o

		Frequency
109.	*Potentilla crantzii* (Crantz) G. Beck	o
110.	*Dryas octopetala* L.	f
*111.	*Alchemilla alpina* L.	vr
*112.	,, *filicaulis* Buser	r
*113.	,, *wichurae* (Buser) Stefansson	vr
114.	,, *glomerulans* Buser	r
	Geraniaceae	
115.	*Geranium sylvaticum* L.	f
	Violaceae	
116.	*Viola palustris* L.	o
	Onagraceae	
117.	*Chamaenerion latifolium* (L.) Sweet	f
118.	*Epilobium palustre* L.	vr
119.	,, *anagallidifolium* Lam.	f
120.	,, *lactiflorum* Hausskn.	r
*121.	,, *hornemanni* Rchb.	vr
	Hippuridaceae	
122.	*Hippuris vulgaris* L.	vr
	Umbelliferae	
123.	*Angelica archangelica* subsp. *norvegica* (Rupr.) Nordh. (*Archangelica officinalis* s. Stefansson)	f
	Pyrolaceae	
124.	*Pyrola minor* L.	o
	Ericaceae	
*125.	*Loiseleuria procumbens* (L.) Desv.	o
126.	*Cassiope hypnoides* (L.) D. Don	a
127.	*Vaccinium uliginosum* L.	f
	Empetraceae	
*128.	*Empetrum hermafroditum* (Lange) Hagerup	?a
	Plumbaginaceae	
129.	*Armeria maritima* (Mill.) Willd. (*A. vulgaris* Willd.)	a
	Gentianaceae	
130.	*Gentianella tenella* (Rottb.) H.Sm. (*Gentiana tenella* Rottb.)	o
131.	*Gentiana nivalis* L.	o
132.	*Menyanthes trifoliata* L.	vr
	Labiatae	
133.	*Thymus drucei* Ronn. (*T. arcticus* (E. Dur.) Ronn.)	f
	Scrophulariaceae	
134.	*Rhinanthus crista-galli* L. (*R. minor* Ehrh. non L.)	vr
135.	*Bartsia alpina* L.	f
*136.	*Euphrasia curta* (Fr.) Wettst.	f
*137.	,, var. *piccola Pugsl.*	-
*138.	,, cf. *frigida Pugsl.*	vr
139.	*Pedicularis flammea* L.	f
140.	*Veronica fruticans* Jacq.	o
141.	,, *alpina* L.	?vr
*142.	,, *pumila* All. (*V. alpina* var. *australis* Wg.)	f
	Lentibulariaceae	
143.	*Pinguicula vulgaris* L.	o
	Plantaginaceae	
*144.	*Littorella uniflora* (L.) Aschers.	vr
	Rubiaceae	
*145.	*Galium verum* L.	vr
146.	,, *pumilum* subsp. *islandicum* Sterner (*G. pumilum* s. Stefansson)	f
	Compositae	
147.	*Erigeron uniflorus* L.	o
148.	*Gnaphalium supinum* L.	f
*149.	,, *norvegicum* Gunn.	vr
*150.	*Leontodon autumnalis* var. *taraxaci* (L.) Hartm.	vr
*151.	*Taraxacum faeroëense* Dahlst.	vr
*152.	*Taraxacum croceum* Dahlst.	o
153.	*Hieracium alpinum* aggr.	o
*154.	,, *microdon* Dahlst.	vr
*155.	,, *nigrescens* aggr.	o

MOSSES

1. *Sphagnum teres* (Schimp.) Aongstr.
2. *Andreaea rupestris* Hedw.
3. *Polytrichum urnigerum* Hedw.
4. ,, *juniperinum* Hedw.
5. ,, *commune* Hedw.
6. *Aongstroemia longipes* (Sommerf.) Bruch and Schimp.
7. *Blindia acuta* (Hedw.) Bruch and Schimp.
8. *Dichodontium pellucidum* (Hedw.) Schimp.

9. *Dicranoweissia crispula* (Hedw.) Lindb.
10. *Tortula ruralis* (Hedw.) Crome.
11. *Desmatodon latifolius* (Hedw.) Bruch and Schimp.
12. *Grimmia apocarpa* Hedw.
13. „ *funalis* (Schwaegr.) Schimp.
14. *Rhacomitrium canescens* (Hedw.) Brid.
15. *Splachnum vasculosum* Hedw.
16. *Leptobryum pyriforme* (Medw.) Wils.
17. *Pohlia cruda* Hedw.
18. „ *drummondii* (C. Muell.) Andrews
19. „ *gracilis* (Schleich.) Lindb.
20. „ *ludwigii* (Spreng.) Broth.
21. *Mnium affine* Bland.
22. „ *punctatum* Hedw.
23. „ *cinclidioides* Hüben.
24. *Aulacomnium palustre* (Hedw.) Schwaegr.
25. *Paludella squarrosa* (Hedw.) Brid.
26. *Meesia uliginosa* Hedw.
27. *Bartramia ithyphylla* Brid.
28. *Conostomum tetragonum* (Brid.) Lindb.
29. *Philonotis fontana* (Hedw.) Brid.
30. var. *tomentella* (Mol.) Dixon
31. *Drepanocladus aduncus* (Hedw.) Warnst.
32. „ *revolvens* (Sm.) Warnst.
33. „ *uncinatus* (Hedw.) Warnst.
34. *Acrocladium stramineum* (Brid.) Richards and Wallace
35. „ *giganteum* (Schimp.) Richards and Wallace
36. *Camptothecium nitens* (Hedw.) Schimp.
37. *Brachythecium reflexum* (Starke) Bruch and Schimp.

LIVERWORTS

1. *Marchantia polymorpha* L.
2. *Fossombronia dumortieri* (Hook. and Genth.) Lindb.
3. *Lophozia ventricosa* (Dicks.) Dum.
4. „ *alpestris* (Schleich.) Evans
5. *Cephalozia bicuspidata* (L.) Dum.
6. *Pleuroclada albescens* (Hook.) Spruce
7. *Blepharostoma trichophyllum* (L.) Dum.
8. *Scapania curta* (Mart.) Dum.



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THE BRITISH POPULATION OF THE PINK-FOOTED GOOSE, ITS NUMBERS AND ANNUAL LOSSES

By Hugh Boyd and Peter Scott

THE Trust expedition to the Þjórsárver in 1953 and the rocket-netting operations in Britain in 1953 and 1954 which are described elsewhere in the Report represent the latest and largest contributions to an investigation which was begun in 1950. Earlier Reports have included accounts of the 1951 Þjórsárver expedition and the technique of rocket-netting, and tabular summaries of recoveries and recaptures of marked geese, but hitherto no extensive treatment of the results of this work has been attempted. However, during the last year these results have been examined with some care and the first reports on them have been completed. One of these, dealing with some aspects of the distribution of Pinkfeet in Britain, is included in this report (pp. 107–122). A second, concerned with the method of estimating the numbers of the species and its mortality, will be published elsewhere, because its preoccupation with the technical problems of sampling and estimation might seem tedious to readers unfamiliar with the study of the dynamics of animal populations. But the results of this investigation, tentative though most of them are, should be of interest to everyone concerned with the status of geese in Britain.

The present paper summarises the findings of the technical report and considers their relation to more general problems of conservation, especially the use of censuses, and the relation between total losses and those due to shooting.

The British Population

An essential requirement in any inquiry into the numbers of animals is to define the population with which you are concerned. This is often very difficult, but it happens that the Pinkfoot presents fewer problems in this connection than do most birds. The species breeds in only three places (Greenland, Iceland and Spitsbergen), and winters only in north-west Europe (almost entirely in Britain, Denmark, Germany, and Holland). The breeding-places are all accessible, in the sense that there are no political restrictions on visits of observers, but sufficiently hard to get at to make a complete breeding census in any one season quite impracticable, so that if we are to determine the total number of Pinkfeet we must do so while they are in their winter range. Since in all the countries frequented there is widespread interest in birds it might seem that a winter census should not present very great problems. Before this study was begun it was clear that there were many more Pinkfeet in Britain than on the Continent, so that it seemed reasonable to begin by finding out the number of Pinkfeet in England and Scotland. It is clear now that the Pinkfeet wintering in Britain are almost completely isolated from those on the Continent. The Trust ringing has shown that the British birds go to Iceland and Greenland in the summer, but not, apparently, to Spitsbergen, while only one British-ringed Pinkfoot has been found in Denmark. The ringing in Iceland has shown that the great bulk of the Iceland population must winter only in Britain (there is only one Dutch recovery of an Iceland bird, three from Denmark and none from Germany). Finally the results of ringing 566 Pinkfeet in Spitsbergen in 1952

and 1954 (see pp. 170–176) have shown that these birds visit Denmark, Germany and Holland, but not Britain. Thus it is possible to treat the British Pinkfeet as a distinct population, even though their isolation is insufficient, or has not continued long enough, for them to have become sub-specifically different from the Spitsbergen-Danish group, though it has been shown that the latter are slightly smaller than our birds (Løppenthin, B. (1932) Medd. om Grønland 91, no. 6).

The Numbers of British Pinkfeet

The requirements for a census of the British population may be stated very simply : all the Pinkfeet in Britain on a chosen date have to be counted. Since these birds are not scattered throughout the British Isles but are almost wholly confined to eight English counties and 14 in Scotland and at any one time are based on only about two dozen roosting places it would not be impossible, though it would be difficult, to organise simultaneous observations in all the localities used by the species. This has not been done, nor very seriously attempted, simply because it is too difficult to count geese. The evidence provided by the Wildfowl Count Scheme, by experienced observers, and by the efforts made by members of the Trust staff to count the geese visiting the New Grounds and those flocks encountered during rocket-netting expeditions all combine to produce the impression that *counts* of large numbers of geese are rarely possible and that *estimates* are dangerously unreliable. It is probably easier to count large flocks of geese at Slimbridge than anywhere else in Britain ; yet, when the numbers here are much over 1000 it is unusual to be able both to establish that all the geese in this (unusually limited) area were included and to produce closely consistent totals from the efforts of several counters or repeated counts by one observer. A total *count* of, say, 3200 here probably means *at best* that the number of geese in the area was between 3000 and 3400. An *estimate* of 3200 perhaps implies a range of the order of 2700–3700. In other parts of the country the situation is worse, because the feeding range of the geese is usually much more extensive, the availability of suitable vantage points for counting them while feeding is quite haphazard, counts at the roosts are usually impracticable and estimates of numbers in flight are wildly inaccurate. It would be very surprising if it were to be shown that a national census of Pinkfeet led to a total count of useful accuracy. The results of combining observations from all available sources suggest that during the last five years the Pinkfeet in Britain in early autumn have not exceeded 70,000 or been less than 26,000 : but a ' total count ' of, say, 43,219 obtained by simultaneous observations would not represent any substantial advance on these estimates. The accuracy of a collection of counts cannot be high, and cannot be precisely evaluated.

It is all very well to condemn the direct census method, but can any better alternatives be found ? The massive experience of the Fish and Wildlife Service and the various State agencies in the United States seemed to indicate that, for all its faults, this method was the best available, especially when extensive use can be made of counts from aircraft, a technique we have not yet been able to employ in Britain. However, the capture of comparatively large numbers of geese with rocket-nets opened up the possibility of using methods of estimating population-size from the recaptures of ringed geese in a chain of samples made at regular intervals. Such capture-recapture methods have been used in estimating the numbers of various mammals, fish and insects since the

first attempts of Petersen, a Danish fisheries biologist, in 1894. As long ago as 1930 F. C. Lincoln suggested that the relation

$$\frac{\text{number of waterfowl banded}}{\text{number recovered in their first hunting season}} = \frac{\text{number of waterfowl in N. America}}{\text{number killed by hunters}}$$

could be used to estimate the total number of waterfowl in North America. The failure of this attempt, because of the lack of reliable information about the size of the annual kill and difficulties due to trapping methods, seems to have deterred American waterfowl investigators from serious efforts to employ capture-recapture methods. But the 'Lincoln Index' is a very crude example of these methods (indeed it is not really one at all, since the kill is not strictly equivalent to a live-recapture sample) and, since the underlying assumptions and the statistical procedures have been the subject of careful investigations in recent years, attempts to use recaptures to estimate the numbers of Pinkfeet seemed well worth while.

The simplest method for estimating total numbers has been found the most suitable. If x is the number of Pinkfeet in Britain in the autumn of the year t_0, if a Pinkfeet were marked and released that year, n caught in the following year t_1, and r of those n found to be carrying rings put on in t_0, then the maximum-likelihood estimate of the population at t_0 is $= \hat{x} \frac{an}{r}$. Where r is small, Bailey (*Journal of Animal Ecology*, **21**: 120–127. 1952) has shown that $\hat{x} = \frac{a(n+1)}{(r+1)}$ is a less biased estimate, and his modified formula has been employed.

The numbers of Pinkfeet in the British population at 1 November are estimated, by the above method, to have been 52,000 in 1951, 37,000 in 1952 and 49,600 in 1953. The standard of accuracy of all these estimates is low.

The theoretical standard errors of the estimates for 1952 and 1953

$$\left[\sqrt{V}, \text{ where } V = \frac{a^2 (n+1)(n-r)}{(r+1)^2(r+2)} \right]$$

are 6500 and 8500, i.e., about 17% of the estimated value of x.

These results are more reliable than estimates made from field counts, but may be insufficiently precise for the purpose of determining annual fluctuations in the total numbers of Pinkfeet in Britain in autumn. The 1951 result is unreliable, and an estimate of 18,200 for 1950 must be rejected (see below). It is, however, interesting to note that 1952 was a bad breeding year in Iceland and that the proportion of juveniles in the autumn catches in Britain was only 19·9%, compared with 32·5% in 1953 and the mean for the four years 1951–54 of 29·0%, so that the population in 1952 probably *was* substantially smaller than in 1953.

The estimates of adult and first-year death-rates and the number of adults in 1950 enable the numbers of geese in 1950–53 to be calculated from the theoretical age composition of the population (Table I). These calculations lead to estimates of 51,000 in 1950, 46,000 in 1951, 41,000 in 1952 and 43,000 in 1953. Apart from the 1950 figures, these estimates are in fairly good agreement with those from the recapture method. In particular they confirm that, during the period, the population was greatest in 1951 and least in 1952. The 1950 estimate by this method seems a more likely one than the 18,200 from the recapture data, the latter being impossible to reconcile with the 1951 estimates because of the relatively low productivity of geese, but is itself not very reliable.

TABLE I

Theoretical Age-composition of the British Autumn Population of the Pinkfoot, 1950–53

d=adult death-rate=26% ; e=survival-rate (=1-d)=74% ; e_1=first-year survival rate =58% ; N=number of adults in 1950=28,000 ; N_0, N_2, N_3=number of juveniles in 1950, 1952, and 1953 as percentage of N.

	Number of Pinkfeet in October each year				
	Juveniles	16 months	28 months	40 months	Total Adults
1950	N_0	Nd	Nde	Nde^2	N
1951	Nd/e_1	N_0e_1	Nde	Nde^2	N_0e_1+Ne
1952	N_2	Nd	N_0e_1e	Nde^2	$Nd+N_0e_1e+Ne^2$
1953	N_3	N_2e_1	Nde	$N_0e_1e^2$	$N_2e_1+Nde+N_0e_1e^2+Ne_3$

It seems unlikely that very great increases in the annual catch of Pinkfeet can be made without disproportionate expenditure of money and effort. In 1953 and 1954 the catch was about 1550 : it might be increased to 2500. So long as the simple estimate $x = \frac{an}{r}$ is employed such an increase will not greatly improve the accuracy of successive estimates. But it should be possible to devise methods using longer sampling chains (of catches over several years) more suited to the problem than those at present available, and estimates by such means would be improved by larger catches. The principal problems in the development of better methods of estimation are the seasonal variations in the proportion of young birds, the different death-rates of first-year and older birds and the extent of correlation between successive estimates. Though an increase in the annual catch remains desirable, the outstanding difficulty in the catching programme is to relate the size of the catches in different regions to the size of the more or less distinct regional groups which appear to exist within the British population (see pp. 107–122).

Annual Losses

Estimates of total numbers are the most striking indicators of changes in the dynamics of a population, but it is necessary to investigate both productivity and mortality to discover how the changes have been produced. This section is concerned with the annual losses suffered by Pinkfeet after they have entered the British population (in their first October). Losses in the first year have earlier been shown to be proportionately greater than in subsequent years (5th Annual Report, p. 28). It is therefore necessary to estimate the death-rates of juvenile (first-year) and older birds separately.

There are two distinct sources of information on losses, though they are alike in referring to marked birds. (The assumption that losses of marked geese are representative of those amongst unmarked ones also, cannot, perhaps, be fulfilled precisely, but it seems likely that any differences are negligibly

small.) The recapture data provide the first source. This has the important merit that *all* marked geese seen again are recorded, but the disadvantage that the numbers of recaptures are comparatively small (85 adults recaptured in 1951–54, from 2589 marked in 1950–53, and 40 juveniles from 1124 in the same interval). A maximum likelihood method of estimation is used (method 'A' of Leslie and Chitty, *Biometrika*, 38 : 269–292, 1951). By this method the annual death-rate for adults is found to be 21 $\pm$ 12% and the juvenile death-rate in the first year after marking 44 $\pm$ 20%.

It is also possible to calculate the death-rate from the recoveries of marked birds. These are more numerous than recaptures, though more difficult to use, because recoveries do not constitute a complete record of all marked birds killed, but only that proportion of them found and reported. The proportion of October-ringed birds recovered in the same season declined from 12·4% in 1950–51 to 5·6% in 1953–54. This might have been due to a decreasing death-rate, but the evidence suggests that the difference is more probably due to a falling reporting-rate (due to finders of rings failing to report them to the British Museum). Accordingly, two models have been used in estimating the death-rate. In the first the annual death-rate is assumed constant, while the reporting-rate is allowed to vary. The observed juvenile-adult ratios in the British autumn catches are used to determine the initial relation between recovery and reporting. In the second model the reporting-rate is assumed constant, at various arbitrary values, and the death-rate is allowed to vary. The method of estimation again consists in the solution of the maximum-likelihood equation. The first model leads to an estimated death-rate of 26 $\pm$ 1·6% for adults and 42 $\pm$ 2·8% for juveniles in the first year after marking. These results are consistent with (and much more precise than) those obtained from recaptures. From the second model, if the reporting-rate is assumed to be 30%, the adult death-rate was 31% in 1950–51, 31% in 1951–52, 26% in 1952–53 and only 12% in 1953–54. If the reporting-rate was as high as 50% these rates would have been 21%, 18%, 13% and 5·4% respectively. But, as is discussed below, most reported casualties are due to shooting and the evidence of wildfowlers makes it clear that 1953–54 was not a bad year for shooting. It was, indeed, more probably rather a good one. Thus for the purpose of establishing a general picture of the dynamics of the Pinkfoot population the model assuming a constant annual death-rate is to be preferred. However, since the determination of *changes* in the characteristics of the population is a major concern of this investigation, it is clearly desirable to elaborate a model in which both death-rates and reporting-rates are treated as variables. This apparently presents no great statistical difficulties, but at present the recovery data are insufficient to enable such a model to lead to better estimates than are provided by the simpler methods used so far.



Losses from Shooting

At least 350 deaths in 982 casualties to ringed Pinkfeet reported between October 1950 and July 1954 were due to shooting. The inference that 88% of all losses to Pinkfeet after their first October are caused by shooting is perhaps unjustified, since presumably geese dying from 'natural causes' are less likely to be found than those killed by man, but it seems likely that at least four-fifths of losses are due to shooting.[1]

We have seen that the estimated British population in late October 1953 was 49,000 by the capture-recapture method, or 43,000 from the death-rate method. If we take the mean of these values (46,300) and suppose that the juvenile-adult ratio in the catches of 1953 (506 juveniles : 1052 adults) was representative, the approximate numbers of adults and juveniles were 31,200 and 15,100 respectively. If 26% of the adults and 42% of the juveniles died before the next November the total losses would have been 8100 adults and 6300 juveniles, or 14,400 geese, and the losses due to shooting 88% of this total, say 12,700 geese.

Is an annual kill in Britain of 12,700 Pinkfeet improbable? When, in the course of a protracted correspondence in the *Shooting Times* in 1954, a similar total kill in the season of 1951–52 was suggested, that estimate was assailed as extravagantly large. Can any support be found for the estimate of losses in the period November 1953–October 1954?

The problems of estimating the waterfowl kill have engaged the United States Fish and Wildlife Service for over 20 years, without the attainment of techniques of proven validity, although the hunter survey by mail questionnaires introduced on a national scale during the 1952–53 season appears highly promising. (Publication of the results is being delayed until results from other seasons are available.) By comparison the data available on the British kill are incredibly meagre. Comparatively few sportsmen keep careful detailed records of their bags, and few of those who do are willing to disclose them to anybody who might conceivably use them to the shooter's disadvantage. But a small number of bag records are available and can be supplemented by information collected from the letters reporting the shooting of ringed Pinkfeet.

From the recovery letters we know that, during the season 1953–54, 451 persons shot 586 ringed geese and that 113 of these rings were found in bags totalling 583 geese. It appears that the most probable bag of these 451 shooters was $583 \times \frac{586}{113} = 3020$ geese. It is assumed that all these shooters reported *all* the ringed geese they obtained. This is probably not true, because there are indications that people are more likely to report the first rings they obtain than those which they find later. The bag sample is also biased by containing too many October letters. In October 1953 a large proportion of the juveniles entering the British population carried rings (put on in Þjórsárver in July and August). It is a feature of October shooting that the proportion of juveniles bagged is very high and that these include a lot of young birds shot when flying singly and 'lost.' Thus the ratio $\frac{113 \text{ rings}}{583 \text{ geese}} = 0{\cdot}19$ is probably too large (it is appreciably higher than the ratio $\frac{235 \text{ rings}}{1558 \text{ geese}} = 0{\cdot}15$ found in rocket-netting catches in 1953). Corrections for these failings would both increase the estimate

[1] The second most frequent cause of death reported was collision with overhead cables or telegraph wires. Ten cases of this kind occurred up to July, 1954.

of the season's kill. This estimate of 3000 represents the total kill during the season only if all the ringed geese *shot* were reported. No one will maintain that this is so. Indeed, the estimate of the reporting-rate in 1953–54 suggested that only about one-seventh of the ringed birds *dying* were reported. Had the calculation not been made until some years had elapsed the reporting-rate would probably have appeared rather higher (reports are often belated), but it is in any case comparatively small. The problem of obtaining an estimate of the kill independent of the calculated death and reporting-rates remains, but transformed to a search for the total number of persons shooting at least one Pinkfoot during the season. If 450 gunners shot 3000 geese the estimated total kill of 12,700 geese would correspond to 1900 successful Pinkfoot shooters. Do as many people as this shoot Pinkfeet? Members of wildfowlers' organisations seem to think not, wildfowlers not in such organisations seem to think it possible. An inquiry into this point would be difficult to conduct and is only indirectly related to the population dynamics of the Pinkfoot, but would be of great value, since it is important to learn whether the shooting pressure on wildfowl in Britain remains constant, or whether it reflects the increase in human population.

General Review of the Numbers of British Pinkfeet

Figure 1 illustrates the variations in numbers of Pinkfeet in the years 1950–54. It is based on the October totals obtained from the combined use of death-rate and capture-recapture estimates, together with an estimated loss of goslings between hatching and first arrival in Britain of about 60% (see pp. 82–87). The graph demonstrates some points of importance. First, the total numbers are changing continuously, not merely from year to year but from week to week. Thus, if we are to use total counts to estimate trends, it is clearly necessary to decide with some care at what dates the comparisons of seasonal numbers should be made. Second, the number of sexually mature adults (three or more years old) bears no simple relation to the size of the total population. Third (though this is not well established by the illustration) the

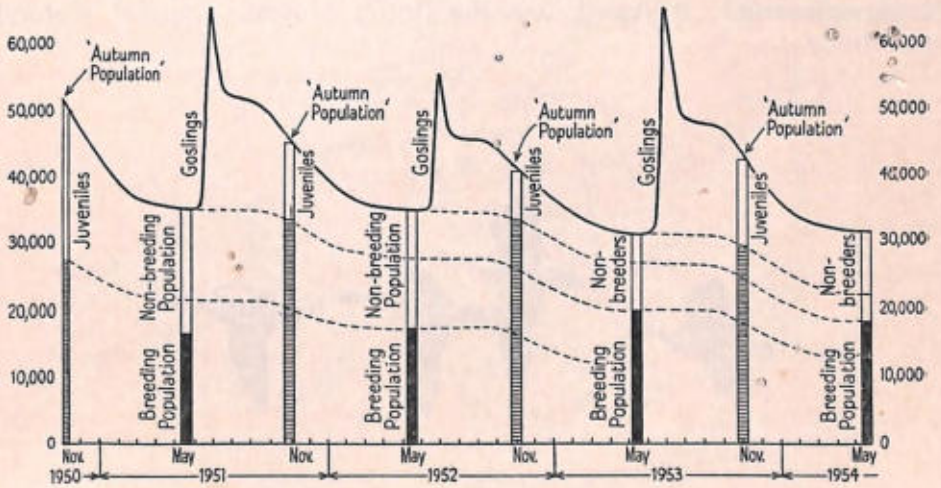


Fig. 1.—*Number of Pink-footed Geese in the British population, October,* 1950–*May,* 1954, *estimated from death-rates and recovery rates*

number of goslings produced in any year is not simply related to the number of sexually mature adults and is in any event substantially less than would be expected from knowledge of the clutch-size. A productivity analysis suggests that even in climatically favourable years like 1951 and 1953 at least a quarter of the mature females hatched no young. Much more work on the problems of breeding success will be needed before we can establish to what extent conditions in Iceland and Greenland, rather than in Britain, are responsible for determining the size of the Pinkfoot population. At the same time, it will be necessary to continue the study of losses in Britain and the factors affecting them. Despite all the deficiencies in the first years of this study which have been revealed, the Pinkfoot remains an especially favourable species for fundamental investigations on the regulation of goose numbers.

ACKNOWLEDGMENTS

A long-term study such as this depends upon the goodwill and co-operation of a great many people. We wish to record our warm thanks to all the members of the rocket-netting teams who have helped us to catch geese, to the landowners and farmers who have so readily given us permission to work on their land, and to the wildfowlers and other finders of rings who by reporting their finds have added greatly to the value of our ringing.

We are particularly indebted to Mr Neil Gilbert, Department of Genetics, University of Cambridge, for much help with statistical problems, especially the construction and solution of the maximum-likelihood equations for estimating the adult death-rate from recovery data. Dr D. J. Finney, Reader in Statistics, Marischal College, Aberdeen, provided helpful criticisms of an earlier draft of this paper. In the first years of the investigation Dr Dennis Chitty, Mr P. H. Leslie and Mr H. N. Southern, all of the Bureau of Animal Population, University of Oxford, gave valuable advice on sampling and methods of estimation. We are especially indebted to Dr Finnur Guðmundsson and Mr Robert Spencer for making available the letters reporting recoveries to the Náttúrugripasafnið, Reykjavík, and the British Museum (Natural History) respectively.



THE ROLE OF TRADITION IN DETERMINING THE WINTER DISTRIBUTION OF PINKFEET IN BRITAIN

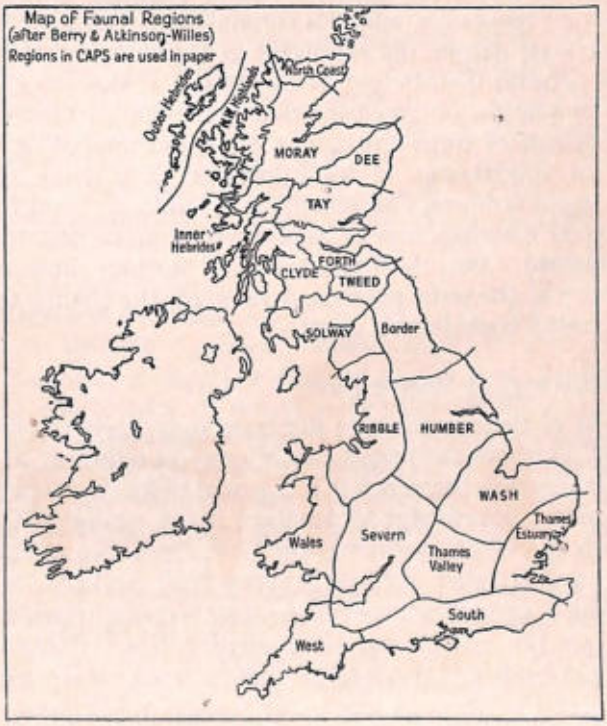
By Hugh Boyd

SUMMARY

559 recoveries and 155 recaptures of Pinkfeet ringed in Britain since 1950 provide some information on the distribution of the species in Britain. Ringed geese are probably fairly representative of unringed ones, but the conditions of their capture and recovery impose severe limits on the amount of detailed information they provide.

Most marking of Pinkfeet in Britain has been done in October and November. There are evident tendencies for marked birds to remain in the areas where they were captured during the following winter, and to return to these areas in later years, particularly at the corresponding season. The proportions of geese remaining in, and returning to, an area show regional differences. The birds of the Tay, the Solway and Eastern England are relatively sedentary and strongly attached to those regions ; those of South-East Scotland are relatively mobile.

Pinkfeet marked as adults show greater attachment to the region of marking than those marked in their first autumn of life. These young birds behave like older ones caught in the same places during their first winter, as would be expected from the persistence throughout the winter of family groups in



geese. But in their second and later winters they are more likely to visit other areas than are their parents. Adults marked in East England are relatively more sedentary than those marked in the Tay region of Scotland.

The Pinkfeet frequenting the Humber and the Wash in autumn and winter appear to constitute a single population, rather distinct from the more northerly ones. Those wintering in Scotland are more difficult to segregate, although the Solway geese, those in Midlothian and those in Aberdeen remain more or less separate from the geese living in Fife, Kinross, Perth and Angus.

Spring recoveries from North-East Scotland (where there is no effective close season inland) suggest that the English and the Scottish populations when on passage through North-East Scotland frequent the same areas, although the English and Solway birds appear only to visit Aberdeen while the geese which in autumn visit central Scotland move north into the Moray Basin as well as to Aberdeen, and go north earlier than the English birds.

It is suggested that the historical evidence available is unsuitable for indicating the reasons for changes, or constancies, in the numbers of Pinkfeet frequenting various parts of Britain and that attempts should be made to collect better information.

INTRODUCTION

One of the most striking characteristics of wild geese is the tendency they show to return year after year to the same localities, using not only the same roosts but often the same quite small number of fields to feed in. At the same time an observer who has studied geese anywhere for any length of time will have found that the numbers are constantly changing from year to year, as well as during the course of the winter. Almost everybody at all interested in geese has strong opinions about the causes of these changes. Strong opinions are usually founded on ignorance, and it is certainly true that little is known about the causes of change, despite the excellence of the compilation by Berry (1939) concerning the Scottish distribution of the species. This is not surprising, for the simple accumulation of accurate counts, though an essential part of the descriptive treatment of distribution, is a slow and unexciting business. The collection of the impressions of local residents is perhaps somewhat more exciting, often more arduous, and much less rewarding. And to have attained the goal of a good description is to have done no more than to discover what has to be explained. But the importance of learning how and why geese continue to return to the same places and yet gradually change their preferences is sufficient to justify considerable effort.

The Representativeness of Ringed Birds

The main object of these notes is to illustrate some ways in which the ringing of geese can tell us about the persistence of geese in returning to their preferred localities. This is a task for which it is essential to know about the movements of individual geese : knowledge of numbers is not enough. Unusual-looking individuals, such as ' White-eyebrows,' the Whitefront seen at the New Grounds each winter from December 1947 to January 1950, and the ' white ' Greylags and Pinkfeet which are seen somewhere in most winters, provide some information, but they are too rare to provide enough. Ringed Pinkfeet are now, by contrast, common birds and, with some qualifications, as representative of ' the class of all British Pinkfeet ' as any other sample of the same size would be.

The qualifications result from the conditions of capture of the marked geese. The part of the flock in the catching-area of the rocket-nets may be supposed to be selected at random. The efficiency of the nets is probably rarely as high as 70%, i.e., a third or more of the geese in the catching area at the time of firing escape capture. The selection is almost certainly unbiased, but this randomness is, for the purpose of studying social cohesion, a defect, for most geese belong to family parties or pairs, and the method of capture must result in the break-up of some of these units. This is objectionable, not because such interference with family units has lasting effects on the geese (intensive observations on geese marked at the New Grounds have shown that disrupted families re-unite very quickly), but because the inefficiency of the catching process, the movements of the geese under the net after capture, and the system of extricating the birds, combine to prevent the collection of any reliable information on the relationships existing among the geese in a catch. All that is known about the birds is that they were all in one field at one time, and that they comprised *a* adults (x ♂♂ and y ♀♀) and *j* juveniles (x^1 ♂♂ and y^1 ♀♀). The fact that only a small part of the flock is usually caught at one time means that only comparatively few of the birds that could be labelled as ' belonging to locality A' go away bearing such labels.

The ways in which ringed birds are subsequently located impose further restrictions on the information they can provide. Those recaptured in rocket-nets are subject to the same selection process as before. Recoveries by shooting are even worse. Geese are almost always shot one or two at a time. Birds killed by the same man on the same day are not necessarily members of the same flock and the notifications of recoveries rarely provide enough circumstantial evidence for this to be inferred. Consequently a recovery tells no more than that a marked bird was found at locality B at time *t* and the precision with which B and *t* are described varies greatly.

These characteristics of the information provided by ringed birds limit the range of questions they can help to answer. For example, we have been able to learn practically nothing about the persistence of family groups amongst Pinkfeet (although ringing has been very helpful in this connection to the prolonged observations of Whitefronts at the New Grounds). But it is possible for ringing to tell us about the tendency of a goose marked at locality A to be found there again, rather than at B or C, and the subsequent inquiry is developed in this way.

Return to the Region of Marking

Table I lists all the British *recoveries* of British-ringed Pinkfeet received before January 1955, excepting a very few released at the New Grounds and some others for which the locality of recovery was not specified (12 birds in all). The ' regions ' used in this classification (Figure 1) are, for Scotland, the faunal regions used by Berry (*The Status and Distribution of Wild Geese and Wild Duck in Scotland*, 1939), except that ' Solway ' includes the southern, English, shore of the Firth and, for England, those used by Atkinson-Willes (*National Wildfowl Counts, 1952–54*, 1954).

The considerable differences in the column totals are due principally to differences in the numbers of birds marked in various regions and the length of time since the marking took place. For example, 846 geese have been marked and released in Tay, between October 1951 and November 1954, but only 131 were caught in Dee and these not until late November 1954, so that

they had only been at risk for six weeks at the time the table was compiled. Here we are concerned with the column totals only because they indicate differences in the amount of information provided by the samples marked.

Though the row totals doubtless bear some relation to the total number of geese killed in each of the regions this relation is obscure and will not be considered in this paper. However, it may be remarked that, though the proportion of marked geese reported varies from region to region, there is no reason to suppose that the chance of a ring being reported depends in any way on the place in which the goose was marked, since the rings used all bear one address and give no indication of the locality of marking.

The numbers of geese recovered in the same region in which they were marked are shown in bold type. In most cases, these figures are the largest both in the rows and in the columns in which they occur. This is clear evidence for the existence of a tendency to persist in the area of marking. But there are exceptions (notably the birds marked in Tweed and Humber), and it is striking that whenever sufficient geese have been marked in a region to produce a substantial number of recoveries these recoveries are found to be scattered over all, or nearly all, the regions listed. Evidently as in any other biological inquiry, to dispose summarily of the problems of persistence is to ignore inconvenient facts.

TABLE I

Regional Distribution of RECOVERIES of British-ringed Pinkfeet, 1950–54

Region of Recovery	Region of Marking								Total Recovered in each Region
	Dee	Tay	Forth	Tweed	Solway	Ribble	Humber	Wash	
Moray ..	—	3	8	—	—	—	—	—	11
Dee	**4**	11	5	5	7	1	1	3	37
Tay	—	55	37	18	13	—	3	2	128
Forth ..	—	17	**35**	5	9	—	1	1	68
Tweed ..	—	2	6	**2**	2	—	—	—	12
Clyde ..	—	1	5	—	3	—	—	—	9
Solway ..	—	9	16	20	**35**	2	6	5	93
Ribble ..	—	2	5	4	6	**7**	4	6	34
Humber ..	—	1	12	13	7	—	**11**	14	58
Wash ..	—	7	22	18	7	2	20	**28**	104
Others ..	—	3	1	—	—	—	1	—	5
Total recoveries of birds marked in each region	4	111	152	85	89	12	47	59	559

Before pursuing the problem, it is perhaps worth noting the very small number of entries in the row 'Others' which embraces most of England, all Wales, and most of the west and north of Scotland. It was unnecessary to ring Pinkfeet to demonstrate that their occurrence in large numbers was limited to certain parts of the country, but the agreement of this finding with expectation helps to justify the belief that ringed geese may be regarded as representative of unringed ones also.

The general impressions produced by Table I suggest ways in which the inquiry into persistence may be developed. Implicitly, the problem is a temporal one, so that the questions 'when?' and 'for how long?' are those of first importance, but the table suggests that there may well be differences in the behaviour of the geese found in different districts.

Table II summarises the recoveries of British-ringed Pinkfeet made in the same season as that in which they were marked, classifying them by months as 'Home' (= regions where marked) and 'Away' (any other region). Even when a method of grouping so generous to the idea of 'home' is used, only 36% of the recoveries can be described as 'where ringed.' The proportion is appreciably higher in October-November (taken together because ringing is done at that time, so that the recoveries in each of those months are abnormally few) than in the mid-winter months, and much higher than in March-May. The recoveries in the latter period are however badly biased by the end of the shooting season in February. Spring shooting is legally restricted to inland localities in the east and north of Scotland. It is not surprising, therefore, to find spring recoveries virtually confined to these areas, with the result that they tell us little about the spring distribution of Pinkfeet. The recoveries between October and February are more useful. The monthly totals suggest a gradual scattering from the region of first arrival in autumn. If, however, we look at the contributions made by the different regional samples, we find that this general impression results from an amalgam of quite different patterns. This is made more apparent in Table III, in which the numbers of 'home' recoveries are expressed as percentages of the monthly totals.

TABLE II

Monthly Occurrence of RECOVERIES of British-ringed Pinkfeet in the Season of Marking

Ringing Locality	Month(s) of Recovery										Total	
	Oct.–Nov.		Dec.		Jan.		Feb.		Mar.–May			
	Home	Away	Home	Away	Home	Away	Home	Away	Home	Away	Home	Away
Tay ..	7	3	8	4	8	10	4	3	3	5	30	25
Forth ..	7	9	5	23	4	25	—	3	1	11	17	71
Tweed	2	8	—	10	—	8	—	5	—	5	2	36
Solway	3	1	1	5	9	5	—	1	—	6	13	18
Ribble	2	—	2	1	1	2	—	—	—	—	5	3
East England	11	1	11	5	7	11	3	—	—	3	32	20
Total ..	32	22	27	48	29	61	7	12	4	30	94	170

TABLE III

Home RECOVERIES as Percentage of Monthly Recovery Totals, from Data of Table II

(Note : Brackets indicate inadequate samples)

Locality	Oct.–Nov.	Dec.	Jan.	Feb.	Mar.–May	Oct.–Feb.
Tay	70	67	44	57	38	54
Forth..	44	18	14	(0)	8	21
Tweed	20	0	0	(0)	(0)	6
Solway	75	17	64	(0)	(0)	52
East England ..	91	69	64	(100)	(0)	65

While it would be unwise to put much confidence in the numerical values of these monthly percentages, in view of the relatively small numbers on which they are based and the probability that regional variations in reporting and relative kill will affect them more or less seriously, the table suggests the existence of two types of regional population. In the first type, more than half the population remains throughout the winter in the region inhabited in autumn. In the second type the great majority of the geese soon desert their autumn localities in favour of other regions.

The geese found in Tay, Solway and East England are relatively sedentary. Those occurring in Lancashire (Ribble) are probably in the same category,

TABLE IV

Regional Distribution of RECAPTURES of British-ringed Pinkfeet in Autumn, 1950–54

Region of Recapture	Region of Marking							Total
	Tay	Forth	Tweed	Solway	Ribble	Humber	Wash	
Dee	1	1	1	—	—	1	—	4
Tay	**10**	4	4	4	—	1	1	24
Forth	7	**22**	7	6	—	1	—	43
Tweed	1	1	**3**	2	—	—	—	7
Solway ..	2	9	1	**8**	—	2	4	26
Ribble.. ..	3	—	—	4	**1**	—	—	8
Humber ..	2	4	3	3	1	**6**	6	25
Wash	1	6	1	2	—	4	**4**	18
Total ..	27	47	19	26	3	15	15	155

although the sample is too small to establish this. The geese found in autumn in Forth and Tweed are not attached in the same way to these areas. From observational evidence the birds frequenting the Moray region in autumn show a similar tendency to move to other regions later. Lack of sufficient food in mid-winter may be the explanation of this.

The use of recoveries is a poor technique for exploring the changes in numbers of geese in any locality during the course of the winter. The principal objects of this analysis of Table III are to establish first that within-season changes occur and second that geese are most likely to be found in the region of marking soon after capture. The latter finding suggests that in collecting and examining evidence relating to the attachment of geese to particular areas it would be well to pay especial attention to recurrence at the same time in successive years.

Recaptures during rocket-netting operations provide data on recurrence which is in several respects better than that given by recoveries, although limited in extent. The regional grouping of *recaptures* shown in Table IV rather resembles that of *recoveries* (Table I). There is the same scatter, both in the columns and the rows, the same tendency for the ' where ringed ' totals (in bold type) to be the largest, and the Tweed-marked sample again appears as exceptional. Since these recaptures with the exception of a few Solway and Wash-ringed birds, ringed in mid-winter, were all of birds ringed in October-November and caught again in the same months in later years, they provide definite evidence of a tendency to recur in the same region at the same time. But it is obviously desirable to analyse the situation more carefully.

The Effect of Age on the Tendency to Return

The discussions so far have assumed the region of marking to be the principal variable affecting the tendencies to remain in a region during one winter or occur there again in subsequent winters. From what is known of the social behaviour of geese there is at least one other factor likely to be effective, the age of the birds. Young geese migrate south with their parents and remain in family parties throughout the winter, unless these parties are broken up by shooting or accident. The young birds leave their parents in the spring, probably only on return to the breeding-grounds. Some may rejoin their parents for their second winter, although in a looser association than before, but the proportion of second-winter birds doing this is probably quite small and most birds of this age-group are independent, although associating with other geese. They tend to form pairs at this age, though these pairings may be relatively unstable and do not lead to successful breeding in the following summer. (Observational evidence on the behaviour of two-year-olds is largely restricted to studies of White-fronted Geese ; inferential evidence on the status of second-winter Pinkfeet is discussed at pp. 78–81.) There is thus an *a priori* probability that the movements of birds ringed in their first autumn will parallel those of their parents during the first season but that they may differ appreciably in later years, so that it seems worth while to compare the recoveries and recaptures of geese ringed in their first autumn with those of the older birds caught at the same time in the same places. The success of such a comparison is, however, likely to be seriously impaired by the fact that unmarked geese in their second autumn cannot be distinguished from older geese when captured.

The regional persistence of young and old geese is compared in Tables V and VI. In these tables the categories ' Home ' and ' Away ' refer to the region

of marking and to any other region respectively; 'young' means marked in first autumn of life (at 4–5 months); 'old' means marked in second or subsequent autumns (year class not known). Table V contains entries in the form '$a + b = c$,' where 'a' represents recoveries *in October-December only*, 'b' recaptures, and 'c' their sum. No 1954-marked birds are included, nor are those marked in December 1950 or January-March 1951. In Table VI the proportion of 'home' occurrences for each age class is expressed as a percentage of the total occurrences in the same and subsequent seasons. The data from Forth and Tweed are combined: they are characterised by the high proportion of recaptures in the home occurrences. Humber- and Wash-ringed birds are also taken together.

The 'same season' totals in Table VI show that the proportion of young birds found where ringed is similar to, though somewhat less than, the proportion of older birds taken 'at home.' In later seasons the geese marked when young are much less often taken where ringed than those marked as older birds. This difference between 'young' and 'old' birds in later years is statistically significant, whereas the difference in the season of ringing is not, nor is the apparent fall in the proportion of older birds found 'at home' well established. Attempts to discriminate between 'second season' and 'still later' records have been inconclusive, perhaps because the samples are too small for such sub-division. There appear to be some regional differences of interest. As would be expected from the earlier discussions, the Forth and Tweed-ringed samples are very different from the others, to the extent that young birds ringed in these regions are as likely to be found there again later as are older ones, although the proportion of recurring birds is very much lower than in other regions.

TABLE V

Regional Persistence of Old and Young Pinkfeet Based on Recapture data

(For explanation of classification see Text)

Region of Marking	Age at Marking	Occurrence in same Season				Occurrence in later Season			
		Home		Away		Home		Away	
Tay	Old	16+1	17	4+4	8	28+10	38	9+13	22
	Young	5+0	5	3+0	3	1+ 1	2	2+ 3	5
Forth and Tweed ..	Old	7+7	14	27+2	29	3+12	15	34+21	55
	Young	6+2	8	17+0	17	1+ 9	10	15+ 9	24
Solway	Old	1+0	1	3+2	5	2+ 6	8	5+ 7	12
	Young	2+0	2	3+0	3	2+ 0	2	2+ 8	10
Ribble	Old	2+0	2	0+0	0	1+ 0	1	0+ 0	0
	Young	2+0	2	1+0	1	0+ 1	1	0+ 2	2
East England ..	Old	16+2	18	3+0	3	8+13	21	4+ 2	7
	Young	5+0	5	1+1	2	4+ 3	7	1+ 6	6
Total	**Old**		**52**		**45**		**83**		**95**
	Young		**22**		**26**		**22**		**48**

TABLE VI

Proportion of Occurrences in 'Home' Region, as Percentage of Seasonal Total for each Age Class

Region of Marking	Age at Marking	Same Season	Later Seasons
Tay	Old	68	63
	Young	63	29
Forth and Tweed	Old	33	21
	Young	32	29
East England	Old	86	78
	Young	71	50
Total	Old	54	47
	Young	46	31

Comparing the Tay and East England samples, it appears that the older geese caught on Humber and Wash are both more sedentary and more liable to return to the same region than those caught in the Tay area, and geese caught as young show similar tendencies.

The Validity of the Regional Groupings

The existence of differences between some of the regional samples is clear, but before these can be used to make assertions about the populations of geese inhabiting various regions it is necessary to establish, if possible, that the recorded differences reflect differences in the behaviour of Pinkfeet and are not just the consequences of faulty specification. The faunal regions used, though delimited by physiographical features supposed to constitute barriers to the movement of wildfowl, are arbitrary creations. Do they correspond reasonably well with apparent discontinuities in the distribution of the Pinkfoot? If not, would the findings so far reported be drastically modified by regrouping the data? These questions require careful consideration. Because the rocket-netting programme has left some important haunts of the species still unsampled and, even more, because the large numbers of geese ringed in 1953 and 1954 have not yet been at risk long enough to yield anything like their full fruits, an exhaustive treatment could not yet be achieved. But there is a much more serious handicap to the consideration of problems of this kind. Over four-fifths of the recoveries reported are due to shooting. It is the general practice amongst wildfowlers not to publish details of the localities that yield their best shooting. We are not concerned here with the motives underlying this reticence, but obviously we cannot publish place names given in confidence, nor should we provide a gazetteer for goose-shooters. This means that any discussion must involve the use of imprecise locality names. Thus unfortunately a public discussion of the effects of geographical grouping can scarcely go beyond the relative merits of 'faunal areas' and 'vice-counties.'

Only three examples of the effects of grouping will therefore be considered. The first, and simplest, concerns the Pinkfeet of eastern England. The majority of these geese roost either on the sandbanks of the Humber estuary or on those of the Wash. The birds using the Humber roosts feed both in the East Riding

of Yorkshire and in Lindsey (North Lincolnshire), at times flying as much as 20 miles inland each day. The birds of the Wash can perhaps be divided into a northern group, roosting in the Wainfleet area, and southern groups roosting near Holbeach or else on flood areas inland. The movements of these geese are complex and have shown important changes since Pinkfeet first started frequenting the Wash in numbers, less than 30 years ago. There have been extensive changes in the feeding places used by the Humber geese too, accompanied by changes in their number (although the details of these changes are much disputed). Our concern here is with the question: are the Pinkfeet of the Humber and the Wash separate or can they be regarded as one? It will have been noticed that, though in Table I the recoveries in the two areas were listed separately, in later tables they were combined, in the category 'East England.' Thus the answer to the question takes the form of a *post facto* justification of the view that they may be considered as a whole.

TABLE VII

Recoveries and Recaptures of Marked Humber-roosting and Wash-roosting Pinkfeet

(*a*) *Occurrences in the Humber and Wash Areas, throughout the Winter.*

		Ringed	
		Humber	Wash
Humber	Recaptured	6	4
	Recovered	11 } 17	14 } 18
Wash	Recaptured	6	4
	Recovered	20 } 26	28 } 32

(*b*) *Occurrences of Humber and Wash-ringed geese in other parts of Britain (from Table I).*

Ringed	Recovered								
	Moray	Dee	Tay	Forth	Tweed	Clyde	Solway	Ribble	Total
Humber ..	—	1	3	1	—	—	6	4	**15**
Wash	—	3	2	1	—	—	5	6	**17**

(*c*) *Occurrences of geese ringed in other parts of Britain in the Humber and Wash Areas (from Table I).*

Recovered	Ringed					
	Tay	Forth	Tweed	Solway	Ribble	Total
Humber	1	12	13	7	—	**33**
Wash	7	22	18	7	2	**56**

In Atkinson-Willes's (*loc. cit.*) arrangement of faunal areas in England, the boundary between 'Humber' and 'Wash' is a line running roughly due west from Mablethorpe on the Lincolnshire coast to just south of Louth, then south-west across the Wolds to a point about five miles south of Lincoln, thence almost due south to Grantham, thereafter between south-west and south to Melton Mowbray and Market Harborough. Local observers (we are especially indebted to Mr Jack Smith for descriptions of the movements of geese in North Lincolnshire) have established that there is no corresponding barrier to the movements of geese. Although the vicinity of Louth is not now an important area for Pinkfeet they move freely north and south along the Wolds. Thus the question at issue may be re-cast in the form: are the relative numbers of recoveries and recaptures of marked Humber-roosting and Wash-roosting geese consistent with the hypothesis that the Pinkfeet in these areas in autumn may be regarded as a single group? From part (*a*) of Table VII it will be seen that there is a striking uniformity about the occurrences of geese ringed in these areas and occurring again within them. Ringing of the Wash geese has occurred each year since 1950, of Humber geese only since 1952, and the total numbers ringed in the two areas are different, but the proportions of Humber-ringed birds found in the Humber area $\left(\frac{17}{35} = 0{\cdot}49\right)$ and the Wash $\left(\frac{26}{58} = 0{\cdot}45\right)$ are very similar. The distributions in parts (*b*) and (*c*) of Table VII reinforce this evidence of homogeneity. The occurrences in other parts of Britain of Humber- and Wash-ringed geese almost coincide (Table VII (*b*)). The agreement shown between the numbers of recoveries in the Humber and Wash areas of geese marked elsewhere is not quite so close (there are suggestions that Tay-ringed birds favour the Wash and Solway birds the Humber) but the recorded differences could very well be due to chance. Thus at the level of this investigation the geese of the Humber and the Wash may be regarded as a single group.

The second regional grouping problem refers to the boundaries of the Forth area of Scotland. The treatment of the valley of this river and the lands bordering the Firth as a unit results in the use of a northern boundary running nearly due west across Fife from Fife Ness to, and along, the Ochil Hills. In consequence the Pinkfeet roosting on Loch Leven (and feeding, often, in the west of Fife) are separated from those occurring in the east and north of that county, the latter birds being grouped with those occurring on the north side of the Tay: and are grouped instead with (1) those found in Midlothian and East Lothian and (2) those of the valley of the Forth upriver from Grangemouth and west to about Buchlyvie. The southern boundary of the Forth area towards its eastern end runs along the Lammermuir Hills, which are supposed to separate the Forth area from that of Tweed. The Firth of Forth below Bo'ness is largely unsuitable as a roosting place for Pinkfeet, and becomes very wide below the Forth Bridge. It seems quite possible that the Firth would provide a barrier to the movements of geese at least as formidable as the hills used as the northern and southern boundaries of the Forth area. The material available for investigating the relative efficacy of these barriers consists of markings and recaptures in North Fife, Kinross, Midlothian and Berwickshire, together with recoveries from many localities in Forth, Tay and Tweed. Unfortunately no Pinkfeet have yet been marked in the upper Forth valley.

Some idea of the validity of the regional groupings can be obtained from the recoveries and recaptures tabulated in Table VIII (Part (*a*) of this table is

TABLE VIII

Recoveries and Recaptures of Pinkfeet in Forth and Adjacent Areas

(*a*) **Recoveries** *of geese ringed in Forth and adjacent areas.*

Ringed	Recovered							
	N. Fife	Kinross and West Fife	W. Forth	Tay (other than N. Fife)	Loth-ians	Tweed	Other Regions	Total
North Fife ..	11	8	4	26	2	2	30	83
Kinross ..	—	5	6	2	2	—	11	26
Midlothian ..	8	4	5	27	13	6	62	125
Berwicks ..	3	1	2	15	2	2	60	85
Total ..	22	18	17	70	19	10	163	319

(*b*) **Recaptures** *of geese ringed in Forth and adjacent areas.*

Ringed	Recaptured				
	N. Fife	Kinross	Midlothian	Berwicks	Total
North Fife	7	1	6	—	14
Kinross	—	—	1	—	1
Midlothian	1	1	20	1	23
Berwicks	4	1	6	3	14
Total	12	3	33	4	52

(*c*) **Recoveries** *in Forth and adjacent areas of Pinkfeet ringed elsewhere in Britain.*

Ringed	Recovered					
	N. Fife	Kinross and West Fife	West Forth	Lothians	Tweed	Total
North Tay	1	1	—	—	—	2
Solway	1	2	5	2	2	12
East England ..	—	—	1	1	—	2
Total	2	3	6	3	2	16

somewhat confused, and the simplicity of parts (*b*) and (*c*) is due largely to lack of content). The collection of the North Fife and Kinross records in Table IX establishes a significant difference in the occurrences of geese marked in these areas ($\chi^2_c = 5{\cdot}09$, $P < {\cdot}05$) despite the small size of the Kinross sample, and inspection of Table VIII (*a*) shows that the difference is consistent with the hypothesis of a barrier between the Tay and Forth areas (note that in West Forth Kinross-ringed birds are relatively much more abundant than North Fife ones). But when the recoveries of Kinross- and Midlothian-ringed birds are compared (Table X) it is evident that these two samples cannot be considered as from a single population. (Recaptures are not combined with recoveries here, because the catching effort in Midlothian has been very much greater than in Kinross : in considering Table X it may be worth bearing in mind that the bias of the shooting effort is probably in the opposite direction.) Kinross-ringed birds are found relatively more often on the north side of the Firth of Forth and in the river valley than Midlothian-ringed birds, most of whose within-region recoveries have been in Midlothian and East Lothian. Thus, as expected, the Firth of Forth is a barrier to the mingling of the geese living on opposite shores although the upper part of the river serves as a unifying factor. Another difference between the Kinross and Midlothian samples is in the extent of their tendency to disperse. 50% of the recoveries

TABLE IX

Recoveries and Recaptures of Geese Marked in North Fife and in Kinross

Ringed	Recovered or Recaptured		Total
	North Fife	Kinross	
North Fife	18	9	27
Kinross	—	5	5
Total	18	14	32

TABLE X

Recoveries of Pinkfeet Ringed in Kinross and Midlothian

Ringed	Recovered				Total
	Kinross and West Fife	Lothians	W. Forth	Other Areas	
Kinross	5	2	6	13	26
Midlothian	4	13	5	103	125
Total	9	15	11	116	151

TABLE XI

Local Recoveries and Recaptures of Pinkfeet Ringed in Midlothian and Berwick.

'a + b' = 'recoveries and recaptures'

Ringed	Recovered and Recaptured		Total
	Lothians	Tweed	
Midlothian	13+20 **33**	6+1 **7**	40
Berwick	2+6 **8**	2+3 **5**	13
Total	**41**	**12**	53

TABLE XII

Recoveries at a Distance of Pinkfeet Ringed in Midlothian and Berwick

Ringed	Recovered							Total
	Moray	Dee	Tay	Clyde	Solway	Ribble	E. England	
Midlothian ..	7	4	35	3	14	4	30	97
Berwick ..	—	5	18	0	20	4	31	78
Total ..	7	9	53	3	34	8	61	175

TABLE XIII

Recoveries in Moray Basin and Dee of British-ringed Pinkfeet

Ringed	Recovered			Total
	Ross and Cromarty	Moray and Banff	Aberdeen	
Fife and Kinross.. ..	3	1	12	16
Midlothian	6	1	4	11
Berwick	—	—	5	5
Solway	—	—	6	6
Ribble	—	—	1	1
East England	—	—	5	5
Total	9	2	33	44

TABLE XIV

Monthly Distribution of British-ringed Pinkfeet in North-east Scotland

Area	Month of Recovery							
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May
Moray Basin ..	—	—	2	2	1	1	3	2
Dee	2	3	—	10	2	4	12	—

of Kinross rings are within the Forth area, 19% near where ringed. Only 18% of the Midlothian samples were reported within Forth, 11% near where ringed. Thus, in Table III, p. 112, the inclusion of Kinross with Midlothian-ringed birds serves to reduce the disparity in same season recoveries, between the ' Tay ' and ' Forth ' samples : evidently it would be better, for this purpose, to include Kinross birds with those from Tay as ' relatively sedentary,' in contrast to the ' relatively mobile ' Midlothian and Tweed populations.

This shared high mobility adds interest to the comparison of recoveries of Midlothian and Berwickshire-ringed Pinkfeet (Tables XI and XII). The local recoveries and recaptures, especially in Tweed, are few, and somewhat in conflict, but there is a tendency for the geese to be found where ringed rather than in the neighbouring area. Recoveries at a distance of geese ringed in the two areas confirm that differences exist between them. Geese marked in Midlothian in autumn are more likely to be found later in Moray and Tay, less likely to be found in Solway and East England, than geese marked in Berwickshire at the same time. Thus the boundary between Forth and Tweed does seem to be useful in separating two groups of geese using roosts only about 30 miles apart.

Tables I and III showed that the Solway geese can probably be separated into mobile and sedentary components. These birds seem intermediate in several respects. This lack of distinction makes the description of this group difficult and it is better left until more material is available. Further analyses of the results of marking in the Tay area must also be postponed, because the number of localities in which catches have been made is too small to be representative, this being a large area in which observations suggest that internal movements are unusually complex.

For the discussion of the third problem in distribution, the occurrences of Pinkfeet in the North East of Scotland, we have to rely on recoveries there of birds marked elsewhere, since no geese were marked in Dee until November 1954 and none have yet been marked in the Moray Basin area. Table XIII reveals that the total number of recoveries of British-ringed geese in North-east Scotland is still small, but suggests some interesting possibilities. Apparently the Pinkfeet from England and the Solway visit Dee but not the Moray Basin. The Pinkfeet of Fife and Kinross favour Aberdeen, though some go to the Moray Basin, but it may well be that those ringed in Angus and Kincardine do not visit these more northerly haunts, for none have so far been recovered there. Geese belonging to the ' mobile ' population of Midlothian visit all the northern haunts, but probably favour the Moray Basin, while those of Berwick may be confined to Aberdeen. These occurrences of southern-ringed geese in

the north are not confined to the spring (Table XIV). The 17 mid-winter recoveries (December-February) comprise five Fife-ringed, two from Kinross, four from Midlothian, three from Berwick and three from the Solway, but none from England, suggesting that the *winter* movements of those birds which are already in the south by October or November do not take them to the North of Scotland.

Conclusion

These tentative explorations of possible regional differences in the mobility of Pinkfeet and their attachment to preferred localities do not take us very far towards understanding how this attachment is achieved, although they provide a rather more detailed picture of the composition of some of the groups making up the British population at this time than was previously available. It might be useful to supplement the ringing data by assembling historical accounts of the changing numbers of Pinkfeet in all their British haunts. But Berry's (*loc. cit.*) summary of the information on the status of the Pinkfoot in Scotland up to 1938 indicates only too clearly how imprecise was the evidence then available. General impressions are never to be trusted and are worse than useless as data for analysing the *causes* of change. It is clear that in most places visited by Pinkfeet important changes in numbers have occurred in the last seventy years, but in no instance known to us are these numbers adequately chronicled, and the essential concomitant information about changes in land use and disturbance is even more meagre. Thus it seems probable that the historical information necessary does not exist and must be built up over, say, the next twenty years, at the same time as the ringing data are accumulating. Before we can understand why changes occur (or, perhaps even more importantly, do not occur) in various localities we need to know the details of numbers at all times during a long period of years, details of the composition of the flocks, with respect to age, breeding places and other wintering places used, details of roosting and feeding areas and feeding habits, kinds of disturbance (shooting, aircraft, bird-watchers), changes in climate, and perhaps many other things. This is a lot to ask, but all the information is accessible, except perhaps that relating to the factors still unrecognised.

The evidence from ringing shows how easily *changes* in distribution could come about, but the only explanation for adherence to particular localities which it supports is the relative persistence, or inertia, of adult geese. Is this sufficient (and does it deserve) to be called ' tradition ' ?

ACKNOWLEDGMENTS

Over 600 people have collaborated in the production of this paper, although none of them bears any responsibility for the inferences and opinions based on their contributions. The majority of the collaborators is comprised of those wildfowlers and other finders of ringed geese who have taken the trouble to report their finds. I am very grateful to them, and to everyone who has assisted the goose-ringing programme, either as a member of the rocket-netting teams, or by giving permission for the catching of geese on their land. I am especially indebted to Mr Robert Spencer of the Bird-ringing Committee of the British Trust for Ornithology.



FLUOROSCOPIC MEASURES OF SHOOTING PRESSURE ON PINK-FOOTED AND GREY LAG GEESE

By William H. Elder[1]

CONCERN over the future of wildfowl populations in North America stems in part from the fact that human populations there have doubled in the past 50 years and, at present rates of increase, will double again long before another 50 years have passed. With American traditions of free-hunting and with game of all sorts being the property of the people and vested in the state, the shooting pressure applied by those in pursuit of game, and especially migratory birds, must necessarily rise proportionately with the increase in human populations. It therefore behoves the New World to look critically at the practices in Europe in order to learn how waterfowl have persisted so long in shootable numbers in the face of a comparatively dense human population.

In recent years many efforts have been made in America to estimate the comparative shooting pressure that the sporting public applies to various kinds of waterfowl. These have included tabulations of the numbers of licences sold to shooters, numbers of federal 'duck stamps' sold (a form of tax on those pursuing waterfowl only), estimates of total kill by sample counts of hunter's bags, voluntary report systems and rates of recoveries of rings from waterfowl shot and reported.

Each of these methods is fraught with particular difficulties, for total shooting pressure is the resultant of many forces, including number of guns in the field and the number of wildfowl at which they may shoot (as controlled by regulation of close-seasons and the weather phenology of the particular year). Shooting pressure is also influenced by the sporting traditions of the nation, for this determines the number of species considered worthy of the wildfowler's efforts.

In an earlier paper (Elder, 1950) it was pointed out that the amount of lead

[1] This study was conducted while the author was on sabbatical leave from the University of Missouri and was aided by financial assistance from the Wildlife Management Institute, Washington, D.C., and the American Museum of Natural History, New York.

actually fired at waterfowl, of any given species, in the form of shot or pellets must be proportionate to the number killed and to the number that survive wounds to carry pellets in their flesh as a mark of the experience. Because pellets lodged in the flesh do not disintegrate but remain permanently intact they can be readily seen when the bird is examined in the dark under a fluorescent screen bombarded by X-rays.

A convenient apparatus for accomplishing this with live birds trapped for ringing was described in the paper cited above and I have now used it in the examination of more than 20,000 birds. My desire to compare the effects of the very different social traditions in Europe and North America on shooting pressures sustained by their respective waterfowl populations made me eager to accept the kind invitation of Peter Scott to come to the Wildfowl Trust in the autumn of 1953.

METHODS

It was my good fortune to accompany the goose-netting trips of the Trust and to examine nearly all birds caught for the presence of lead pellets in their bodies. This was accomplished by erecting a collapsible aluminium frame over which was stretched a rubberised black-out tent. Inside this dark room a small portable X-ray machine was held in a lead protective box, topped by a fluorescent screen. The unit was energised by a compact, aluminium, gasoline-driven generator of 1500 watt capacity ; the generator weighed but 125 pounds and was connected by 100 feet of electric cable to the X-ray machine. This distance reduced the noise during operation. In practice each goose was firmly wrapped in a piece of burlap sacking, passed through a small light-tight door in the tent, slid beneath the fluorescent screen and examined for a few seconds under 3½ milliamps of current. When our crew became fully trained, we were able to examine as many as 190 birds per hour.

Because the two sexes of any species may have different average life spans, as shown for North American ducks (Bellrose and Chase, 1950), it is apparent that the males, being longer-lived, will have more years in which to accumulate pellets and hence the data must be grouped separately for the two sexes. It is also obvious that juveniles examined in October-November have experienced but part of their first year of being shot at and will have many fewer shot than adult geese, hence they too must be considered separately. When the data are thus broken down into age and sex groups they are too few to report separately from each trapping site and hence are lumped for the entire season.

For those interested in the local populations sampled, I shall add that they were captured in the following areas : West Lancashire, the Wash, the Humber, the Solway, South-east Scotland, Loch Leven, the Tay and Montrose.

FINDINGS

In Table I below are shown the data resulting from the fluoroscoping of 1476 geese. On the basis of this sample we cannot conclude that there is a statistically significant difference between Grey Lag and Pink-footed Geese or between the males and females of either species. In the Pinkfoot, where the sample is most nearly adequate, the slightly greater proportion of adult males carrying pellets can be almost entirely accounted for by their slightly larger body size presenting a bigger target to the shooter. If we compute their comparative silhouette

areas by the formula :

$$\frac{\text{Area of Male}}{\text{Area of the Female}} :: \frac{(\text{Average Weight Male}) \text{ to the power of } \frac{2}{3}}{(\text{Average Weight Female}) \text{ to the power of } \frac{2}{3}}$$

we find that males have 7·1% more area. Because the proportion of the two sexes is very nearly equal in each group, it is safe to average the samples and conclude that among the 825 adult Pink-footed Geese 41% were carrying the evidence that they had been hit by shotgun fire while 37% of the 161 adult Grey Lag Geese carried the same evidence.

Less than 5% of the juvenile geese experiencing their first gunning season had yet acquired lead pellets. This strongly suggests that the shooting pressure they have sustained prior to reaching Britain is not very great and that perhaps most of the pellets they will acquire will be from British guns.

TABLE I

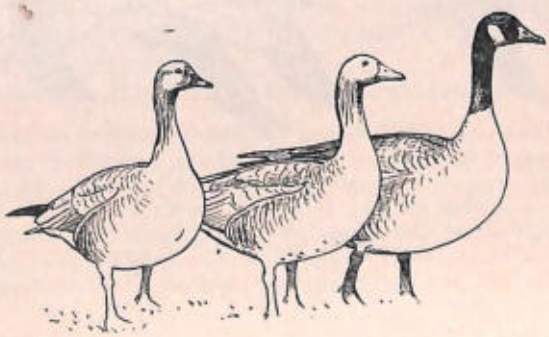
Incidence of Lead Pellets Found in the Flesh of Pink-footed Geese and Grey Lag Geese in Britain by Means of the Fluoroscope, 11 October-23 November 1953, and Canada Geese in Missouri, U.S.A., 7 November-9 December 1949

	Adult Males			Adult Females			Juvenile		
	No. Examined	No. with Pellets		No. Examined	No. with Pellets		No. Examined	No. with Pellets	
Pink-footed Goose ..	407	179	44·0%	418	161	38·5%	309	15	4·9%
Grey Lag Goose ..	82	30	36·6%	79	30	38·0%	99	3	3·0%
Canada Goose ..	402	179	44·5%	333	144	43·3%	596	129	21·6%

TABLE II

Number of Pellets Carried by Adult Pink-footed Geese, Detected by Fluoroscope, Autumn 1953

	Number of Pellets											Number of Geese Examined
	1	2	3	4	5	6	7	8	9	16	23	
Number of Geese ..	167	87	44	15	10	6	1	4	4	1	1	825



Unpublished evidence on the Canada Goose *Branta canadensis interior* in Missouri (Shanks, *in litt.*) indicates that the adult populations of this species traversing North America in the Mississippi Valley carry approximately the same percentage of lead pellets in their flesh as do British geese. The similar gunning pressures in America and Great Britain as indicated by the fluoroscopic evidence are extremely interesting, for geese on their wintering ground in Great Britain are pursued for at least four months. This is approximately the same time span that the Canada Goose endures pursuit by gunners from its nesting ground in Canada to wintering areas in the southern United States. It appears that the fast transportation in America (where nearly all shooters proceed by private auto) and wide use of automatics and pump guns offsets the effects of the tremendous distances and multiplicity of restrictive regulations so that American geese are shot as heavily as British geese, despite the fact that British geese are confined to a comparatively small wintering area and are protected by few restrictive regulations.

However, before final interpretations can be made we must know the average life span or mortality rates of the species on the two continents. In America 95% of the population 'turns over' or is replaced by reproduction every five years (Hanson and Smith, 1950) but this will not be known for Europe until there is a greater accumulation of recoveries from the ringing programme.[1]

[1] The most recent figures indicate that 95% of the British population of Pink-footed Geese 'turns over' in 6 years.

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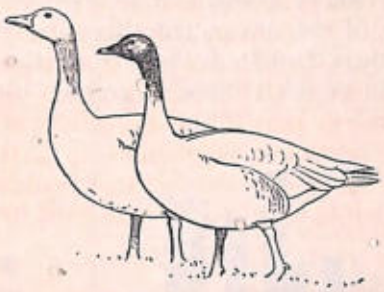
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THE RELATION OF AGE AND SEX TO THE WEIGHTS OF PINK-FOOTED AND GREY LAG GEESE

By William H. Elder [1]



To the thousands of sportsmen who pursue wildfowl the world over and to the many persons who keep them in aviaries, as well as the legion of ornithologists and amateurs who enjoy watching them against the sky, the question, 'How big is a wild goose?' is most familiar. But answers usually are too general or based on too small a sample to be conclusive. Furthermore it has been shown that weights of Canada geese (Elder, 1946) are different in the two sexes and vary according to age and season. Having become intimately acquainted with the plumage and external anatomical features of the Canada goose while ringing several thousand in Illinois, I was delighted with the opportunity of accompanying Director Scott in order to make similar observations on British geese.

The goose-netting operations of the Wildfowl Trust provided me with the opportunity of handling more than 1600 geese in the autumn of 1953. My part in this operation was to determine the sex and age of each bird as it was ringed. This was accomplished by examining the tip of the tail feathers for the presence of the tiny notches which distinguish birds of the year from older birds (Hochbaum, 1942). The sex of each bird was then determined by eversion of the vent—a technique previously worked out (Elder, 1946)—to detect the presence or absence of the copulatory organ, characteristic of males in both ducks and geese. Thus the birds could be classified into the four age-sex groups shown in Figures 1 and 2.

Weights were taken to the nearest ounce by means of a spring scale from which a bag was suspended to hold the goose. These weights were later converted to pounds and tenths of pounds to facilitate statistical analysis.

The Pink-footed Goose *Anser brachyrhynchus*

The frequency distribution of the weights of 636 birds of this species is shown in Figure 1. A progressive decline in weights from adult males to juvenile females is apparent. It also seems clear that adults are heavier than juveniles of the same sex and that males are heavier than females of the same age group. An analysis of the weights was made in order to discover whether these apparent differences were statistically significant.

Table I gives the sample size, means and standard deviations [2] for each age

[1] This study was conducted while the author was on sabbatical leave from the University of Missouri and was aided by financial assistance from the Wildlife Management Institute, Washington, D.C., and the American Museum of Natural History, New York.

[2] Standard deviations were found directly by taking half the difference between the 84th and 16th percentile weights. The significance of the means was determined by finding their critical ratios—the ratio of the difference of the means to the standard error of the means. Any ratio exceeding 3 (chances 1 : 370) is considered significant.

and sex group. The differences between the weights of adult and juvenile males, between adult and juvenile females and between adult males and females were all found significant. Very likely a larger sample would reveal that the difference between juvenile males and females was also significant.

Table II is a summary of information taken from the literature dealing with weights of Pink-footed geese. Only two authors state the size of their sample and Haigh's data are included in Witherby, whose average of six pounds is considerably more than the over-all average of the 5·6 pounds found in my study. That such comparisons have little value is clear from the present study : when both the sex ratio and age composition of the sample so greatly affect

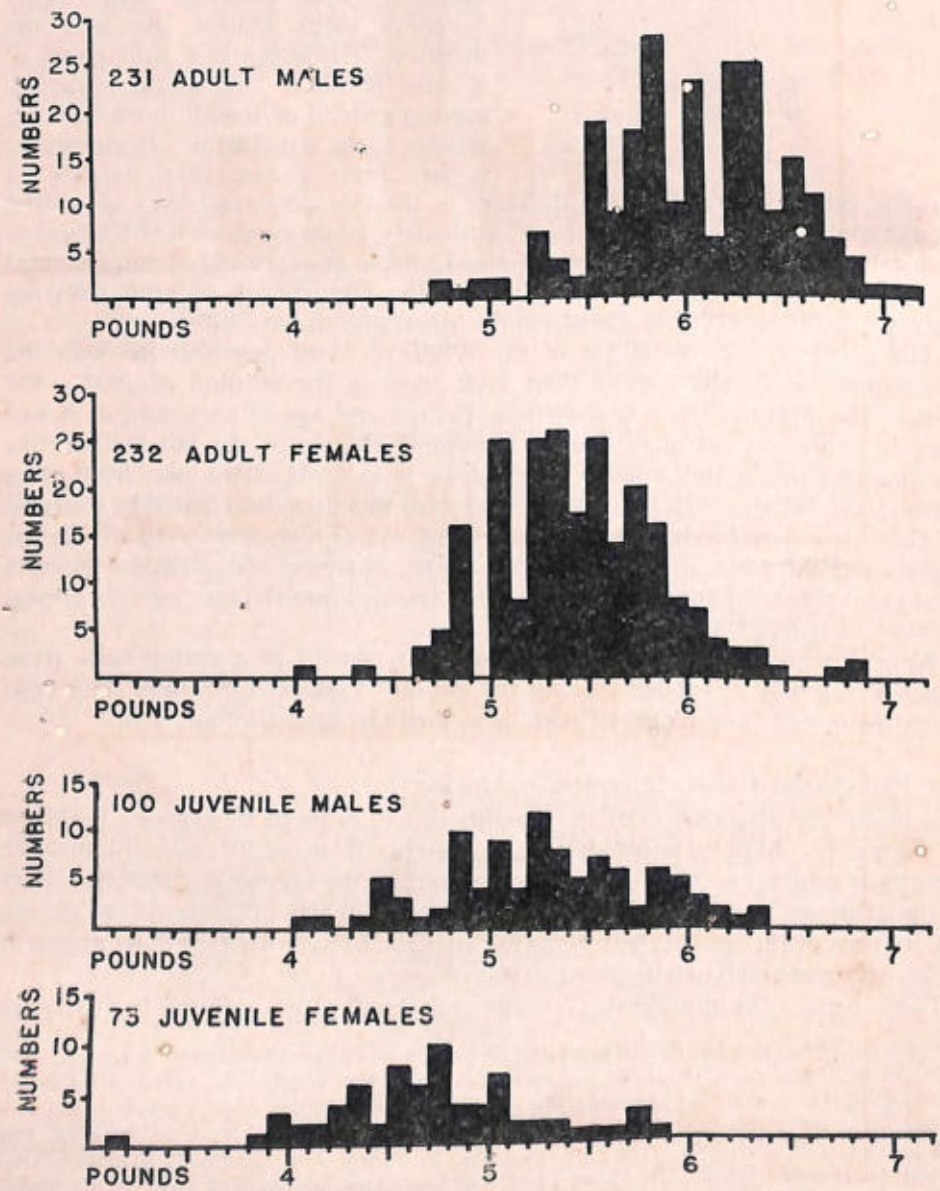


Fig. 1.—Frequency Distribution of the Weights of 636 Pink-footed Geese

the mean, sound comparisons from year to year or season to season can only be made when the weights are classified by age and sex groups.

The table of weights given by Haigh (1935) lumps birds of all sexes and ages together but it shows so well the distribution and high proportion of heavy birds that it is presented here in graphic form as Figure 2.

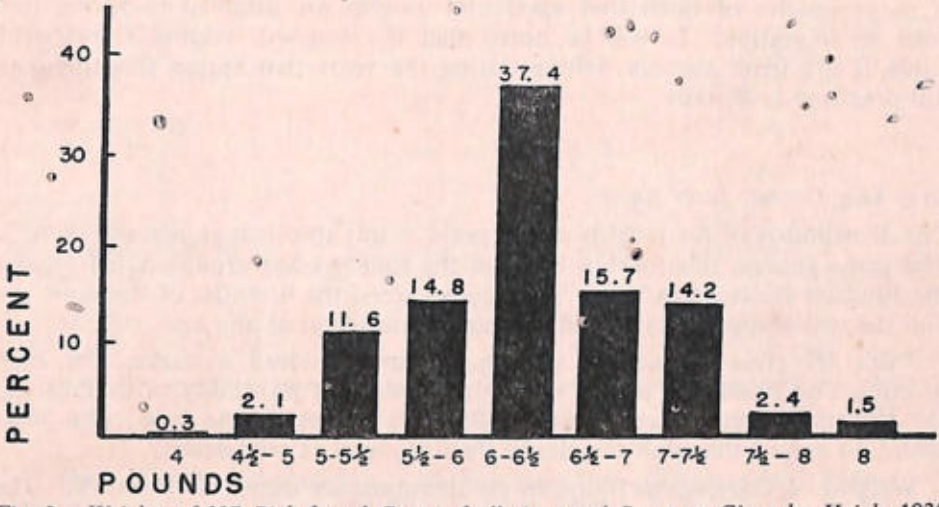


Fig. 2.—Weights of 337 *Pink-footed Geese of all Ages and Sexes as Given by Haigh,* 1935

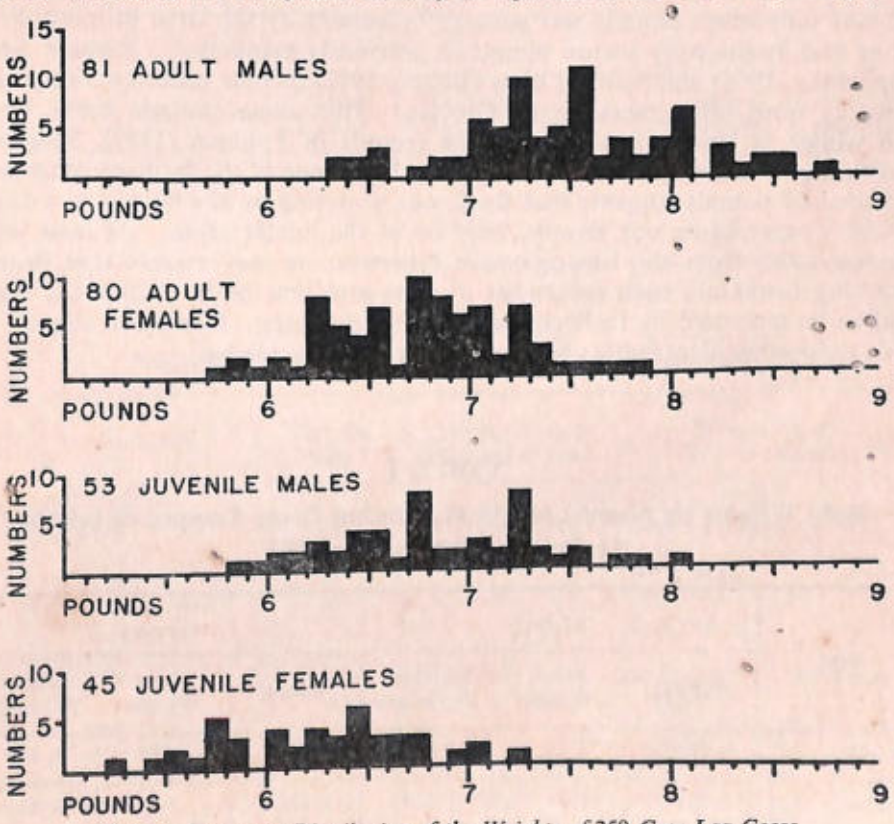


Fig. 3.—Frequency Distribution of the Weights of 259 *Grey Lag Geese*

It is surprising that in a sample of the size I handled the maximum weight of any bird was only 7 pounds 3 ounces. At least half of the authors listed in Table II cite maximum weights of 7½ pounds or more. Because 1953 was a mild winter it seems doubtful that the weather could have caused the birds to be light. Perhaps it was due to the early season sample for it has been shown in many species of birds that maximum weights are attained in spring just prior to migration. It will be noted that the heaviest weights reported in Table II are from authors writing during the years that spring shooting was still practised in Britain.

Grey Lag Goose *Anser anser*

The distribution of the weights of 259 geese of this species is shown in Figure 3. The same general relationship between the four sex-age groups noted among the Pinkfeet is also seen here. The adults exceed the juveniles of the same sex and the males apparently exceed the females in weight at any age.

Table III gives the sample size, means and standard deviations for each group. The small size of the sample precludes the possibility of establishing the statistical significance of these differences except in one case: the adult males do exceed the adult females at the 95% level of confidence.

Weights of Greylags as found in the literature are shown in Table IV. The means given all exceed that found for the birds in the present study. That this was only seven pounds was perhaps influenced by the large proportion of young and by the early season sample as previously mentioned. Russian birds (Alpheraky, 1905) and Spanish birds (Bolam, 1912) include much heavier geese, probably from other races of the Greylag. That some of these heavy birds also winter in Britain is shown by the records of Popham (1899), Saunders (1899), Payne-Gallwey (1896) and others. That none of the birds we examined exceeded 8¾ pounds suggests that the flocks wintering on the Solway and Loch Leven, whence came our sample, may be of the lighter races. At least until the recoveries from the ringing prove otherwise we may assume that British wintering flocks are each somewhat discrete and that birds of different races tend to be separated by their choice of wintering areas. Continued ringing of birds accurately identified as to age and sex is badly needed.

TABLE I

Body Weights (in pounds) of 636 Pink-footed Geese Trapped in Britain 11 October-23 November 1953

Age	Males			Females		
	Number	Mean Weight	Standard Deviation	Number	Mean Weight	Standard Deviation
Juvenile ..	100	5·33	0·513	73	4·79	0·469
Adult.. ..	231	6·09	0·469	232	5·49	0·438

TABLE II

Weights of Pink-footed Geese as given in the Literature

Authority	Sample Size	Average Weight Pounds : Ounces	Weight Range Pounds : Ounces
Alpheraky, 1905, 89	—	—	6 : 8 to 7 : 4 (Ad. ♂♂)
Bolam, 1912, 350	—	—	7 : 0, Max.
Gladstone, 1922, 204	—	—	6 : 0 to 7 : 8
Haigh, 1935	337	—	4 : 0 to 8 : 4
Harvie-Brown, 1906	—	—	4 : 8 to 8 : 8
Heinroth, 1928, 173	—	6 : 0	—
Macpherson, 1892, 239	—	—	4 : 14 to 7 : 8
Niethammer, 1938, 406	—	—	4 : 12 to 5 : 9
Ogilvie-Grant, 1912	—	—	5 : 8 to 7 : 0
Payne-Gallwey, 1896, 69	—	—	6 : 8 to 7 : 4
Robinson, 1903	—	—	6 : 12 to 7 : 12 (Ad. ♂♂) 6 : 0 to 7 : 4 (Ad. ♀♀)
Saunders, 1899, 404	—	—	5 : 8 to 7 : 0
Witherby, *et. al.*, 1939, 200 ..	692	6 : 0	4 : 0 to 8 : 0

TABLE III

Body Weights (in pounds) of 259 Grey Lag Geese Trapped in Britain 14–23 November, 1953

Age	Males			Females		
	Number	Mean Weight	Standard Deviation	Number	Mean Weight	Standard Deviation
Juvenile ..	53	6·88	0·500	45	6·29	0·475
Adult	81	7·52	0·444	80	6·80	0·421

TABLE IV

Weights of Grey Lag Geese as given in the Literature

Authority	Sample Size	Average Weight Pounds : Ounces	Weight Range Pounds : Ounces
Alpheraky, 1905, 28 ..	—	—	5 : 12 to 12 : 0
Beveridge, 1918	300	7 : 6½ (7 : 13, Nov.–Feb.)	Only 3 exceeded 10 : 0
Bolam, 1912, 344	—	8 : 0	12 : 0, Max.
(Chapman, Spain, Dec.)	27	—	10 : 8
Coburn, 1903	—	—	8 : 0 (Ad. ♂)
Gladstone, 1922, 204 ..	—	7 : 0 to 9 : 0	—
Heinroth, 1928, 154 ..	—	—	6 : 11 to 8 : 13 (German birds)
Naumann, 1905, 285 ..	—	—	9 : 0 to 12 : 0 (16 : 0 when very fat)
Neithammer, 1938, 391 ..	—	—	7 : 8 (♀♀), Max.
Ogilvie, 1920, 177	50	7 : 8	8 : 10, Max. (Av. Wt. declined 1 : 8 after 10 days frost)

TABLE IV—*continued*

Authority	Sample Size	Average Weight Pounds : Ounces	Weight Range Pounds : Ounces
Ogilvie-Grant, 1912, 309 ..	—	—	8 : 0 to 10 : 0 and heavier
Payne-Gallwey, 1896, 64 ..	—	—	9 : 0 to 11 : 0 (Juv., 7 : 8 to 8 : 0)
Peel, 1901, 74	—	—	10 : 0, Max.
Saunders, 1899, 398 ..	—	—	8 : 0 to 10 : 0
Stevenson, 1864	—	—	7 : 8 (Ad. ♂)
Thompson, 1851, 45 ..	—	—	11 : 12 (Ad. ♂, primaries pulled)
Witherby, *et al.*, 1939, 185	83	7 : 8	5 : 8 to 9 : 12

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THE MYCOFLORA OF WILD PINK-FOOTED GEESE SAMPLED IN ICELAND AND SCOTLAND, 1953

by W. J. L. Sladen and P. K. C. Austwick

SUMMARY

An attempt was made, (i) to study the fungi isolated from the upper respiratory tracts of wild Pink-footed Geese at their breeding-grounds in Iceland and at their winter quarters in Scotland, in order to discover whether they harboured *Aspergillus fumigatus* in the wild, and (ii) to test suitable methods for collecting samples in the field under adverse conditions. Cultures were made by streaking throat-swabs on to Sabouraud's dextrose agar slopes and neither these nor the controls revealed *A. fumigatus* or any other potential pathogenic fungus, but the isolates obtained showed that the quality and quantity of the fungus content of the upper respiratory tracts of the geese may be dependent on their environment. Suggestions are made for improving technique. A species of Ascomycete grown from the throats of three geese in Iceland appears to be new to science.

INTRODUCTION

Avian Aspergillosis is a common and usually fatal disease especially of young poultry and of wild birds in captivity (Ainsworth and Rewell, 1949). It is caused almost exclusively by *A. fumigatus*, a cosmopolitan fungus which can be readily isolated from soil, plant remains, and generally from the environment of animals. Very little is known about the natural occurrence of the disease in wild birds, though Ainsworth and Austwick (1955) have recorded it in a Rook, a Jackdaw and four Woodpigeons. The disease causes much of the mortality among adults in the Wildfowl Trust collection, and during recent years has killed many valuable specimens. Nothing is known about the natural occurrence of the disease in wildfowl and the present investigation was undertaken to ascertain the presence of *A. fumigatus* in the upper respiratory tracts of wild Pink-footed Geese in their natural habitats.

Previous investigations (Sladen, 1952 and 1954) among penguins in the Antarctic, and among Kelp Geese and Steamer Duck brought back to the Wildfowl Trust did not reveal the presence of *A. fumigatus*, or other potentially pathogenic fungi before captivity. In addition, Sladen swabbed the throats of 23 wild geese in Scotland in November 1952, after they had been caught for ringing by rocket nets. A number of non-pathogenic fungi were grown from these swabs after streaking on to Sabouraud's dextrose agar, and one culture gave an abundant growth of *A. fumigatus*. Contamination due to the primitive field conditions may have been responsible for this positive result, because two out of five control, and apparently sterile, swabs also grew isolated colonies of the same species. The work however suggested further lines of approach. First, a much larger sample of swabs from the upper respiratory tracts of wild birds was indicated, and second, methods of collection and culturing needed testing in the field.

The Wildfowl Trust's expedition to Central Iceland in 1953 (see Scott, Boyd and Sladen, 1955) provided opportunities for following up this work. Two

hundred and fifty-four of the 9,005 adult and gosling Pink-footed Geese captured for ringing had their throats swabbed and at the same time 46 cultures were made from the feathers of the geese and the soil in the catching area and by exposing agar slopes to the air during streaking operations, (termed 'controls' throughout this account). In November 1953, a further sample was taken from 40 of the same species caught by rocket-nets in Dumfriesshire and a further 10 controls collected. Sladen was responsible for the field work and Austwick for the examination of the isolates.

EQUIPMENT FOR FIELD WORK

Cultures were made on Sabouraud's dextrose agar slopes in Bijou bottles. Standard throat swabs were used which were sterilised twice, the second time after being packed into tin containers. These tins were kept sealed until required, thus reducing the danger of contamination to a minimum.

METHODS

In Iceland. Swabs and culture media were transported to the catching area by pack-pony. Each goose was held firmly round the wings and body by an assistant. The left hand was used for opening the bill and the swab, held in the right hand, inserted and rubbed against the fauces where the nares entered the hard palate and then rubbed across the epiglottis until the bird gave a little 'cough.' Care was taken not to rub the swab against the fingers used for keeping the mouth open. The ever present wind and dust were also potential sources of contamination, and there were further disturbances when birds were caught for ringing. Swabs were therefore collected on the windward side of the catching cage and, if inoculated on to the culture media immediately, the Bijou bottle heads were held pointing away from the wind. Speed in technique also helped to overcome danger of contamination. Some of the swabs were replaced in their sterile containers and inoculated within six inches of a primus stove on return to camp. A comprehensive set of controls was taken from the feathers of the geese, the ringers' hands, clothing and beards, and from the gravel and vegetation in the catching area. More controls were also taken to make sure that the swabs and culture media had remained sterile in spite of their travels under adverse conditions.

In Scotland. Results from the Iceland cultures and controls indicated that the technique of inoculating the swabs on to the culture media immediately after being collected from the geese was as satisfactory as bringing the swabs back to camp and inoculating them by a primus stove. All the Scottish swabs were therefore collected from the geese before they were ringed, and inoculated immediately on to the slopes. Controls were again collected from goose feathers, the ringers, from the surrounding vegetation, and also to test that the swabs and medium had remained sterile in transit.

INCUBATION

The two sets of cultures received different treatment. Those from Iceland were inoculated and kept with the caps loose at field temperatures for up to seven days before they were screwed down for despatch to England by air. Three days later the caps were loosened again and the tubes incubated at 25 °C. for seven days before examination. The caps of the Scottish culture bottles

were screwed up immediately after inoculation and sent by post, the tubes remaining closed until they were similarly incubated four days later.

In each case examination consisted of recording those fungi which could be identified immediately, and subculturing the remainder on to 2% malt agar. The subcultures were further incubated and recorded when characteristic growth had appeared. Some of the Iceland cultures may have been 12 days older than the corresponding Scottish ones, a fact which no doubt favoured the appearance of slow-growing fungi from the Iceland inocula.

RESULTS

A. fumigatus was not detected in any of the 350 cultures, either from swabs or controls. Other fungi belonging to 17 different genera were isolated, and eight species were identified. Some of these, for example *Truncatella truncata* and *Pseudogymnoascus roseus*, appear to be new records (regional records, for almost all would count as new records from the 'substrate'), and at least one of the unidentified species, an Ascomycete (P. 71), is probably new. A large number of isolates produced sterile white or dematiaceous mycelium and hence have not been determined further.

None of the species recorded are known to be pathogenic. There is little doubt that the majority grew from spores present on the mucosæ of the geese. The clue to the source of these spores is given in the isolations from the swabs and controls of the Scottish sample, where the fungi recorded from the throats and those from the stubble were in many cases identical. Table I gives details of the fungi isolated, and their frequency in the various samples, together with the total numbers of cultures examined.

From swabs. Fungi were recorded from 23% of the Icelandic cultures and 97% of the Scottish, whilst bacteria occurred in 75% and 100% of the samples respectively. 15% of the first sample gave sterile cultures.

It is the occurrence of large numbers of fungi in the Scottish cultures that is of interest, for most of the species encountered are characteristic of decaying vegetation and more particularly decaying cereals. Thus species of *Fusarium*, *Cephalosporium*, *Trichoderma* and dematiaceous fungi were dominant and were isolated in similar quantities from the controls made by inoculating slopes direct from the stubble. By comparison, the Iceland cultures did not show such an abundance of these species and it is clear that by the time the birds had been in Scotland for a short while they had picked up much of the new fungus content of their throats from their surroundings, either by inhalation or during feeding.

From controls. A comparison of the fungi in the various controls with those from the swabs suggested that little contamination of the cultures had occurred in spite of the adverse conditions. The controls made from the gravel or stubble present in the catching areas gave fungi typically isolated from these substrates, and the extent of the controls seems to have been quite adequate to deal with any suspected sources of contaminants. (Table II).

DISCUSSION

Although *A. fumigatus* was not isolated, the data have proved interesting from several points of view, and suggest ways in which the sampling and culturing technique could be further improved.

The negative finding of this investigation does not indicate that *A. fumigatus* is necessarily absent from the throats of wild Pink-footed Geese, for it seems fairly certain that its normal ubiquitous occurrence would provide a source of spores, even if in small numbers, in almost every environment.

The sampling technique used, although no doubt providing a fairly satisfactory sample of the throat mucus, could not be expected to indicate the spore content of lower portions of the respiratory tract. Moreover, the conditions following the inoculation of the slopes were not ideal for the growth of *A. fumigatus* and the development of other saprophytic fungi was probably favoured at the expense of this species, which requires an unrestricted air supply and relatively high temperature (35–37 °C.) for optimum growth.

A more intensive sampling technique, covering the larynx and tracheæ of the birds, would appear advisable, with a complete examination, both clinical and cultural, of a representative number of respiratory tracts (*i.e.* by killing the birds). During the present investigation however, swabs taken after dissection from the lower parts of the tracheæ of three goslings and one adult bird which had died at the Arnarfellsalda catch (29 July 1953), produced only one positive culture, giving a yeast and bacteria. Moreover in the course of the Agricultural Research Council Survey of Animal Mycoses extensive cultural examination

TABLE I

The fungi isolated

Species and Totals	Swabs		Controls		Totals	
	Site*				Swabs	Controls
	I	S	I	S		
Acremoniella atra (Corda) Sacc.	—	3	—	—	3	—
Aspergillus glaucus series	—	—	3	—	—	3
Cephalosporium spp.	4	13	—	2	17	2
Cladosporium herbarum Link	—	—	1	1	—	2
Fusarium spp.	2	21	2	3	23	5
Mucor spp.	—	—	2	3	—	5
Penicillium spp.	5	—	6	—	5	6
Phoma spp.	2	—	1	—	2	1
Pseudogymnoascus roseus Raillo	1	—	—	—	1	—
Stemphylium sp.	—	—	1	—	1	—
Trichoderma viride Fr.	—	4	—	1	4	1
Truncatella truncata (Lév) Steyeart	2	—	3	—	2	3
Indet. ascomycete (P. 71)	3	—	—	—	3	—
Indet. yeasts	1	2	4	—	3	4
Indet. mycelial fungi (white)	25	31	12	5	37	36
Indet. mycelial fungi (dematiaceous)	4	14	3	6	18	9
Bacteria	192	40	12	3	204	43
Actinomycetes (aerobic)	4	—	2	—	4	2
Sterile slopes	38	—	24	2	38	26
Total fungi isolated	55	58	31	21	112	51
No. of species (or genera if not identified further)	11	6	12	6	13	14
Total no. of cultures	254	40	46	10	294	56

*I = Iceland
S = Scotland

TABLE II

Control from	No. of Tubes							
	Fungi		Bacteria		Sterile		Total No. of Tubes	
	Site*							
	I	S	I	S	I	S	I	S
Gosling feathers	1	—	—	—	—	—	1	—
Adult feathers	5	2	3	2	—	—	6	2
Ringers' hands, clothing, etc. ..	5	—	3	—	1	—	7	—
Gravel or stubble	4	5	—	—	—	—	4	5
Caps left off for varying periods ..	7	—	6	1	8	—	16	1
Swab exposed to air	1	—	1	—	2	—	4	—
Unused swab streaked	—	—	—	—	14	2	14	2

*I = Iceland
S = Scotland

of swabs taken from the larynx and trachea of an adult wild White-fronted Goose from the New Grounds, Slimbridge, by Mr J. A. J. Venn, Veterinary Investigation Centre, Langford, Bristol, gave only two colonies of *A. fumigatus*, in spite of the presence of vast quantities of spores of this fungus on chronic bronchial lesions.

The incorporation of an antibacterial antibiotic into the media, and the replacement of Sabouraud's dextrose by either 2% malt or Czapek-Dox agar would probably enhance the possibility of isolating *A. fumigatus*, whilst the supplementary use of a dilution technique for a number of samples would check the efficiency of the swab-streak method for obtaining a true picture of the viable fungi present. Further, incubation as soon as possible after inoculation at a temperature of 35–37° C. would minimise the chances of other fungi suppressing the *A. fumigatus*, but this might not be easy in the field.

One point of considerable interest in these samples has been the number of isolations and the species of fungi found in the samples from the Scottish grounds. Here it is evident that the fungus content of the throat was derived directly from the stubble on which the geese were feeding and that in this way the fungus spores present on the mucosæ change in number and species with the environment of the birds. Thus *Truncatella truncata* cultured from two swabs in Iceland is chiefly known from plant material. It was also obtained from the feathers of one bird and appeared in a tube exposed to the air for an hour at the collecting site. Similarly, *Trichoderma viride* is a common soil fungus and was obtained in Scotland from four throat swabs and from the stubble of the catching area. Of other fungi common to both collecting grounds, the species of *Fusarium* were most abundant. These fungi are characteristic of decaying plant remains, especially cereals, and appeared in half the Scottish swab cultures and all three controls from the stubble, but only in two swab cultures and two controls from Iceland. It is expected therefore that *A. fumigatus* will be picked up from the surrounding plant life and soil as readily as those species of fungi found in this investigation.

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ASPERGILLOSIS IN WILD GEESE: A NEW TECHNIQUE FOR ITS DETECTION

A three-year study of the disease is going forward at the New Grounds. Mr J. V. Beer contributes the following note :

At the end of 1954 a new swabbing technique was used to detect *Aspergillus fumigatus* in Pink-footed Geese caught in rocket-nets in Britain. The technique aims at taking a fuller sample from the throat of the goose than the stick and cotton-wool method.

Briefly the methods of isolation are as follows. A rubber-tube swab is used to obtain material from the throat of the goose and is then washed in a sterile malt extract solution contained in a small screw cap bottle. This solution contains an antibiotic to keep down the growth of bacteria. The sample bottles are returned to the laboratory and kept in a refrigerator until the end of the expedition when a start is made to isolate the moulds. In isolating the mould the methods used were such that bacteria were completely inhibited from growing and large numbers of other moulds were inhibited by the relatively high incubation temperature. The moulds are grown out on a solid medium, of similar composition to that above, in a petri dish. Incubation is carried out at 40°C for one week. Suspected *A. fumigatus* colonies are purified by several successive transfers onto Czapek-Dox agar in petri dishes. Incubation is again carried out at 40°C and for 3–4 days. The purified culture is grown on a Czapek-Dox agar slope in a test-tube and kept at a low temperature. This culture is used to produce more growth for diagnostic studies and for experimental work.

A. fumigatus was found on 7 of 235 swabs. Just over 350 geese were swabbed and the remaining material is being worked up.

The full significance of these isolations is difficult to assess as the mould is a fairly common soil inhabitant.



THE DISCOVERY OF PINK-FOOTED GEESE NESTING IN ICELAND, 1929

Extracts from the Diary of S. W. P. Freme

The late S. W. P. Freme, in company with W. M. Congreve (C. in the narrative), made the first discovery that the interior geese (heiðagæs) of Iceland were Pink-footed and not White-fronted as had previously been believed. In view of the importance of this discovery to our subsequent knowledge of the Pinkfoot, we feel that the details of the journey are of especial interest. We are indebted to Mr J. R. Charnley for permission to use these extracts (hitherto unpublished). The two ornithologists were staying at Skútustaðir, at the south end of Myvatn at the beginning of June 1929.—Ed.

1 *June.*—A message has arrived from a farmer on the edge of the desert to say that White-fronted Geese are breeding within a day's journey of him. It would be a great thing to prove that these geese really breed in Iceland. Eggs have been exported from here to England, but as yet no reliable ornithologist has given them his 'cachet.' It will be hard work I expect. We have talked it over, and we propose to ride for them on Monday. This will enable us to make Viðerkeri the same day, and we can push on to the breeding place on Tuesday. C. intends to obtain clutches of eggs for proof, which I shall clinch by shooting and skinning a bird. Almost excited tonight! Meanwhile we are pleased with Páll. He has done good staff work and will get 'backshish' for this if it does not turn out a mare's nest! I have a shocking cold tonight. I suppose it was the east wind catching us after we swam back from the Diver's nest. It might have left me alone till the big ride was finished. I expect I shall have a rotten time.

Monday 3rd.—Feeling rotten. Our ponies are supposed to be here by 9, but as time is of no account to these folk, I think we'll not get away before 10.

Páll, Congreve and I rode out at 10.20, taking the usual fish and egg ration in a cardboard box, and travelling light as regards luggage. Three or four miles down the track to Husavik we turned southward and rode over sparse scrub till we came to Lake Sandvatn on which was a small herd of Whooper Swans. We rode on turning almost due south till at 1.10 we halted for lunch. Afterwards, we pushed on, slowly because of the bad going, and continued over the same monotonous kind of country till almost due west of Sellandars Fjall. The day was quite warm. We saw very few birds but got a fine view



at close quarters of a grand falcon which had just dived on a male Rjupa. These unfortunate Ptarmigan get a rotten time. We counted at least 15 corpses or remains on this ride, all apparently of male birds. The ponies were marvellous, making the most of the ground that no horse could have gone over without mishap. My beast, Dina, a piebald lady of 13 years is wonderful, and the way she crosses bogs and streams would have to be seen to be believed. After 5½ hours riding we made Viðerkeri, a large but poorly-built farm pretty far from civilisation. It stands, indeed, almost on the edge of the desert, though there are, I believe, one or two hovels even nearer to that abomination of desolation. We were met in great style by Tryggvi Guðmundsson, our host and guide for the time, a fine wiry old savage who combines the manners of a duke with the appearance of a pre-Renaissance freebooter, who stabled our ponies and showed us our quarters. We have a ramshackle bedroom with one window—broken, and in the dining room is a long bench which does duty as a table. For seats are wooden forms, and there are two chairs chipped from the lava rock and padded with sheepskins. I cannot imagine how this man and his family live out here in the 'blue' like this without going dotty. It would suit me for a little while but . . . !

All the track of our ride today has been through a country devoid of life, and it was a surprise to find a farm tucked away in this weird undulating tundra that seems to sweat with an unwholesome damp from the snow that has left marshes where a day or two ago it lay deep. As far as we can make out we should be about 30 miles from the alleged breeding-ground of the White-fronted Geese. Tryggvi showed us eggs which he claims came from there two years ago. There were two clutches. One was certainly of a goose of some sort, but we think the other most likely was laid by a saw-bill duck—Goosander or Red-breasted Merganser. Today I have not suffered much from our 28 miles or so of ride, but my cold is frightful and I am running a temperature which does not, however, prevent me from being rather hungry. Tryggvi has rather put the wind up me by telling us that the ride to the breeding-ground and back will take 16 hours ! If this be really the case I'm likely to be a wreck tomorrow !

We have arranged to start off at 4 a.m. and are going to turn in very early. After coffee, taken *en famille*, we went a short distance with the farmer's little boys, and they took us to where they had found a Golden Plover's nest. The bird was sitting tight and allowed us to approach within a few feet before she left the nest with the silent twisting flight that always makes me think of a

woodcock flushed in the open. The eggs were four—the usual normal clutch. The depression that did duty for a nest was lined with a few dried leaves of the Arctic willow and twigs of the same, and some of the birds' own feathers.

We then walked over high tundra ground and saw a good many birds. Whimbrel and Snipe were in plenty, but I noticed that the Dunlin and Golden Plover were mainly in flocks. This may be the result of the recent cold weather, but it may herald the approach of more wintry conditions. An Arctic Skua of the melanistic form, to which the term 'Richardson's Skua', originally applied, was looking for eggs ahead of us, but apparently without success. I watched a mixed flock of Golden Plover and Dunlin flying from a Merlin, but could not see which fell a victim as they joined too far ahead of us.



Came in for dinner, also *en famille*. Despite a feverish feeling which impelled me to take 30 gr. quinine, I ate some mutton and the usual skyr ; were present Tryggvi and his wife, four sons, a daughter and a visitor, besides C., Páll and I. Between us we ate nearly a whole sheep. There were actually potatoes and lashings of dried fish (char), dried cod and a mutton ham which was excellent though imperfectly cured. I gave them all Turkish cigarettes which excited them very much, and had quite a conversation with them through Páll. Tryggvi, though very rough, is a stout fellow. He is thoroughly cheery and looks as hard as nails. Left him deep in the Heðinskrugla Saga at about 9 p.m. and after going out to have a look at the weather, turned in. It has gone very cold, and a big woolly cloud that has come up in the distance looks very like an impending snowstorm. If we're going to have bum weather tomorrow in addition to my other troubles I shall most probably do a graceful collapse on the way.

4 *June*.—We had the world's worst night ! The family made a hell of a row singing and dancing until well after midnight. The farm cat, a large and dirty specimen put the tin hat on everything by jumping through the broken window and landing on my chest. My very natural outburst and the protests of the startled cat woke C. who promptly started a slanging match. I felt about ready for this, so in Shakespeare's words we 'cursed away a summer's night.' I had been asleep about an hour and a half when Tryggvi came clattering downstairs and Páll beat on our door with a loud bellow of 'Hel vatu.' I turned out feeling like a warmed-up corpse and found that I was shivering all over and decidedly groggy. We got hot coffee and porridge—Allah be praised!—about 3.50, and at 4.40 our little expedition rode out. I was mounted on my beloved Dina, and C. on Brunka who also came from Skútustaðir. Páll had the other pony and Tryggvi rode his own, leading the pack pony as well. Two spare ponies accompanied us, being driven in front. The pack pony had a lucky day, as she was carrying less than 60 lbs. load, instead of the 120 she is generally considered capable of dealing with.

It was an exceedingly cold morning, with every indication of snow to come. We rode at first along a fairly clear track over rolling tundra, so smoothly that we made a good eight miles an hour, and after about an hour and a half found that the comparatively flat ground ended abruptly at the shore of Lake Svartavatn, close to which stood what must in this district be the last outpost of humanity. On this water we saw a good herd of 45 or more Whooper Swans, presumably on passage as they showed no signs of pairing but swam and fed together, trumpeting occasionally. On a previous pool close to Víðarkeri, we had seen few birds, all ducks, and I think none but Scaup, Mallard and Longtails. After passing Svartavatn we had to dismount and walk our ponies over the tundra as there was no track but merely appalling humps of ground about a yard apart over which riding was impossible, and after a little while entered an enormous lava field of many miles extent, which was dangerous going and had to be taken dead slow. On emerging from this, which took an hour or more, though we only rode through a segment of it, we dismounted, having crossed a river, to water the ponies and rest them. Dina was foundering being the eldest out, though I think she puts it on a good deal knowing that I am gentle with her. After 10 minutes ' stand easy ' we pushed off again and for some time our way took us across a barren plain of black sand which with its flanking sides of stones, lava and dusty ashes made a picture of appalling desolation, more depressing than anything I have ever seen. I was still feeling pretty done, and the doses of quinine which I took every half hour had rendered me perfectly deaf.

After leaving the black sand country we crossed another of the hideous lava fields and saw far in front of us a plain of green grass like the estuary of a tidal river. Crossing ridges of sand and stones we rode into the approach to the gorge of the Krossár, a wide expanse of stunted grass intersected by soft ditches flanked by the swelling stony hills that further on roughened into grim precipices. Since entering the desert region we had set eyes on no living thing at all excepting a solitary ringed plover, which is said to be the only bird that breeds in the desert. In the hurry of starting and in my present state of health I had been too preoccupied to think of equipment, so that I now found that I had been idiotic enough to forget my field glasses. I soon came to regret it, for from a stony ridge on our left flank a grey goose rose and flew down our back track. I could have sworn that it was a Pink-footed Goose—the very apex of our hopes. I borrowed C.'s glasses and got down to investigate, and felt that it was unquestionably a Pinkfoot, a bird with which by reason of long waits on the Dee marshes I am only too well acquainted. A little doubt now arose as to whether there could possibly be Whitefronts and Pinkfeet together. We had now no doubt that there must be Pinkfeet here, and thought it probable that the natives had been mistaken all along. A little later the halt was called again and C. and I changed ponies each mounting one of the spare ones. I got a snorter whom there was no holding, and involuntarily led the field for the next half-hour, which was all that was required to get us to the entrance to the gorge. We saw several geese, all evidently Pinkfeet, on the way. On entering the gorge and riding as far as rocky debris would permit, we dismounted and paused to look for awhile at the snaky necks that craned down at us from the tops of the steep bluffs. Congreve then mounted the cliff on our left and I walked back until I stood beneath a tall buttress on which a goose, obviously on the nest, was sitting. A little later I heard C.'s whistle indicating that he had flushed the bird. It came over me beautifully and I got it nicely. Long

before I even fired I knew it to be a Pinkfoot. She had been sitting on only one egg. Nearby the nest was evidence that ravens had devoured other eggs. I mounted the cliff and we found that several other nests had been similarly plundered within a very short distance. Ravens have evidently made a hunting ground of this. We soon found another nest, the female sitting tight with the gander beside her. I crawled within five yards of them and tried to take a photograph, but failed owing to the shutter of my camera jamming. The female lay right on her side and tried to hide, but when my presence became known to them they rose together and made off. There were five eggs and plenty of down, of which I took photographs. We moved on to where Páll and Tryggvi were waiting, and then C. went back to take the five eggs and try to get a photo of the birds. I found another nest of four, and this C. also took when he returned, having got a photograph of the geese at rather too great a distance. We sat down to have lunch after we had spent a little time in observing the many geese which were flying round, and decided that they were all undoubtedly Pink-footed.

So far we had seen no birds in the gorge but geese, but now as we sat eating the Barrow's Goldeneye eggs we had brought with us from Vioerkeri we saw, a little further up the gorge and on the same level as ourselves, the finest falcon I have ever seen. It was a very old Icelander and at 100 yards distance looked to be quite white. Though of quite different shape it was distinctly larger than a Buzzard, and of very sturdy build. Intending to procure it I made a stalk and soon got within 30 yards. The falcon had a very small bird—a pipit—held in one great yellow foot, and was lowering its blunt head to pluck the atom when it caught sight of me. I coveted it, but hated to think of shooting it, though not usually so soft-hearted, as I thought there might be young to feed. Spreading its very pale grey wings, it sailed round a bend of the gorge, both long thick legs drooping, and the tiny pipit still clenched in one foot. This was the whitest Iceland falcon I have yet seen. After lunch we began to work down towards the river, as Tryggvi saw a goose on the opposite side which he said was White-fronted. I am perfectly sure, however, that it was a Pinkfoot. On



our way down, we found evidence that foxes had destroyed many nests, and also saw a number of eggs that had been destroyed by ravens. Geese rose from crannies and ledges in bad places, and we could see others sitting on their nests, across the stream. All were undoubtedly Pinkfeet. Congreve, Tryggvi and Páll waded the stream, but seeing that they went above their thighboots I did not follow, knowing that I could not afford a wetting in my present condition, especially as the day was so cold and I had no dry things to change into. I worked back along the bottom of the bluff, finding another nest or two and the evidence of many more destroyed. C. and the others found the birds nesting freely on their side of the stream. There the foxes had done less damage, though C. found a decapitated goose. He took two clutches of six and one of seven. Tryggvi took a clutch of five that I had previously seen. On my way back I noticed another Iceland falcon, a greyer bird, fly into a cave where I have no

doubt there was an eyrie. I also watched a brute of a raven egg hunting, and the geese appeared to be afraid of him. The ponies had strayed about a mile, and C. having rejoined me, we ate an egg each while Páll and Tryggvi went in pursuit.

On our journey back, we took a different route up the side of a very steep stony hill. This was such a tough climb that I led my pony, as did the Icelanders. At the top of the climb was a flat plain, and amidst boggy tundra ground we saw a fairly large tarn and on it a pair of Whooper Swans. Páll soon found a nest of four eggs, and C. arranged to have them taken when they had laid up their full clutch. Tryggvi agreed to ride out from Viðerkeri and get the eggs for 12 krónur! The going was bad round the shores of the tarn, as the ponies tested every step for the fear of getting bogged. Frozen snow was falling, driven by a polar wind. We reached the repulsive lava fields eventually, the most hideous formation I have ever met with, and in our fatigued condition it seemed to us that they were interminable. By the time we had got through and led our ponies over the bad ground before coming to Svartavatn Lake, I was nearly asleep in the saddle. I woke up when we got on to the good track over flat tundra, and we hustled our ponies into a gallop that I think soon sweated the fever out of me despite the drive of falling snow. We did the last stage of the journey all out, and arrived at Viðerkeri dead beat. We changed our wet clothes before lowering some scalding coffee and some salt mutton. Begging a couple of cans of warm water we staggered to bed, cold and stiff with our hands bruised and cut by the lava rock and with every muscle aching. I felt very weak, but conscious of the fact that I no longer had any fever about me. To know that we had settled an ornithological fact long doubted and disputed was well worth the aching bones we had earned. Personally I felt as though I had been kicked in the pants by an outsize in horses. It had been said that a raid on any of the reputed colonies of geese in Iceland was possible only to a native. That compensates me for my hard day, and C. is consoled by the authenticated clutches he has got for his collection. . . .

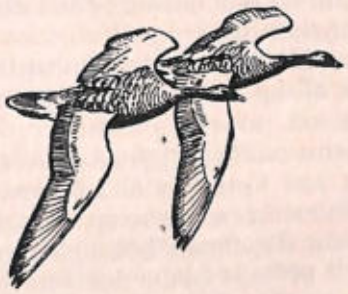
5 *June*.—Woke feeling all old and feeble. C. has my cold, for which I am sorry. We are exceedingly stiff but frightfully elated. Even the thought of the 25 miles we have to do today doesn't seem to matter.

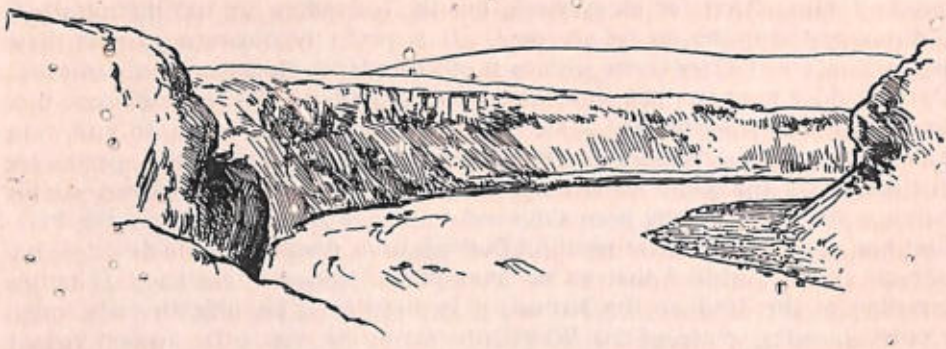
To my disappointment I found that the goose was irreparably knocked about by the tramping it had received on the journey. I skinned the neck and head, which are sufficiently distinctive for proof, and gave the carcass to Tryggvi, who will eat it. C. was blowing eggs all the forenoon, whilst I was doing the goose helped by Tryggvi's little boys who are simply splendid kids. Arranged to start back at 2 p.m. Paid Tryggvi 70 krónur for board and services and dashed him 10 extra. Gave Sverrir, the youngest boy who seems to have attached himself to me, my small knife which seemed to have taken his fancy. Then we had to sign our names in Tryggvi's visitors' book and also in Sverrir's Birthday Book. We rode out about 2.10, after various and repeated farewells from the family. Our luck was out as regards weather, for all the slow way home we shivered through a bitter snow blizzard. On Sandvatn we saw a fine old Northern Diver at close quarters, a noble looking bird beautifully marked. We got to Skútustaðir after 4 hrs. 20 mins. riding, having made the ponies hurry over such small tracts of level ground as we covered. C.'s cold is very bad, but mine seems to be working out. This climate takes some beating for quick changes. One thing is quite clear, it is very doubtful indeed whether the White-fronted goose does breed in Iceland. They are said to have bred

on the Jökulsá River for many years, but the Icelanders are too inaccurate as ornithologists for this to be accepted. It is perfectly obvious (*a*) that these people confuse *all* Grey Geese with each other under the local name of *Gragaes* ; (*b*) they do not know that *Anser brachyrynchus* (Pinkfoot) is a different bird from *Anser anser* (Greylag) ; (*c*) it seems certain that those who do know the Latin names of the geese and who do know that the above two species are distinct, apply the name *Anser albifrons* (Whitefront) to the Pinkfoot simply because *albifrons* has long been supposed to nest in Iceland, whereas the Pinkfoot has not ! Evidence is plentiful that *albifrons* does breed on Jökulsá, but it must be remembered that as we have just exploded one fallacy as to the breeding of this bird on the Krossá, it is more than possible that the other reputed breeding place of the Whitefront may turn out to be no less than a wrongly identified colony of Pinkfeet. Pending a trip to the Jökulsá, which is too far for us to arrange so late in the season, I shall try to collect evidence on the subject.

Certainly the circumstances should be investigated as our report of the Pinkfeet at Krossárgil will certainly discredit the statements of Icelandic ornithologists that the birds breeding at Grafarlönd are really Whitefronts. C. and I are inclined to the belief that the Whitefront does not, and never has bred in Iceland at all.[1]

[1]A conclusion which has now been shown to be almost certainly correct.





A VISIT TO KROSSÁRGIL, NORTH-CENTRAL ICELAND, 1954

WITH SPECIAL REFERENCE TO THE PINK-FOOTED GOOSE

By G. K. Yeates

In June 1954, in company with Lt-Col Niall Rankin, I visited North Iceland in order to see and photograph the Pink-footed Goose (*Anser brachyrynchus*). So much has recently been published on this species that further papers on it may appear to require some excuse. Our real reason for concentrating on the Pinkfoot was, of course, that we both wanted to do so, even if the whole world had done so before us ! It was certainly a bird which had never been really adequately photographed at the nest. There were, however, other equally serious considerations. No ornithologist seems to have studied the Pinkfoot for very long in the incubation period ; and the colonies in North-Central Iceland have been rarely visited.

Our route was by jeep from Akureyri to Goðafoss, and down the Barðardalur, along the eastern bank of the Skjálfandafljót, to the farm of Viðikir, where live Kári and Egil Trygvasson, sons of the farmer (Tryggvi Guðmundsson) who took Congreve and Freme on their original discovery of the Pinkfoot in Iceland (Freme, pp. 139–145 ; and Congreve and Freme, 1930). They were also the guides of Finnur Guðmundsson (personal communication), in his expedition to the headwaters of the Skjálfandafljót, and there can be no doubt that no living Icelanders, except perhaps Ólafur Jonsson (1946), better know the remote Ódáðahraun and the distant country to the northern slopes of Vatnajökull. We arrived at Viðikir on 10 June, and from here we rode over to Hrafnabjörg on the 12th ; and on the 13th we were guided on ponies into Krossárgil by Egil Trygvasson. Here we were in camp, until Egil and another brother, Kjártan, came to take us out on 23 June.

The Icelandic goose-story has been a tale so muddled in the telling that only recently has it been clarified by Scott, Fisher and Guðmundsson (1953). The expeditions of the Wildfowl Trust in 1951 and 1953 to the oasis of the Þjórsárver beneath Hofsjökull have shown clearly the pattern of the distribution of the Pinkfoot in Iceland. The Þjórsárver oasis, with over 2000 nests, is the nucleus, the heart and centre, not only of Iceland, but of the Pinkfoot in Iceland. The

breeding-stations to the south, down the Þjórsá, on the Kisa, Dalsá, at Gljúfurleit, and possibly on the Tungnaá (Scott *et al.*, *loc. cit.*) are overflows or outliers. The colonies to the north, based on the three rivers, Skjálfandafljót, Jökulsá á Fjöllum and Jökulsá á Brú, are perhaps best regarded in the same way, though the evidence suggests that, possibly, 50 years ago there existed at Grafarlönd a Pinkfoot colony of some considerable size. If so, the Odáðahraun colonies would be better regarded as relics of Grafarlönd before it was raided out of existence.

Although the large size of the Þjórsárver colony has rightly made its discovery so exciting, the classic ground of the Pinkfoot in Iceland is the Skjálfandafljót gorges and the Ódáðahraun, for it was here that the initial discovery was made —by Congreve and Freme (*loc. cit.*) in Krossárgil in 1929. This was followed by some activity—Magnús Björnsson (1932–34) in 1931, 1932, and 1933, and Haig-Thomas and Bird (1934) in 1933, and Haig-Thomas again in 1936 (1937). Since then only Finnur Guðmundsson in 1945, has visited the more inaccessible colonies, though the Ridley brothers (personal communication) reached Hrafnabjörg in 1952.

Finnur Guðmundsson, reviewing all the evidence and as a result of his own deep penetration of the Skjálfandafljót, has said that there are probably 200 pairs based on the river. Of the position on the two Jökulsás and in the oasis of Herðubreiðarlindir and Hvannalinder we have no evidence since the early thirties (Björnsson (*loc. cit.*) : Roberts (1934)), except that P. Beckett (quoted by Scott *et al. loc. cit.*), found Pinkfeet nesting in the last locality in 1948. Both the Kraká and the Svartá, stated by Björnsson to be nesting localities, should be discounted. Finnur Guðmundsson found there no geese at all. I questioned the Trygvassons closely on this point, and it was clear that there has been confusion with Greylags (*Anser anser*). Kári Trygvasson thought that both species overlapped here and occasionally shared the same islets in the river. All evidence we have goes to show, however, that the two species are more or less mutually exclusive. We never saw a Greylag further south than a mile and half above Hrafnabjörg, where the Pinkfeet took over, although the Greylag is an abundant species on the northern stretch of the Skjálfandafljót. The only exception seems to be an extraordinary case of inter-breeding, discovered by the Ridley brothers near Goðafoss, between a female Greylag and a gander Pinkfoot. The eggs, however, were infertile.

As long ago as 1936 Haig-Thomas (*loc. cit.*) was mystified by the way the geese were leaving Central Iceland. The truth is that all these colonies are merely overflows and outliers and are therefore unstable. Finnur Guðmundsson (1952) has made it clear that, in the last 30 years at least, no blame is to be attached to raids by local farmers. I can confirm this from conversations this year with the Trygvassons. They say that up to the mid-twenties raids were made (on Krossárgil quite apart from the much-raided Grafarlönd), but that none had been made since. They said, in fact, that we were the only people to venture to Krossárgil before mid-July or August, when the geese have of course got their broods off, since Guðmundsson in 1945, and before that, Haig-Thomas in 1936. Any fluctuations at Krossárgil can therefore hardly be laid at the door of human interference.

Yet fluctuations in these colonies are evidently very marked from year to year, and not easily accounted for except on the grounds of instability arising from their outlying character. Thus this year we found six nests (and suspected another two) at Hrafnabjörg, where the Ridley brothers in 1952 could only

find one. On reporting this to the Trygvassons they said that in that case there should be at least 20 pairs at Krossárgil. In the issue, there were four pairs. In short, while Hrafnabjörg was having a record season, Krossárgil, only 17 kilometres away, was at its lowest ebb. No comparable figures exist for Hrafnabjörg ; those that there are for Krossárgil give the following : 20 nests in 1929 ; 30 in 1933 ; 3 in 1936 ; about 15 in 1945 ; and 4 in 1954.

Krossárgil is a barren gorge of naked rock. It is the largest gorge in the Ódáðahraun, cutting some five kilometres into the surrounding hills. It is utterly chaotic—a natural shambles of rock and lava, fantastic and unreal, rather frightening even in the perpetual sunshine of the first week of our stay ; quite terrifying in swirling mist and rain—a godless place. Here, where the very skeleton of earth is exposed, and where there is little or no green growth, old goose nest-mounds were conspicuous—just because they were green (or yellow) as a result of past use by the geese, which had probably in their droppings sown the original seeds and afterwards manured them. Indeed, they stood out like green oases in the dead chaos of the lifeless rock—welcome, even if unoccupied, because in that fearsome gorge it felt good to be anywhere where life had once pulsated. Of these old goose-mounds there were at least 20 on or near the top of the cliffs (and certainly more on the north side of the gorge which we never had cause to investigate in detail). There were many more possible old nest-sites on ledges in the middle of the cliffs. Here it was less easy to be certain, as vegetation seemed able to get here a better natural hold. (Indeed, the cliffs even supported a few flowers, especially *Dryas octopetala*, *Saxifraga stellaris* and *S. cernua*, and the fine *Arabis alpina*.) In addition, there were the islets in the river (which incidentally in June in their grey-green leaf gave promise of a flash of incredible beauty within a few weeks in the form of that lovely willow-herb *Chamaenerion latifolium*). Here the richer vegetation concealed all evidence of erstwhile goose-occupation, but on these islets, *fide* the Trygvassons, five or six pairs of geese have often bred. Thirty pairs in any one season appear to be a maximum for the gorge, although it has many more nest-mounds and possible sites, without taking into account the short gorge of Sandmúladalur close by to the north, which, again *fide* the Trygvassons, holds up to three pairs in some seasons. It seems likely therefore that there is non-breeding in every year. So far as 1954 was concerned, the cause was certainly not bad weather, for Iceland had the mildest winter and earliest spring in the memory of many. All the evidence suggested some form of non-breeding.

Where the Krossá leaves its yawning canyon and joins the Skjálfandafljót, it emerges through a less inhospitable terrain, made grey-green by *Salix glauca*. Here the big river has carved for itself a flat valley, through which it runs in many channels creating islets of grass and pebbles (the ' black sand ' of Central Iceland), and in general a strath of green vegetation. This is the feeding ground of the Krossá geese. On it was always a gaggle of about 25 Pinkfeet. From this gaggle skeins, usually of 5–7, once of 16, regularly visited the gorge, especially in the early morning between 05.00 and 08.00 hours G.M.T. These birds appeared to be merely visiting, as they would fly up the gorge with much goose-talk, circle round the few nesting pairs, cause a general hullabaloo, and return to the strath.

Once I saw a party of 16 pitch on the talus (masses of rock debris) where, if I may be anthropomorphic, they looked extremely foolish, chattering amongst themselves and doing precisely nothing. After 20 minutes of this time-wasting, they proceeded up the gorge. Much more significant than this, I twice saw two

birds (pairs, surely?) fly up the valley and go to definite, but unoccupied nest-mounds. One pair I watched do this from my tent at 05.00 hours. The gander stood erect on guard: the goose did such a realistic shuffle into the ground that I immediately threw off my pyjamas and waded in my birthday suit across the river to investigate. There was nothing.

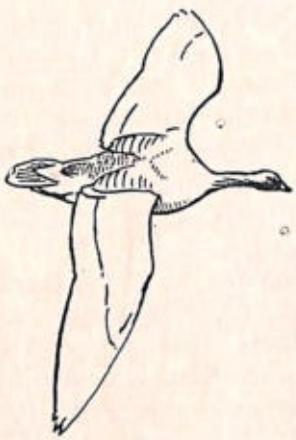
What were these birds—the visiting skeins, the odd pairs that occupied a nest-mound, a territory, as it were? Carrick and Dunnett (1954) have recently requested greater accuracy in describing birds which are not nesting, and have suggested a series of terms to define such birds. Using their vocabulary, some of these birds would doubtless be 'pre-breeders' i.e., immatures. Some might well be 'prevented breeders,' though certainly in 1954 not because of inclement weather. I think we should have found evidence of 'failed breeders,' for Pinkfoot down and scrapes, though exiguous and small, will provide evidence of occupation for a month or two after desertion. (I found the nest of one definite 1954 'failed-breeder' at Hrafnabjörg.) The fact that *pairs* actually visited old nest-mounds and false-brooded (to be quite accurate, sat down there) suggests genuine 'non-breeding,' for surely in the incredibly mild spring of 1954 so large a number of birds as existed in the strath could not *all be* either 'prevented breeders' or 'pre-breeders.'

True 'non-breeding,' as defined by Carrick and Dunnett (*loc. cit.*), is rare in birds, but it seems that the Pinkfoot may be a sensitive bird in this respect. For instance, the Bird brothers (1946) reported very few Pinkfeet nesting on Hochstetter Foreland in North-East Greenland in 1938, a 'complete non-breeding year' although 'summer came early: it was very fine; ice conditions were particularly good.' In Krossárgil in 1954 the same held good—and; furthermore, the nest-sites were there, ready and waiting. Apparently so too were the birds. Why did they not respond? None of the causes suggested by the Birds (*loc. cit.*) or Marshall (1952) seem to give a clue to the answer.

The nest-sites at both Hrafnabjörg and Krossárgil were of the cliff type. Hrafnabjörg is a most desolate lava-gorge, through which the Skjálfandafljót rips its tearing way. The western side is a fearsome and ugly slag-heap of loose scree some 200–250 feet high, in which are several precarious-looking buttresses. The tops of these provided four pairs of geese with nests—and right safe from man or fox they seemed to be. On the eastern (our) bank the cliffs are lower (75–100 feet), greener, and in most parts quite easily negotiable. Here we found two occupied nests, one 'destroyed' nest of this year, and several nest-mounds, some with nest-scrapes. One nest was in a site that would have admirably suited an eagle—a hollow on a ledge with a protective slab of rock overhead. The other was in the typical Pinkfoot (gorge-nesting) site—on the top of the cliff on a narrow promontory of rock. This is so essentially the normal site in this type of breeding-ground (cf. also Congreve's photographs (1953) of Barnacle Goose (*Branta leucopsis*)) that it is almost certainly chosen in order that, with three sides inaccessible to foxes, the isthmus may be held. Pinkfeet ganders in these gorge-sites, where there is restricted perching or standing space, stay *very* close to the incubating goose, usually indeed cheek by jowl with her.

At Krossárgil, one nest was of this last type; two were on ledges in the cliff-face; and the fourth was on top of a mushroom of lava which grew out of a buttress. It formed a large plate some six feet in diameter, and had an ugly fall on all sides of its overhang. A more impregnable nest it would be difficult to imagine.

Pinkfeet apparently differ very much in temperament, as all who have had any dealings with them at the nest agree. Kári Trygvasson tells me that he has actually stroked a goose whose eggs were chipping. The majority are very tight sitters, both goose and gander stretching out low on the ground when human intrusion gets too close—about 150 yards. At Hrafnabjörg the goose did not leave the 'eagle' nest till my face appeared round a rock four feet away, although her gander had panicked at the sound of our voices above. The bird on the cliff top let us get within 30 feet before flying. At Krossárgil the 'mushroom' goose, secure in her castle, never flushed, although we passed her daily at 20 yards. The gander here, however, normally left as we drew



level. The two pairs on the cliff face merely crouched, and one gander always amused us by trying to emulate the ostrich by burying his head in the nest-mound! The pair we photographed unfortunately belonged to the less tame type. The gander had no nerve at all; his goose very little more. Both flushed at 70–100 yards.

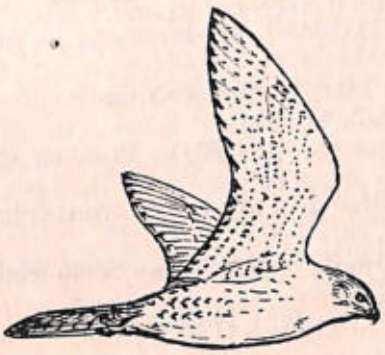
Once off the nest, the geese displayed considerable anxiety, circling round, calling in alarm—a curious, high-pitched, di-syllabic *ee-wink ee-wink*. It was much thinner and more squeaky than anything I have ever heard in winter. At this point it may be remarked that it was a strange experience to stand on top of a cliff and look *down* on a pair of geese, circling over the river 150 feet below as though they were Herring Gulls!

The *Handbook* (Witherby *et al.*, 1939) laying dates for this species needs serious revision. 'The middle of June' may suit Greenland and Spitsbergen: it is a month too late for Iceland. The farmer at Stóratunga, who owns Hrafnabjörg, told us that he found a nest this year on 15 May. At Krossárgil the 'mushroom' nest had at least two chicks dry and on the move on 21 June. On the 22nd we noted that one of the cliff-nests had hatched and was vacated. Mid-May is evidently the average time of Icelandic laying. Scott, Fisher and Guðmundsson (1953) estimated in 1951 that first eggs were laid in the Þjórsárver on 12 May, most clutches completed by 25 May and that the majority of goslings hatched on 22 June—findings with which our observations closely agreed.

Our 10 days at Krossárgil were concentrated on the geese—all four pairs of them! Apart from these four pairs and the daily visiting circus of non-breeders, once one penetrated the gorge and the desolate hills, life rather gave up the unequal struggle. The geese apart, this wilderness gave sanctuary only to a pair of Gyr Falcons (*Falco rusticolus*), with a nest amongst the geese (this

was, thanks to rotting carcases, the greenest spot in all Krossárgil); one (perhaps two) pairs of Goosanders (*Mergus merganser*); at least one pair of Purple Sandpipers (*Calidris maritima*)—these on the desert above; two pairs of Wheatears (*Oenanthe oenanthe*); and above all a string of some 15–20 pairs of Snow Buntings (*Plectrophenax nivalis*). These went on as long as there was water to provide flies for food. Krossárgil is long, and its whole length had never been examined (Guðmundsson). In investigating its upper reaches, Snow Buntings alone convinced us we were not on the moon.

Consequently we got to know the movements of our few pairs of geese with considerable intimacy. I sleep badly in a tent, and those difficult early hours between 02.00 and 06.00 hours were often enlivened for me by *pairs* of geese visiting the strath for their daily bread. Perhaps it was as well we did not strike a year of many breeding pairs, for I cannot resist the call of a goose, and I slept badly enough as it was. But, when one considers the pains Pinkfeet take to make their nest impregnable, it is odd to find that they have evolved a system of feeding which draws *both* birds away from the nest at the same time.



Iceland Falcon

It was, however, not only the nesting geese of Krossárgil and the 25-odd non-breeders in the valley below which occupied our attention. On 16 June, at 20.00 hours, in three winter-skeins, 60 geese flew very high north up the river valley. On 18 June at 07.00 hours a skein of 20 did likewise. Taylor (1953) found this in 1952 in the 'Asterdalur, north-west of Hofsjökull, and suggested a moult-migration of non- or unsuccessful breeders. Clearly it is a feature of late June. Taylor thought it probably greater than usual in 1952 because of the bad spring; but it is quite clear that not only bad weather influences non-breeding in the Arctic, or this possible moult-migration of geese.

Whether or not this long-distance migration is the moult-answer for non-breeders, it is clear that much moulting takes place in the mountain oases and on the islets in the small upland streams. Here there were many goose-droppings. The winter of 1953–54 had been very mild, with very little snow. In our exploration of the upper Krossá and its tributaries it was clear that the melt of 1954 had been so slight that the stream had never risen in spate high enough to sweep the islets clear of even the leaves of last year's fall of *Salix glauca*. There also remained innumerable goose-droppings, far more than at least the 1954 local population could produce. Is it not hither that breeders and non-breeders come to moult? Perhaps the sorties made daily by skeins up the gorge were preliminary reconnaissances of good and safe moulting-places? It seems that these remote spots are certainly thus used. If for some, why for

others this Greenland migration? But the day the romantic Pinkfoot fails to set insoluble questions will be a very sad one.

Postscript.—Peter Scott, who has very kindly criticised this paper, writes: "About non-breeding—I think you underestimate the pre-breeding section of the population. I also think mixed-age pairs are common and may account for the strange behaviour of your pairs, i.e. one sex only of breeding age. No geese breed at one year old (so far as we know), and few at two years old. This leaves a fairly large body of 'pre-breeders,' which may be larger if some are paired to adults."

This suggestion goes far to explain the behaviour above described.

Mr Scott has also suggested that the droppings found on the islets in the streams on the plateau may well come from geese on passage migration in spring, when large flocks use the Þórsá–Skjálfandafljót route to Greenland.

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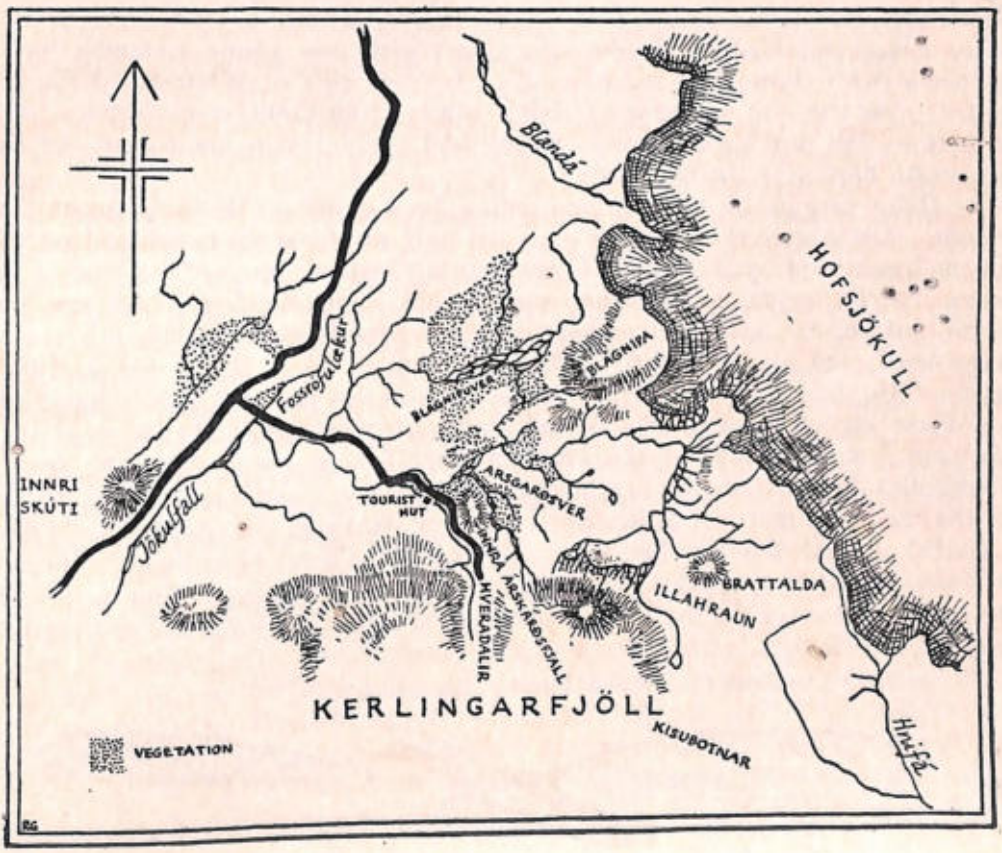
OBSERVATIONS ON GATHERING AND DEPARTURE OF PINK-FOOTED GEESE AT ÁSGARÐ IN CENTRAL ICELAND

By N. G. Blurton Jones and Robert Gillmor

SUMMARY

We spent six weeks in western central Iceland during the late summer of 1954—from 20 August to 14 September—at Ásgarð on the northern edge of the Kerlingarfjöll mountains. Nearly every day the Pinkfeet in the neighbouring oasis were counted. The counts showed that Ásgarð was a gathering place for about 350 Pinkfeet, which joined together into flocks. The gathering movements are probably social rather than migratory. Breeders and their goslings seemed to arrive from outlying areas such as the colony at Kisubotnar, and after flocking left in the direction of the Þjórsárver and Þjórsá. The gathering probably retraces a dispersal in spring as the snow melts, first on lower ground, later on higher ground.

On 2 and 3 September the Ásgarð area was covered in snow. The geese left, apparently for the snow-free Þjórsá valley. Passage birds thought to be from Greenland then gathered but on 12 September snow started again. On the 13th the Ásgarð flocks left in the blizzard and geese passed through all day. The



first arrivals in Britain were on the 13th and 14th. Information on other years is summarised and compared with 1954. Departure seems to be solely a result of snow in the interior. At first the geese fly away downwind. The direction of migration is influenced by terrain and then by south-east drift in the almost invariable conditions following any depression over Iceland which causes snow high up in the interior in September. It is thought that the geese reach the north coast of Scotland mainly as a result of these conditions. The coincidental but inevitable nature of this weather migration of Pinkfeet is contrasted with that of passerine and other birds leaving Iceland.

Brood counts were made between 20 August and 1 September. There was no indication of gosling losses during this period. The mean brood-size was 3·1, substantially smaller than the mean of broods seen in Þjórsárver in July (in 1951 and 1953).

Two British-ringed and at least ten Þjórsárver-ringed Pinkfeet were seen.

INTRODUCTION

From 5 August to 15 September, 1954, we stayed in the interior of Iceland, first at Hvítárvatn and then from 20 August to 14 September at Ásgarð between Hofsjökull and the Kerlingarfjöll. Our objects were to investigate the nature of flocking and the extent of mixing of the Pinkfoot population and, if possible, to observe the autumn migration. By studying the gathering and pre-migratory behaviour we hoped to learn something of the long-term and proximate stimuli of the autumn migration and their relative importance. In the event there proved to be no specifically pre-migratory behaviour, but by good luck we were able to watch the actual departure.

Hvítárvatn

After a weekend birding on the west coast with two young Icelandic bird-watchers (who showed us the nest of an isolated pair of White-tailed Eagles nesting near the sea) we went to Hvítárvatn.[1] From Gullfoss we hired a jeep to take us and our huge amount of food and equipment to the tourist hut by the marsh bordering the lake.

At Hvítárvatn (5–12 August) we found a flock of about 300 Greylags on the marsh. These were there all the time, fed only on the green marsh and rested on the black sand by the lake. There were no families, most of them being in pairs, the rest single, so probably one-year-old immature birds. We saw up to 30 Pinkfeet on the tundra around and above the level of the marsh. These were never seen on the marsh. When we returned on 14 September, and left on the 15th, the Hvítárvatn basin was free of snow and full of Pinkfeet (400 plus) and these were all over the marsh and tundra between the Fúlakvisl and Hvítá. Between 5 and 12 August the Pinkfeet were flushed by us from the rivers Jökulfall and Svartá to the east and spent four days on the tundra just north of the hut, apparently roosting on the gravel banks in the Fúlakvisl. They included several families but no ringed birds. There were many moulted feathers, including primaries, here and the usual old droppings. But we found no nests. However the most likely places were across the Fúlakvisl and we did not find a crossing.

[1]Pronounced Kwectavat (n), the final n being almost silent.



Ásgarð

From Hvítárvatn we walked to the Ásgarð hut at Kerlingarfjöll. For this journey we had two packs each. We would carry one each for a short way and then return for the other two, so doing each stretch three times. As a result the 20 miles became 60 and took us two days. We had planned to go from here across to the Þjórsá and follow the Pinkfoot flocks down river. However, half-way across we had to camp on a very unsatisfactory surface where the tent pegs would not hold properly, and having taken some of our provisions ahead we returned soaking wet after a day of torrential rain, driven by a strong north wind, to find our tent blown down and wet through in spite of stones on the pegs and bottom of the tent, and our sleeping bags sodden. We promptly returned to the hut in the dark (a journey neither of us would like to repeat). We recovered our food, etc., during the next few days and stayed in comfort in the Ásgarð hut until 14 September. In spite of this setback we had some extremely interesting goose watching, probably more than if we had been on the move all the time, though there were only comparatively small numbers of geese. Snow fell on the evening of 2 September. Next day the ground was covered in a few inches of snow, the geese had gone and we were very worried. We had sent a letter back on 30 August asking for a vehicle to fetch us on 14 September, but we had visions of the letter not being delivered and us being snow-bound. However the weather was fine the next day and the snow all melted by the evening.

We reckoned that all the Icelandic Pinkfeet had left the area during the snow and gone over to the Þjórsá where we could see from the hill above the hut that there had not been any snow.

Then on 12 September snow began again at about 5 p.m. and by dark it was 6 in. deep. Next day it was still falling and was at least 18 in. deep nearly everywhere.

Early next morning (14th) we left and walked to Hvítárvatn. We found that only the mountains were enclosed in cloud ; we got out of it about five miles from the hut and for the first time since the 12th could see more than 200 yards. The snow covered the whole interior except for the low ground just around Hvítárvatn. On the 15th at 7 a.m. when we were trying to massage ourselves into action for the long walk to Gullfoss a Land Rover drew up outside the hut and an Icelander walked in with his breakfast. He was on his way to fetch us and so we had an easy ride back to Geysir, caught the 12 o'clock bus and arrived in Reykjavík at 4 p.m. He was unaware of the conditions at Kerlingarfjöll and would never have reached us if we had stayed there. As we had to walk it meant leaving a good deal of stuff behind. South of Bláfell we saw a few Pinkfeet as far down as the Sandá. The weather showed no signs of giving up. The snow had a thin crust of ice on it and the Ptarmigan were digging themselves in.

AUTUMN FLOCKING AT ÁSGARÐ

With the exception of the Þjórsárver population the majority of Pinkfeet nest in colonies of less than 100 pairs, more often about 10 pairs. In Iceland these are usually in the river gorges like Krossárgil (see pp. 146–152). Kisubotnar is the only proved breeding-place near the area in which we worked. On arrival in Britain Pinkfeet are usually in large flocks. They evidently gather into flocks after nesting and before migration. The Þjórsádalur farmers saw huge flocks

in the upper Þjórsá valley in October 1951 (*Fifth Annual Report*), but these could have been the Þjórsárver breeders only ; they are known to move down from the Þjórsárver in August (Moore (1951), and Taylor and Davies (1952), unpublished reports).

We did not arrive in the Ásgarð area until 14 August, too late to see moulting or nesting Pinkfeet, and we found no disused nests (probably due to our ignorance rather than the complete absence of nests). Some evidence of scattered breeding is given by the following records of families seen in outlying districts. On 14 August we saw a family of five near the bend of the Jökulfall (near a gorge) and found the remains of a juvenile, killed before it was able to fly properly. On the 16th there was only one family on the Ásgarð meadows and a flock of 33 non-breeders (mostly pairs) on another marsh nearby. Taylor and Davies saw a flock of 25 at about the same place on 15 August 1952. On the 17th we saw a family of four flying round over the Fossrófulœkur oasis.

From 20th to 24th and 27th to 31st we crossed the Ásgarð meadows and a higher mossy valley to the east twice each day and every goose seen was recorded. The results are illustrated in Figure 1. It is apparent from these and it was obvious to the observers that Ásgarðsver was an important local gathering place.

Some geese were seen arriving in the area. The numbers in the mossy valley decreased as the geese gathered on the better vegetation of the Ásgarð tundra oasis. The arrivals are summarised in Table I. Notable arrivals are the

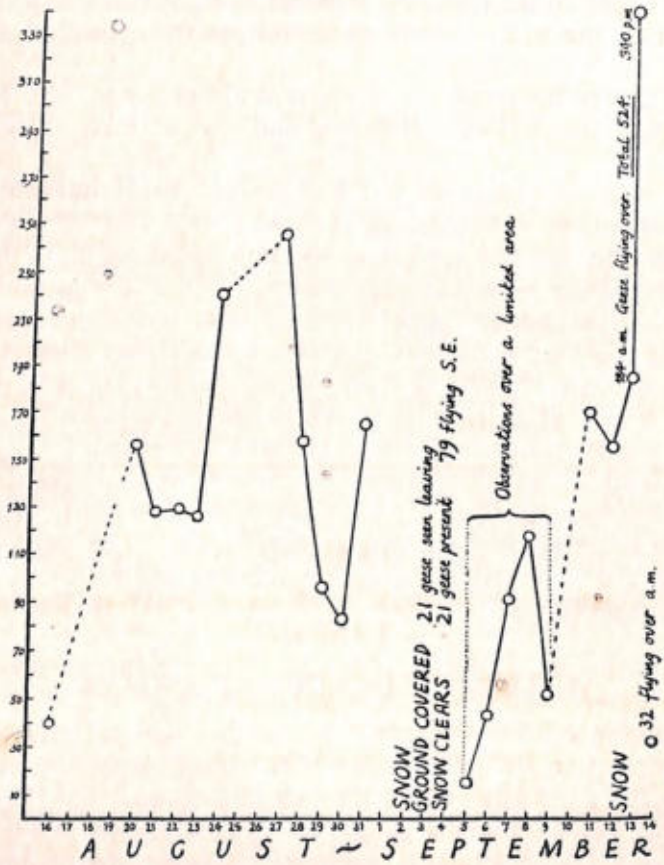


Fig. 1.—*Graph of numbers of Pinkfeet at Ásgarð in August and September*

families on 29th and 30th seen planing in from high over the Kerlingarfjöll, those seen at the camp by Illahraun flying from the direction of Kisubotnar towards Blágnyþuver, and the flock arriving from the south on 31st.

On 27 and 28 August there was a large exodus of about 170 geese. On 28th we saw 81 fly off to the east-south-east. They disappeared flying low over the hills in the direction of Þjórsárver. On 3 September in the first snow the whole flock flew off roughly south-east, i.e., towards the upper Þjórsá valley.

It looks as if this gathering ground is used largely by breeders in the river gorges on the south side of the Kerlingarfjöll. Why they should fly north to Ásgarð rather than south-east to the Þjórsá is not obvious unless the autumn gathering retraces the spring dispersal. This appears to follow the pattern of moving up the Þjorsá to the Þjórsárver as the snow melts, thence to smaller oases when they become clear (e.g. Ásgarðsver, slightly higher than Þjórsárver), and finally to the nesting places.

TABLE I

Arrivals of Pinkfeet at Ásgarð, 23–31 August, 1954

(f = family group, including parents and goslings)

Date	Time	Place	Number of Birds	Arrived from	Subsequent movements
23 August	18.30	Illahraun	f 5	S.S.E.	Flew on N.W.
			6	S.S.E.	Flew on N.W.
24 August	19.00	Illahraun	f 6	S.E.	Flew on N.W.
	19.30	N. of Illahraun	f 4	S.	Flew on W.
25 August	09.00	Illahraun	f 9	S.S.E.	Flew on N.W.
26 August	—	Ásgaðrsver	2 (pair)	?	Joined flock of 14 on ground
28 August	—	Ásgarðsver	f 5	?	Joined flock on ground
29 August	p.m.	Ásgarðsver	f 5	S.S.E.	Settled on tundra
			3	S.S.E.	Joined up, alighted together
			6	S.S.E.	
30 August	—	Ásgarðsver	23–25	N.	Settled on marsh, Jökulfall
31 August	a.m.	East of Innra-Ásgarðsfjall	57	S.	Settled on marsh, Jökulfall
31 August	a.m.	East of Innra-Ásgarðsfjall	16	S.E.	Settled on marsh, Jökulfall

TABLE II

Estimates of Numbers of probable Greenland Pinkfeet passing to west of Hofsjökull

At Ásgarðsver after first snowfall, alighted	170
At Ásgarðsver after first snowfall, passed over	79
? with Barnacles before first snow	12
Passing over Ásgarðsver during second snowfall	376
On Hvítá	160
At Hvítárvatn	300
Total	1,097

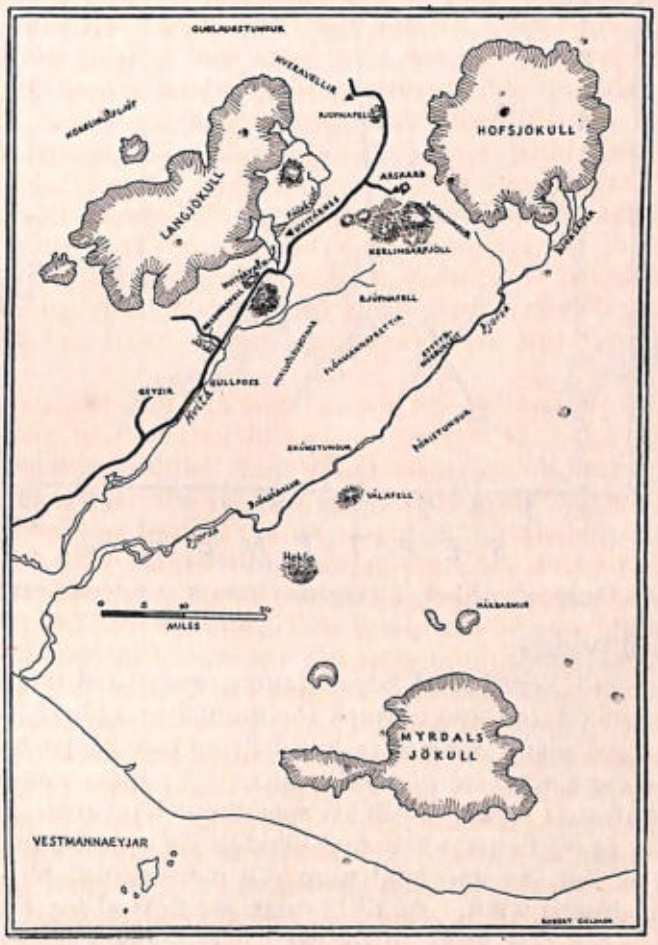


Flocking as well as gathering occurred at Ásgarð. Small flocks would join up with other flocks flying to or from the feeding and resting places or would fly up and around, apparently looking for other geese. Generally the smaller flock flew to the larger. The one large flock seen arriving did not land with other geese. Families with smallish goslings which arrived at the gathering grounds did not join up with flocks until after a few days. Single families often alighted with other birds. The single families on arrival were more susceptible to 'calling in' than other Pinkfeet. Geese seen flying about unnecessarily, unlike Yellow Wagtails (Smith, 1950) which made short flights in the direction of the migration and then return. They simply flew round and frequently landed with other geese or joined other geese which flew up, evidently because they saw geese flying over. These observations suggest that the gathering movements and flocking are purely social and are not related to migration.

On 4 September the weather was fine and clear and the snow melted. Twenty-one Pinkfeet appeared on Ásgarðsver and 14 Barnacles on the gravel of the Jökulfall river. From Innra-Ásgarðsfjall we saw that the snow had only covered the area east of the road from Hvítárvatn to Hveravellir as far east as Illahraun and north to the Blanda. But, unless Pinkfeet breed on Guðlaugstungur or the Norðlingafljót oases, the geese appearing at Ásgarð were from Greenland. This was made to look more likely by the simultaneous appearance of Barnacles. (The first Barnacle was with a party of 12 Pinkfeet on 2 September.) The numbers of Pinkfeet gradually increased. The size of the flocks increased too, although one small flock remained separate for at least two days. Another flock consisted of about 70 paired and single birds with no breeders. Possibly there is only local flocking in Greenland, families and flocks of non-breeders migrating to Iceland separately and joining up there. The number of Pinkfeet passing through the area is estimated in Table II. There is probably a fair degree of mixing of the Þjórsárver Pinkfeet with any that may breed west of the Þjórsárver and with those from Greenland before migration, but we could not tell if the Skjálfandafljót or Jökulsá-á-Fjöllum Pinkfeet gather on the Þjórsá.

There does not seem to be any special survival value in flocking at this particular time The most important point seems to be that Pinkfeet are social birds (this presumably has its own survival value) which in many places disperse in the breeding season to find nesting sites. They return to the flocks as soon as the causes of their separation have faded. Although geese with goslings can run well and in some places march long distances they cannot possibly cross block lava like Illahraun on foot. But it must be something else which tends to keep some families independent after the goslings can fly. Taylor and Davies, and Moore, on the Þjórsárver and ourselves at Ásgarð noticed independent flying families at the gathering grounds in August. Possible advantages of flocking before migration are that the flying involved in gathering and moving

about from feeding to resting place with the flock might be important in developing the heart and lungs and associated reflexes and the muscle capillaries (see Brownlee, 1954) of the goslings before migration. Migration in a flock may to some extent share out the strain of pacemaking. The pre-migratory flocks may also be important in keeping food sources stable. A large flock of geese feeding on tundra-bog would probably be important in producing a tight mat of vegetation. This would be more resistant to soil erosion by wind, rain and streams (all important in the interior), and would conserve water better. Food supplies at the nesting sites are probably rather limited. This may be a reason for autumn gathering.



DEPARTURE

Migratory birds can be divided into two categories (Drost, 1950). They are the ' extrovert migrants ' (weather migrants), and the ' introvert migrants.' In the latter the external conditions are only of secondary importance. Their migration seems to be motivated from within. It is probably connected with the breeding rhythm. It is difficult to see how external factors alone could account for a northwards migration but they could bring about a southward autumn migration. A more ' introvert ' migration could originate from migration stimulated by external factors.

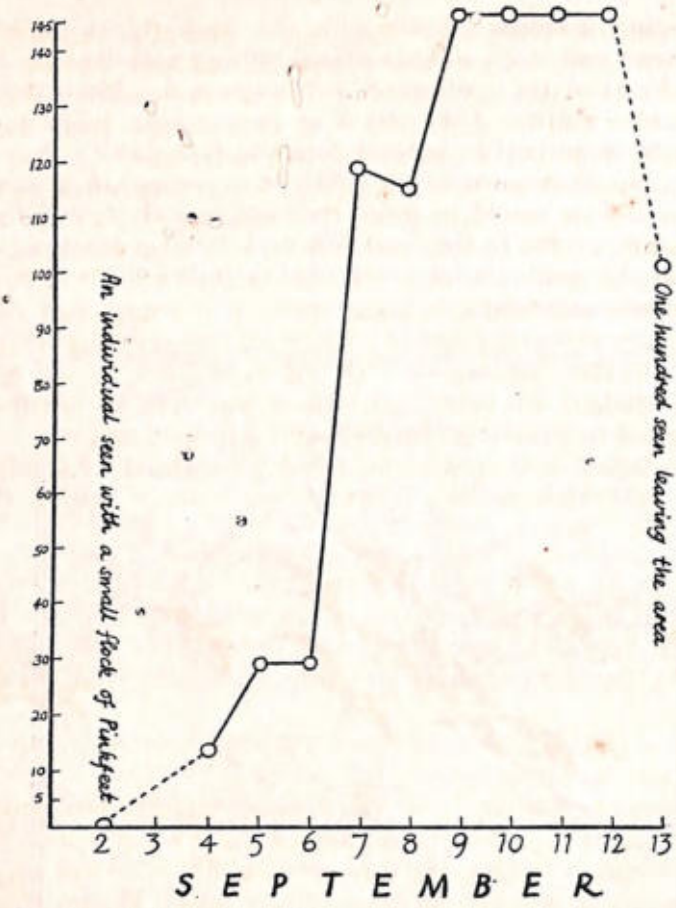


Fig. 2.—Graph of numbers of Barnacle Geese at Ásgarð in September

Observations and Weather

The first snow (2–4 September) began falling under a strong north wind at about 17.00 hours on 2nd and covered the ground in a short time. At about 07.00 hours on 3rd many geese were heard flying over, apparently south eastwards. A few more were heard a little later. The snow was still falling and there was a north-west wind. Visibility was about 100 yards. No more geese were seen until 16.40 hours when five Pinkfeet flew west over the hut. No snow was falling but sky and land were still indistinguishable. There was a slight north-north-west wind. At 17.15 hours we flushed five Pinkfeet from by the Jökulfall. They flew away to the west. Visibility was better for a time and we could see that Innri Skúti and beyond had no snow. At 18.00 hours 11 Pinkfeet flew calling eastwards up the hut valley along the hillsides. They sheered off round the north side of Innra-Ásgarðsfjall.

The 4th was fine and clear and the snow melted quickly below 750 metres. There was a fair east wind. At 14.00 hours we saw about 20 Pinkfeet flying south high up between Langjökull and Hofsjökull, and later 12 very high in the north, calling, and going away south-east towards the Þjórsárver. In the afternoon we counted 21 on Ásgarðsver from the top of Innra-Ásgarðsfjall. In the evening there was a slight south-west wind. At 21.20 hours 47 Pinkfeet flew in from the north-west, fairly low down, calling a little, over us and up the

valley through the Hveradalir gap. Just before, and after the first snow, geese apparently moved in from Greenland (Table II, and see ' Autumn Flocking '). The information on weather in Greenland does not demonstrate any relationship between the weather and the departure from Greenland : there was little snow or wind over Greenland at the times of arrival in Iceland.

The second snow started on the evening of 12 September, when we had counted 155 Pinkfeet and about 145 Barnacles. The weather maps show a depression forming in the south-west of Iceland at that time, with calm weather at 18.00 hours in most of coastal Iceland. By then the blizzard had started at Ásgarð. This time it was more severe and continued through the next two days at least. Visibility was below 100 yards and sky and land were equally white and indistinguishable. On the morning of 13th the depression moved to south-east Iceland. From midday to 18.00 hours there was rain in north-east Iceland but no precipitation had been recorded elsewhere in the lowlands. The amount of snow actually falling decreased during the day but the sky was still obliterated by cloud and visibility kept down by drifting snow. During the 13th the



wind speed increased to force 7, at Vestmannaeyjar. It was probably rather stronger up at Ásgarð. On the morning of 13th we heard a few Pinkfeet flying at 07.00 hours. During the day we saw 524 Pinkfeet and about 100 Barnacles flying over. We probably missed very few. The records of Pinkfeet are shown on the diagrams and are transcribed from our field notebooks below.

At 10.45 hours 60 Pinkfeet flying round above us calling loudly were joined by another 60 and flew east. On coming up against the side of Innra-Ásgarðsfjall (hereafter called the hill) they worked their way round its north side and evidently continued along the north side of the mountains. Of these flocks Jones wrote in his notebook ' very puzzled, didn't know where to go.' At 10.55 hours we saw almost the complete contrast : about 60 Barnacles flying straight and fast high up going south-south-west. At 12.00 hours we heard Pinkfeet flying around just west of the hut. At 12.10 hours 64 appeared, flew north over the hut, turned west flying slowly and calling. At 12.30 they flew up again, circled round and flew away to the west. They appeared to have been repeatedly baulked by the mountains west of the gap. At 14.00 hours 80 Pinkfeet came over from the north-east (avoiding the hill) and turned south working their way up the valley and through the gap in the mountains. Then 60 from the west came up against the hill and worked round the north side. Ten from the north-west turned back from the hill in front of us and seemed to be going to land by the river but may have carried on to the east. At 17.00 hours 40 flew east-south-east and disappeared, probably going along the north side of the mountains. At 17.10 hours 65 came over from the north-west and worked round the hill. Visibility was up to 400 yards for a time. At 17.20 hours 31 Pinkfeet flew over quite high from the west-north-west and seemed to turn into the gap in the mountains. At 17.50 hours about 25 Pinkfeet

show winds blowing from Iceland south then round towards north Scotland all through 3 October and they were still favourable over the last part of the journey on the 4th. These winds followed a depression which passed north-east across Iceland on 1st, 2nd and 3rd with rain or sleet at all the lowland weather stations and snow at Scoresby Sound and in north-west Iceland. So there was probably snow in the interior on 2nd and 3rd and the geese probably left on the 3rd and were blown in to northern Scotland arriving on the 4th.

Conclusions on Departure

The only exodus we saw when there was no snow was after the gathering flocks reached a peak on 28 August. This is considered to be an extension of the flocking movements : flocks left to find other flocks. The two departures in the two snows were forced departures. The geese which left in the first snow went south-east and probably stopped on the upper Þjórsá valley which we could see was snow free. The geese which left in the second snow were actually leaving on their migration to Britain. Some arrived the same day as they left, others the next day. The Pinkfeet, then, seem to stay in the interior of Iceland until the ground is covered in snow. They then depart for Britain, never going to the lowlands of Iceland. Temperature alone seems to have very little effect on geese. In thin snow they are able to feed by grubbing about in it but in deep snow they cannot feed, they sink up to their bellies and cannot walk about at all easily. Since they came south earlier than usual, one might expect that in normal years they were not forced out but departed under internal influences. However, the late departure of 1951 and the similarity of the weather situation at the times of migration in 1953 and 1954 make it look as if the departure we saw was typical.

The autumn departure of Pinkfeet from Iceland is, we believe, solely stimulated by the difficulties and discomforts due to deep snow and is not ' emancipated ' (Tinbergen, 1952) or incorporated into the breeding cycle to any noticeable extent. In this respect it is very primitive, and little more than a weather movement. From what little we saw of them this may not apply to Barnacle Geese. They left without flying round aimlessly and flew south without being influenced by the terrain.

The reliance on external conditions accounts for the short period of migration which is normal for Pinkfeet. In theory they should all depart on the same day since whenever only a part of the interior is snowbound the flocks there could move to a free part. Evidently they do not all do this. Some leave direct from the higher oases before others leave from the lower places. This is probably because Pinkfeet forced off a high oasis such as Árskarð or Eyvafen leave downwind, going south or south eastwards, and do not pass the clear vegetation lower down the Þjórsá to the south-west.

Comparison with other Species

Since the Pinkfoot appears to be almost purely a weather migrant in its autumn migration it may be of interest to compare it with some of the ' introvert migrants ' living in the same areas in summer.

Pinkfeet differ from the passerine species breeding in the interior (Meadow Pipit and Snow Bunting) and other species breeding in Iceland (Merlin, Redwing, White Wagtail). These species have a long period during which migration occurs. In Iceland they move from mid-July to October (their migration continues after the Pinkfeet because they go to the lowlands). They move

flew over high and very fast through the gap in the mountains. At 18.45 hours 40 Barnacles flew over high, fast and straight going south.

The wind directions from 18.00 hrs on 12th to 18.00 hrs on 14th were such that Pinkfeet leaving during this time would be blown south then south-east towards the northern coast of Scotland. The best wind conditions were at midday on 13th when the depression had moved across to south-east Iceland. Conditions were just suitable on 15th, evening 16th, and were very suitable on 17th, when under the influence of a depression between Iceland and Norway, and on the 20th, when there was a depression between the Faroes and Shetland.

On the morning of 14th we left Ásgarð on foot and saw a pair of Pinkfeet fly over towards the Hveradalir gap. Two hours later about 2½ miles west we saw about 30 Pinkfeet flying south-east. We saw no more geese in the blizzard or in the clear weather until we reached Hvítárvatn, where there were about 300 Pinkfeet on the tundra and on the marsh. We would probably have seen any geese flying over high up on the walk to Hvítárvatn.

When we emerged from the blizzard into fine weather at the Fossrófulœkur we could see that the whole area from about 450 metres above Hvítárvatn to beyond Rjúpnafell and all the hills to the south-east were covered in snow. The Kerlingarfjöll and Höfsjokull were still covered in cloud. The previous day this cloud and the blizzard conditions in it had evidently extended all over the interior.

On the journey back to Geysir we found snow only on the Bláfell–Geldingafell pass. We saw another 110 Pinkfeet between Hvítárnes and Bláfell and 50 south of Bláfell, the last 16 being on an oasis at an altitude of 280 metres by the Sandá. There were none on the rather lowland type of vegetation just above Gullfoss at 240 metres. On this and the subsequent bus journey to Reykjavík we could see that the snow was on all the hills even beyond the Þjórsá and possibly down to the level of the higher Þjórsá valley. Presumably it did not come below 450 metres. During the three days 13th–15th, it showed no signs of melting. The places covered by this fall were probably no use to the geese again that autumn. Hvítárnes, the Hvítá meadows and Mikluóldubotnar, Skámstungur, Fitjaskógar, and Póristungur would have been usable until a later snowfall.

To justify any conclusions based on our observations we must attempt to show that this first departure was typical in spite of being so unusually early.

Arrival Records for Other Years

1951. Pinkfeet arrived in Britain unusually late in 1951. Huge flocks were seen on the Þjórsá from Norðurleit down to Þjórsádalur between 5 and 14 October, by the farmers. They began to arrive in Britain about this time. If there had been much snow before this they would have been driven out. Evidently they just stayed on until it did snow, or until food got short as a result of frosts. If they had any intrinsic urge to migrate this should have asserted itself by this time unless the whole breeding rhythm was late that year, but the Trust expedition found hatching earlier in 1951 than in 1953. The British Schools Exploring Society expedition, 1951 (Moore *loc. cit.*) saw flocks forming up at the time we did in 1954 and they saw geese moving downstream from the Þjórsárver in early September.

1953. Cornwallis (1954) states that the first major arrivals of Pinkfeet were on 4 and 5 October in places as far apart as Fair Isle and Gibraltar Point (at the north end of the Wash). This is a normal arrival date. The weather maps

show winds blowing from Iceland south then round towards north Scotland all through 3 October and they were still favourable over the last part of the journey on the 4th. These winds followed a depression which passed north-east across Iceland on 1st, 2nd and 3rd with rain or sleet at all the lowland weather stations and snow at Scoresby Sound and in north-west Iceland. So there was probably snow in the interior on 2nd and 3rd and the geese probably left on the 3rd and were blown in to northern Scotland arriving on the 4th.

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in fine weather (Williamson, 1954) mostly before the conditions are bad. Their migration is the result of a drive motivated from within the bird, building up over a long period and being released by good flying conditions. The long period of migration is due to variation in the breeding rhythm and the need to wait for suitable weather. (See p. 166 for our observations on other species.)

Survival Values of the two types of Migration—why are Pinkfeet Weather Migrants?

In the breeding season Snow Buntings (Scott, Fisher, Guðmundsson, 1953) and at all times Meadow Pipits (Witherby *et al.*) are predominantly insectivorous. The numbers of insects decrease gradually in late summer and autumn as their hatching ends and the weather gets colder and wetter. If all the insectivorous birds stayed until they became even slightly short of food few would complete their migration. As Williamson has shown, small birds have to stock up with food and migrate *without delay*. There has been, and still is, strong selection for early migration in these species. An internal urge to migrate linked with the breeding rhythm allows very accurate timing of migration and ensures to some extent that the birds migrate before it is absolutely necessary (when they would be too weak anyway). Merlins feed on small birds (especially Meadow Pipits) and their departure might follow the pattern of the departure of the small birds.

The food problems do not seem to apply to larger birds. Geese can live a long time without food when at rest, e.g., when being transported in captivity. They can presumably keep up work for a long time on their food reserves even after not feeding for some hours, e.g., departing without food in the morning

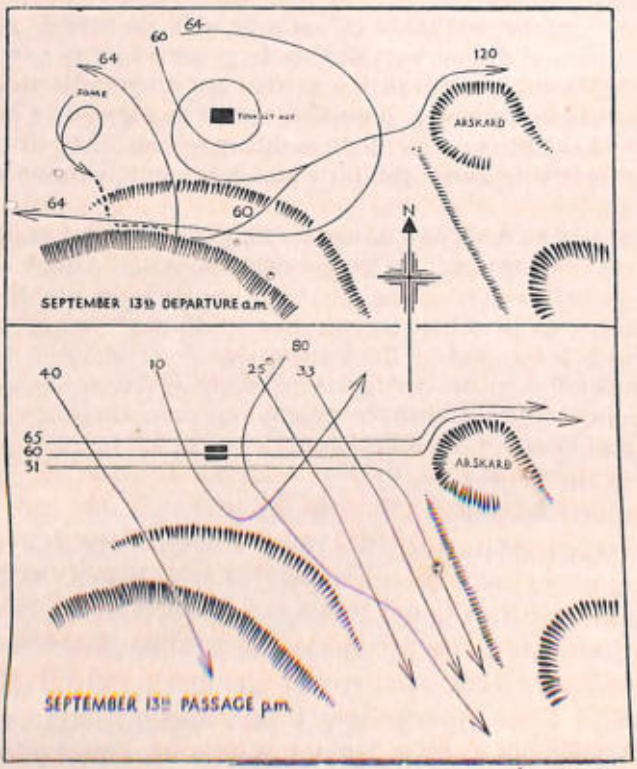
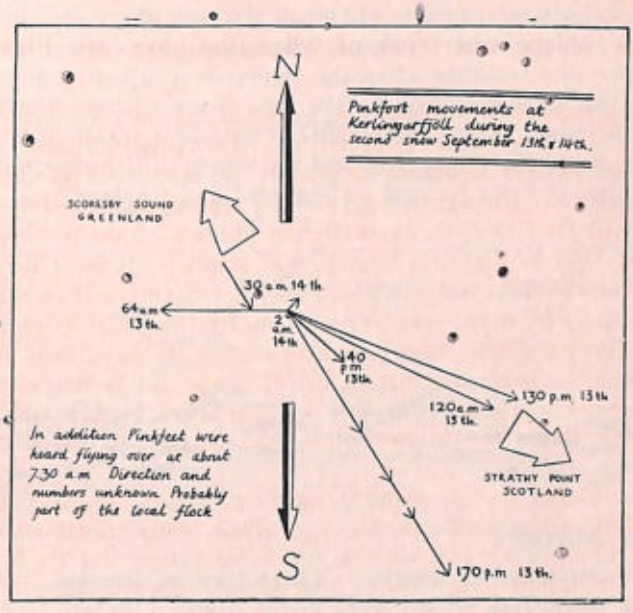


Fig. 3.—Directions taken by Pinkfeet over the hut at Ásgarð (see text)

after a night in the snow. A factor that may act selectively in favour of Pinkfeet remaining later in Iceland is the slow rate of growth of goslings. In September they are still far short of adult weight, and it may be that the later they migrate the better their chance of surviving the strenuous hazards of the southward flight.



Orientation

The geese seen leaving Ásgarð in the second snow flew around seeming not to ' know ' what to do or where to go. Their first move was to fly south, downwind, away from the snow. They then came up against the hills in front of the hut (which flocks passing through a little higher up mostly missed), turned back, came up to Innra-Ásgarðsfjall and worked round it and away. Nearly all the geese seen took the east-south-east route, or the south-east route through the Hveradalir gap. The majority of passing flocks went through the gap. They would have carried on straight over the upper Þjórsá gathering grounds (probably snowbound). Those going east-south-east would probably have turned south round the end of the mountains.

The directions of all the Pinkfeet seen flying over in the snow could be explained merely as a result of the wind and terrain. The question arises again as to how typical of the whole migration and of other years these observations are. In fine weather the geese fly high and straight over the mountains and could orientate and keep their course by landmarks or the sun. In a blizzard the sun could not be used for orientation but we do not think its absence accounts for all the directional uncertainties we saw. Probably departing Pinkfeet always start in a blizzard and their initial course is set as a result of wind and terrain.

There are no mountains by the Þjórsá which would make the geese depart to the south-east immediately. Indeed Pinkfeet flying south from Skúmstungur would be deflected south west by the Hekla range. If they left from Styttri-Norðurleit they might be deflected to the south-east, between Vatnajökull and Myrdalsjökull, by the hills from Valafell to Hábarmur. But after a depression

has passed east over Iceland causing precipitation, in this case snow, the winds flowing round it in an anti-clockwise direction will be north over the interior (also funnelled by the icecaps, see Stewart, 1952) and north-west over the sea south of Iceland by the time the depression has passed and the snow is deep. These winds would make the geese take a south-easterly course, roughly towards Scotland. The winds might carry them all the way there, as they could have done on 13 and 14 September 1954, or, when they have come out of the cloudy weather into the fine weather after the depression, already going south-east, they may keep the same direction by the sun. Even so they are bound to drift with the wind to some extent. We think it simply a result of the coincidence of snow (which starts the migration) and the winds in the associated depression that Pinkfeet migrate from Iceland to Scotland and England.



Notes on other Migrants

Merlin : Do not breed in interior. Three seen on passage. The first on 28 August a clear warm day with a light north wind. One on 31st a cloudy day but with good visibility (wind not recorded). One on 8 September was seen hunting in the morning, which was overcast. It flew off low to the west.

White Wagtail : Do not breed in the interior. Passage birds seen almost daily from 5 August to 5 September. Movement on 21 and 22 August (clear weather) and 4 and 5 September (fine weather after snow on high land).

Wheatear : Do not breed in interior. Passage birds seen nearly every day 5 August to 15 September. They all seemed to be making only very brief stops and would disappear to be replaced by different numbers next day. Passage seemed to be an almost continuous flow of odd birds, pairs, and pairs with fledglings. Many on 17 August, a fine day.

Meadow Pipit : Flocking seen at Mývatn 27 July and at Ásgarð on 21 August. Do breed in interior where often seen. Passage on 21 August (fine). None seen after that until 28th when three seen. In the first snow one or two stayed in the sheltered hut valley. Fluctuating numbers after that until second snow when one in hut valley. One south of Bláfell on 15 September and one at Gullfoss, and more in the rest of the lowlands.

Snow Bunting : Seen at odd places all over area from 8 August to 15 September nearly every day. Breed in interior but larger numbers seen than could be accounted for by local breeders. Flocking on 15 August (Dr Finnur Guðmundsson tells us that Snow Buntings flock in response to a slight drop in temperature even while nesting). Flocks seen 17 August. Passage on 21 August (also Wagtails and Meadow Pipit) and less on 22nd. 27 August few very loath to fly. Many in hut valley in blizzard on 13 September. On 14th total 180 moving north against wind in fine weather over the snow near Innri Skúti.

Brood-Size

Counts of the numbers of goslings in broods seen between 20 August and 1 September are summarised in Table III. Many of the broods must have been recorded more than once. There is no indication of any losses during the period, but the mean brood-size of 3·1 is much smaller than those recorded in Þjórsárver in July, in both 1951 and 1953, suggesting that losses of about one-third may have occurred between hatching and late August.

TABLE III

BROOD-SIZES IN FAMILIES OF PINK-FOOTED GEESE SEEN IN ÁSGARÐ, CENTRAL ICELAND, 20 AUGUST – 1 SEPTEMBER, 1954

Date	Number of Families seen	Distribution of Brood-sizes							Mean Brood
		1	2	3	4	5	6	7	
20 August	12	2	3	3	4	—	—	—	2·8
21 August	16	—	5	3	3	4	—	1	3·8
22 August	15	1	5	5	1	1	1	1	3·2
23 August	16	3	3	6	2	1	1	—	2·9
24 August	26	5	6	6	4	2	2	1	3·1
26–27 August	38	2	8	12	8	4	4	—	3·4
28 August	26	3	9	9	3	1	1	—	2·7
29 August	20	3	6	5	5	1	—	—	2·8
30 August–1 September	22	4	4	5	6	3	—	—	3·0
Totals	191	23	49	54	36	17	9	3	3·1

Ringed Geese

Pinkfeet carrying rings were seen on 13 occasions (Table IV). At least 12 individuals were involved. Two of them carried British rings, put on in October or November 1952, the remainder must have been marked in Þjórsárver in 1953 or 1951.

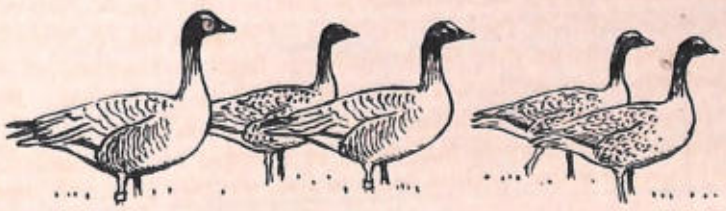


TABLE IV

RINGED PINKFEET SEEN IN CENTRAL ICELAND, AUGUST AND SEPTEMBER 1954

Ring	Date	Bird	Flock	Locality
1. Silver on right	28.8.54	♂ parent with ♀ (NR) and 1 gosling	In flocks of 66	Marsh below Innra-Ásgarðsfjall
2. Silver on right	29.8.54	♂ parent with ♀ (NR) and 5 goslings	Alone	On west side of Illahraun. Patch of moss by stream
3. Silver on right	31.8.54	♂ parent	Alone	Patch of moss between Innra-Ásgarðsfjall and Jökulkrokur below Lodmundur
4. Silver on right	31.8.54	♀ parent and 3 goslings		
5. Silver on right	5.9.54	♀ parent with ♂ (NR) and 3 goslings. ♀ possibly some Whitefront blood	With families of 4 and 3, a pr. and a lone gosling which followed this family	Small tundra patch between hut at Kerlingarfjoll and Jökulfall
6. Silver on right	5.9.54	♂ parent with ♀ (NR) and 2 goslings	The 4 of above group	As above
7. Silver on right	7.9.54	♂ parent	With families of 3 and 3 and a pair	As above
8. Silver on right	7.9.54	♀ parent and 2 goslings		
9. Silver on left (ringed Britain, autumn, 1952)	7.9.54	♀ parent with ♂ (NR) and 4 goslings	With families of 3 and 3 and 4 and a pair	As above
10. Silver on right	9.9.54	♂ parent with ♀ (NR) and 2 goslings	In flock of 10	As above
11. Silver on right	9.9.54	♀ parent with ♂ (NR) and 1 gosling	Same flock	As above
12. Silver on right	11.9.54	♂ paired	In flock of 70	Tundra below Innra-Ásgarðsfjall
13. Silver on left (ringed Britain, autumn, 1952)	11.9.54	Single or paired	Same flock	As above

(NR) = not ringed.

ACKNOWLEDGMENTS

We wish to thank all those who made the expedition possible, especially the Trustees of the Leighton Park Travel Scholarship, the Iceland Research Council and Dr. Finnur Guðmundsson, Sigridur Águstsdottir, H. J. Moore for allowing us to see his report on birds in the interior in 1951, and the Meterological Office Library for the loan of weather maps.

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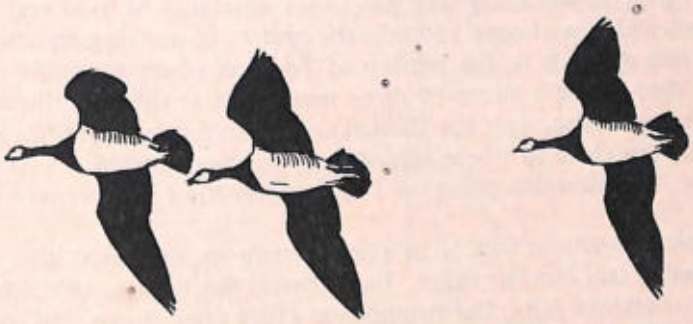
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GOOSE-RINGING IN VEST-SPITSBERGEN 1954

By James Goodhart, Russell Webbe and Thomas Wright

SUMMARY

A PARTY of five visited Vest-Spitsbergen in July 1954 to catch flightless geese for ringing. Catches were made in Reindalen and Sassendalen. 526 Pinkfeet, 23 Barnacles and 74 Light-bellied Brents were ringed. The methods of capture are described, and various improvements suggested. A list of the recoveries of Pinkfeet marked during this expedition and in Gipsdalen in 1952 is appended.

INTRODUCTION

During the summer of 1952 a Sherborne School Expedition made a preliminary investigation into the possibility of catching geese during their flightless period in Spitsbergen. They arrived in Gipsdalen on 10 August and found that the adults were already flying strongly, but managed to catch 42 well-developed goslings.

In view of these results it was decided to plan an expedition to arrive much earlier in Spitsbergen to find out where some of the Pink-footed Goose *Anser brachyrhynchus* concentrations were during the breeding season, and also to catch and ring as many as possible. There were five in the party led by G. T. Wright from Sherborne and the rest were undergraduates—Russell Webbe and James Goodhart from Cambridge, Colin Pennycuick from Oxford and Fredrik Bolin from Oslo.

The advance party of three arrived at Longyearbyen, the mining settlement in Icefjord, on 27 June. Their task was to set up câches of food and equipment in two valleys which we hoped to make the centres of our ringing activities. We carried a series of loads to the bottom of Todalen where we made our second camp. We then made a cache of three man-loads at the Eskerfossan by continuing up Adventdalen, over the Brentskardet into Eskerdalen until we reached the waterfall very close to where this valley joins Sassendalen. Next we carried six man-loads to Reindalen going up Todalen over the 1300 feet pass and down Gangdalen.

Most Arctic expeditions tend to be a little strenuous and exhausting physically, and we probably had our fair share. In the broad flat valleys, except where there were shingly outwash fans, the swamp was fairly continuous, but one seldom sank in more than 18 inches as then one meets the permafrost layer. The rivers in the big valleys—especially the Rein and the Sassen—were broad and deep and had to be crossed in rubber dinghies; however, those in the tributary valleys were veritable torrents and a very firm pair of feet was needed to avoid a dangerous ducking. The snow was quite deep on the high passes, and the big stone blocks that formed the screes were sometimes troublesome.

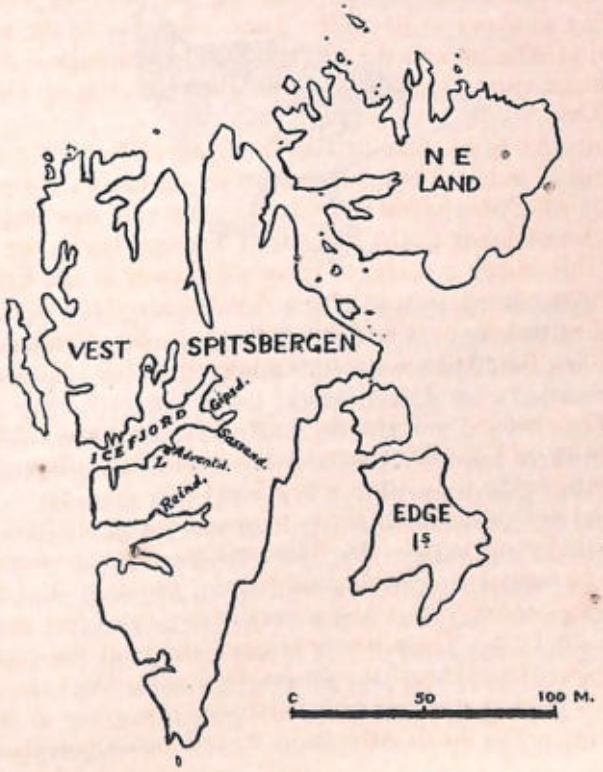
During this first period we saw two small gaggles of Pinkfeet—totalling 11 birds—flying north down Adventdalen, and also a pair that flew in the other

direction. A pair of Pinkfeet, calling frequently, flew round us for some hours in the Bolterdalen area of Adventdalen. On 3 July a small colony of Pinkfeet was found breeding on the buttresses of the gorge below the Eskerfossan. One bird was accidently flushed from a nest containing one egg, and a further three sitting birds were seen as well as six nests of the year being found. No serious attempt was made to explore this colony any further because of an attendant predatory Glaucous Gull.

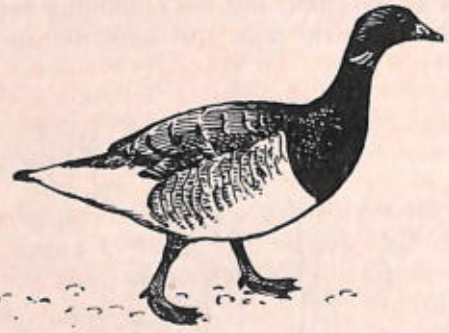
THE CATCHES IN REINDALEN

On 9 July the remaining two of the ornithological party arrived and we were all in Reindalen about three miles from Van Migerfjord by the 11th. On the morning of the 12th 470 Pinkfeet and a few Barnacle had been seen feeding on the shores of the large lakes which lay to the east of the river. We set up our nylon stake nets about half-way along a ridge that ran out about 1½ miles into the valley to the north of the lakes. We were careful to put them in a ' hull down ' position so that they could not be seen from the southern side by the geese. We used a nylon net of 1½ inch mesh which was 300 feet long and 3 feet high, and tubular aluminium stakes which were a great improvement on the bamboo ones used in 1952.

On 14 July we made our first drive of part of the marsh. One man, taking a rubber dinghy with him, made a long encircling movement so as to get to the south of the lakes, while a second man walked down behind the ridge and then south along the central river to prevent them running to it and drifting down to the sea. A third man was in the marsh to the east to prevent the geese running up the high scree slopes, and the remaining two lay concealed on the ridge to guide the birds into the nets. All went well to start with as the geese



concentrated into a flock and ran to one of the lakes, and were dislodged on to the lake nearest the ridge by using the rubber dinghy. The birds seemed very loth to leave this lake and when they were eventually encouraged to leave the water quite a number ran along the shore and entered the lake again, but many were already streaming across the marsh towards the nets at a good pace. The birds unfortunately broke up into several flocks, and quite a number were lost in the final moments of the drive. The resulting catch was 205 Pinkfeet. These were ringed both with a numbered aluminium ring from Stavanger Museum and also with a coloured plastic ring. The next day we drove much the same area and caught 208 Pinkfeet and 1 Barnacle *Branta leucopsis*, but only ringed 196 as 12 of them had been caught the previous day. On the following day —16 July—we left the nets in the same place but concentrated our attention on a lake further to the west and much nearer the river. Using two rubber dinghies we tried twice, unsuccessfully, to move the birds from the lake because they could swim faster than we could propel the dinghies especially against the wind. However at our third attempt we managed to get the geese into the shallower northern end of the lake and pushed them off it and had a good long run to the nets. We caught 115 Pinkfeet (30 ringed in previous catches), 22 Barnacles and 63 Light-bellied Brents *Branta bernicla hrota*. We noticed that when the geese were on the lake and not unduly pressed by us the black and the grey types all stayed in one flock, but when they were more worried it was the Brents that started to panic first and made short rushes across the water ; furthermore when the birds were really in a tight corner they split into two flocks, one all black and the other all grey.



Next day we crossed the very wide Rein river to the western side and found two small lakes with a few Light-bellied Brents on them. We caught eleven adults from the first, and there were four adults and eight goslings on the other which we left unmolested as we considered the goslings too young to be caught. We then made our way down to the fjord shore where we found a shallow lagoon on which there were 92 Pinkfeet. We made a comparatively easy drive off the lake and the birds came off it in fine order, but one of the net poles broke and we lost all except five—one of which had been ringed already on the second day on the far side of the valley. The geese had meanwhile fled to the sea, but it is of interest to note that the five we had caught and then released made no attempt to go to the sea, but swam out into the middle of the lagoon and remained there quite contentedly. We also saw a large flock of birds a long way off sitting by the shore ; it was misty at the time and we could not agree among ourselves about their identification. We had been away from camp for a good while by then and returned without further investigating this flock.

Reindalen has never been mentioned in the literature concerning Pinkfeet as far as we know, but this year there were certainly 650 there excluding any that may have been in the large flock by the shore. These constitute well over 10% of the believed Pinkfoot population of Spitsbergen. But of greater interest concerning this valley is that we neither caught nor saw a single Pinkfoot nor Barnacle gosling, and out of about 40 potential pairs of Brent only two pairs had goslings. Previously we had seen plenty of what we believed to be Pinkfoot droppings in Gangdalen and in Semmeldalen where there are also suitable nesting sites. As these Reindalen birds are colour ringed—Pinkfeet with red, white or green, Brent with orange and Barnacle with white—it may be possible for future expeditions to prove whether this was just a non-breeding year in this valley or whether it is a yearling and two-year-old valley.

The literature seemed to indicate that there would be, at the outside, 200 Pinkfeet in each valley and we had in consequence taken that number of various ring colours. Thus having caught well over 400 in one valley we had to use three colours. In Sassendalen subsequently we used orange at first but found it was virtually invisible on an adult leg a few yards away, so we changed to black. It was our original intention to discover whether these different valley populations mix freely in winter, but as so few were ringed outside Reindalen it is doubtful if our original idea will bear much fruit.

SASSENDALEN

We left Reindalen on 19 July and had rather a strenuous two-day walk to the top of the valley, over the Reindalspasset into the top of Adventdalen and down to the Eskerfossar where we camped. We then moved camp down into Sassendalen and camped below the Skarvrypehøgda about two miles from the sea. We found that there were about 350 Pinkfeet and 25 Barnacle in the bottom five or so miles of the valley, and decided to try and drive them on to a small lake on the eastern side of the river which was about a mile from the sea. The river here is about 900 yards wide and one man, with a boat, must stand in the middle of the river to dissuade them from drifting down to the sea. On 29 July this flock—some of which had been seen to fly—was feeding near the main river opposite Eskerdalen. Two of us went a good way upstream of them and they all entered the river and started to drift down towards the sea, and were stopped by the man in the middle of the river ; they then sat on the river's edge and twice started to run towards the lake, but eventually we made a wrong move and they all ran with great speed to the higher ground to the north of the lake and then made for the sea. There were already some geese and goslings on the little lake, but at least 54 of these scrambled up the far bank leaving 14 adults and about 50 goslings ; 12 of the adults flew away as we drew nearer, and eventually we managed to catch one adult and 25 goslings.

It was later discovered that there was a flock of adults and goslings concentrated at the top of Sassendalen. We were unable to make an attempt to catch this flock as most of the party had to join a geological survey party and go up on to the central ice-cap by a certain date. This was a little while after our main activities in this valley, and it seems very probable that this was the whole valley population which numbered about 900. There is no doubt that a better policy would be to drive all the birds up towards the top of Sassendalen, then to set up the nets on a piece of ground moraine and to get round behind

the geese and drive them back down the valley into the nets. We found that activities around the delta area were neither easy nor pleasant—the river is wide, the sea is near and the bog round the little lake was very bad and was by far the worst that ever crossed our path.

We walked along to De Geerdalen from Sassendalen and one of our party remained in this area during August. A few nests were found near the Hyperite fossan in De Geerdalen and a flock of up to 40 birds, including a few goslings, was seen in this area of the coast on a number of occasions.



GIPSDALEN

We went across the fjord to Gipsdalen using our 16-feet boat which had been dropped at De Geerdalen by the Governor's boat. In this valley we disturbed about 130 geese—including a few goslings—feeding in a marsh about two miles from the sea, and they ran on ahead of us up the valley. When the valley began to narrow we set up the nets on some fairly high ground on the east side of the river. One man then went up to the top of the valley while the others lay in hiding in various places a few hundred yards from the nets. Four hours later the man returned saying that he had seen no geese ; a glacier and ice-cap blocked the top of the valley and the most likely solution is that they ran up one of the high scree slopes for which Spitsbergen is famous.

The result of all our activities in the valleys was that we ringed 526 Pinkfeet, 23 Barnacle and 74 Light-bellied Brent, as well as gaining valuable experience in the art of catching geese in Spitsbergen which we would be very pleased to hand on to anybody who may wish to continue this work.

IMPROVED METHODS

Finally we have some suggestions as to how a very much larger number of birds could be caught by one party in a season. The first essential would be a proper sea-going boat—sealer or such-like—which would enable much more ground to be covered as time would be saved in moving from valley to valley, as well as making an advance party (to carry food and equipment) unnecessary. The party should be larger than ours and probably seven or eight would be ideal. There must be one rubber dinghy for every two people, and also double ended paddles for quicker propulsion. Some form of communication between members on the ground is very necessary so that the leader could sit on some vantage point and direct operations. There is a new waterproof wireless set weighing about three pounds which would seem ideal. We found that during drives there was frequently a mile between beaters and also that the marsh undulated slightly, and the geese were occasionally invisible to the beaters, while those on the higher ground had an excellent view of both beaters and

geese. We heard it said by an old trapper that there were many geese in the valleys on the south side of Van Migenfjord, and it seems probable that they would be well worth while exploring if the party could arrive a little before the birds were flightless so that no time would be wasted if there were none there. The mines at Sveagruva have now closed down and Kjellstrømdalen looks from air photographs to be a very suitable valley, and would probably be well worth a visit, as also would the flat land round Cape Martin, which is known to hold some geese but has not been thoroughly explored.

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RECOVERIES OF PINK-FOOTED GEESE RINGED IN SPITSBERGEN

Ring Number	Age	Where Ringed	Date of Ringing	Recovered
23801	Juvenile	Gipsdalen (78°30′N., 17°E.)	13.8.52	Neuharlingersiel, Ostfriesland, Germany (53°42′N., 7°43′E.), 28.10.52
23866	Juvenile	,,	14.8.52	Fanö, near Esbjerg, Denmark (*c.* 55°26′N., 8°22′E.), 11.10.52
23868	Juvenile	,,	15.8.52	Sande, near Wilhelmshaven, Germany (53° 31′N., 8°1′E.), 31.3.54
23887	Juvenile	,,	14 or 15.8.52	Vaern Enge, Ringköbing Fjord, Denmark (55°52′N., 8°15′E.), 12.10.53
23889	Juvenile	,,	14.8.52	Föhr, Schleswig, Holstein, Germany (54°43′N., 8°30′E.), 15.12.54
23894	Juvenile	,,	14.8.52	Föhr, Schleswig Holstein, Germany, 31.1.54
204808	Adult	Reindalen (77°50′N., 15°30′E.)	14.7.54	Gaasterland, Friesland, Holland (52°50′N., 5°32′E.), 8.1.55
204815	Adult	,,	14.7.54	Stickhausen, Ostfriesland, Germany (53°14′N., 7°40′E.), *c.* 10.12.54
204827	Adult	,,	14.7.54	Gaasterland, Friesland, Holland, 2.10.54
204832	Adult	,,	14.7.54	Gaasterland, Friesland, Holland, 10.1.55
204860	Adult	,,	14.7.54	Astrup, S. Jutland, Denmark (55°10′N., 8°41′E.), 24.10.54
204873	Adult	,,	14.7.54	Oostkerke, West-Flanders, Belgium (51°10′W., 3°14′E.), 13.2.55
204900	Adult	,,	14.7.54	Werdum, Ostfriesland, Germany (53°40′N., 7°44′E.), 4.10.54
205105	Adult	,,	14.7.54	Föhr, Schleswig Holstein, Germany, 16.12.54
205112	Adult	,,	14.7.54	Rijsterbos, Friesland, Holland (52°51′N., 5°35′E.), 10.1.55
205142	Adult	,,	14.7.54	Pitkum, near Emden, Ostfriesland, Germany (*c.* 53°23′N, 7°13′E.), 4.12.54
205153	Adult	,,	14.7.54	Lynderup Enge, Hjarback Fjord, Denmark (56°34′N., 9°20′E.), last week 10.54
205166	Adult	,,	14.7.54	Föhr, Schleswig Holstein, Germany, 22.12.54

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205166	Adult	,,	14.7.54	Föhr, Schleswig Holstein, Germany, 22.12.54

Ring Number	Age	Where Ringed	Date of Ringing	Recovered
205187	Adult	,,	14.7.54	Burderhammrich, Ostfriesland, Germany (53°14′N., 7°18′E.), 5.1.55
204523	Adult	,,	15.7.54	Vaern Enge, Ringköbing Fjord, Denmark, 5.10.54
204525	Adult	,,	15.7.54	Vaern Enge, Ringköbing Fjord, Denmark, 5.10.54
204527	Adult	,,	15.7.54	Föhr, Schleswig Holstein, Germany mid 11.54
204568	Adult	,,	15.7.54	Horsten, Ostfriesland, Germany (53°29′N., 7°59′E.), 2.12.54
204573	Adult	,,	15.7.54	Büchten, Hanover, Germany (52°41′N., 9°37′E.), 23.12.54
204579	Adult	,,	15.7.54	Föhr, Schleswig Holstein, Germany, mid 11.54
205142	Adult	Reindalen	15.7.54	Pitkum, near Emden, Ostriesland, Germany (*c.* 53°23′N., 7°15′E.), 4.12.54
205208	Adult	,,	15.7.54	Föhr, Schleswig Holstein, Germany, 18.12.54
205245	Adult	,,	15.7.54	Steinhausen, Oldenburg, Germany (53°24′N., 8°08′E.), 20.1.55
205250	Adult ♂	,,	15.7.54	Shot together, Föhr, Schleswig Holstein, Germany, 22.12.54
205251	Adult ♀	,,	15.7.54	
205253	Adult	,,	15.7.54	Graauw en Langendam, Zeeland, Holland (51°22′N., 4°4′E.), 20.1.55
205265	Adult	,,	15.7.54	Norden, Ostermarsch, Germany (53°35′N., 7°12′E.), 4.12.54
205812	Adult	,,	16.7.54	Baie de Seine, France (*c.* 49°28′N., 0°20′E.), 22.1.55
205821	Adult	,,	16.7.54	Lüttjegaste, Ostfriesland, Germany (53°11′N., 7°29′E.), 5.11.54
205832	Adult	,,	16.7.54	Bagges Daemring, Ringköbing, Denmark (56°7′N., 8°8′E.), 28.11.54
205848	Adult	,,	16.7.54	Nije Mirdum, Friesland, Holland (52°51′N., 5°35′E.), 15.12.54
204607	Juvenile	Sassendalen (78°10′N., 16°30′E.)	29.7.54	Föhr, Schleswig Holstein, Germany, 4.1.55
205891	Juvenile	,,	29.7.54	Vaern Enge, Ringköbing Fjord, Denmark, 10.11.54
205893	Juvenile	,,	29.7.54	Rindum, near Ringköbing, Denmark (56°6′N., 8°16′E.), 16.10.54
205899	Adult	,,	29.7.54	Föhr, Schleswig Holstein, Germany, 4.1.55
204624	Juvenile	,,	4.8.54	Vaern Enge, Ringköbing Fjord, Denmark, 30.9.54

We are much indebted to Dr Holger Holgersen for informing us of the recoveries listed above, and for permission to publish them here.

It will, of course, be noted that no Spitsbergen ringed Pinkfoot has so far been recovered in Britain.





WILDFOWL AND THE PROTECTION OF BIRDS ACT, 1954

ON 1 December 1954, the Protection of Birds Act, 1954, came into force. This repealed the Wild Birds (Ducks and Geese) Protection Act, 1939, and the Wild Birds Protection Act, 1880, which were the legislative measures relating to wildfowl previously in force. The purpose of the notes which follow is to give a brief account of the provisions of the new Act as they affect wildfowl, with particular attention to the changes in the law. But there can be no adequate substitute for the Act itself (copies of which can be obtained from Her Majesty's Stationery Office, price 9d.) and it must be insisted that these notes are in no way authoritative.

The Schedules

The first section of the new Act is the most important. It establishes that, with certain exceptions, any wild bird, its nest and its eggs are protected, so that it is an offence to kill, injure or take the bird, or take, damage or destroy its nest and eggs. Further, it is an offence for a person to have in his possession any wild bird, recently killed or taken unless he can show that it was taken without contravening the Act. An offence committed in respect of a bird included in the First Schedule to the Act shall be liable to a special penalty. This First Schedule names 59 species, including Bewick's and Whooper Swans, the Grey Lag Goose and six species of duck (Scoter, Garganey, Goldeneye, Long-tailed Duck, Scaup and Velvet Scoter—all uncommon nesting species in Britain). The swans are protected at all times, the others only during the close season.

Section 2 deals with the exceptions to Section 1, laying down that authorised persons[1] shall not be guilty of an offence by reason of killing or taking species included in the Second Schedule to the Act. This Second Schedule lists 20 species. These include the Goosander and Red-breasted Merganser, but in Scotland only (i.e. in England and Wales these species may not be killed at any time). Paragraph two of this section provides that the killing of birds of 33 species named in a Third Schedule is also permitted, outside the close seasons laid down later in the section. This list of birds which may be shot includes eight species of duck (Pochard, Tufted Duck, Mallard, Gadwall, Pintail, Shoveler, Teal and Wigeon) and four species of goose (Bean, Whitefront, Pinkfoot, Canada). To these may be added the Greylag, and the six species of ducks protected by special penalties during the close season, but not at other times. The taking of the egg of any wild duck, goose or swan is permitted, if it is shown that the egg was taken for the purpose of causing it to be hatched.

[1] *Authorised person* : anyone authorised by the owner or occupier of the land in question or by various public bodies named in the Act.

TABLE I

WILDFOWL YOU MAY SHOOT BETWEEN 1 SEPTEMBER AND 31 JANUARY INLAND, OR BETWEEN 1 SEPTEMBER AND 20 FEBRUARY ON THE FORESHORE

Grey Lag Goose
White-fronted Goose
Bean Goose
Pink-footed Goose
Canada Goose
Pintail
Teal
Mallard
Gadwall
Wigeon
Garganey
Shoveler
Pochard
Tufted Duck
Scaup
Scoter
Velvet Scoter
Longtailed Duck
Goldeneye

WILDFOWL OCCURRING IN BRITAIN WHICH YOU MAY NOT SHOOT AT ANY TIME

Swans (all species)
Barnacle Goose
Brent Goose
Red-breasted Goose
Lesser White-fronted Goose
Snow Goose
Egyptian Goose
Shelduck
Ruddy Shelduck
N. American Black Duck
American Wigeon
American Blue-winged Teal
Red-crested Pochard
White-eye
Ring-necked Duck
Mandarin Duck
Buffelhead
Eiders (all species)
Smew
Hooded Merganser
Any other species which may visit Britain in the future

WILDFOWL AUTHORISED PERSONS MAY SHOOT AT ALL TIMES IN SCOTLAND BUT AT NO TIME IN ENGLAND AND WALES

Goosander
Red-breasted Merganser

TABLE II

OTHER BIRDS YOU MAY SHOOT BETWEEN 1 SEPTEMBER AND 31 JANUARY

Curlew
Bar-tailed Godwit
Grey Plover
Golden Plover
Redshank
Woodcock (in Scotland)
Coot
Moorhen
Capercaillie

SPECIAL CLOSE SEASON DATES

You may shoot the following species between 12 August and 31 January :

Snipe
Jack snipe

between 1 October and 31 January :

Woodcock (in England and Wales)

FORMER QUARRY SPECIES WHICH YOU MAY NOT NOW SHOOT

Knot
Dunlin
Lapwing
Oystercatcher

All other species of waders. (There are 43 on the British List in this category).

Note : Pheasant, Grouse, Ptarmigan and Partridge, being Game Birds in the legal sense are not included in this Act and their close seasons remain as before. Quail are, however, fully protected at all times under Schedule 1.

Close Season

Paragraph 6 of Section 2 defines the ' close season ' for wildfowl as :

' (c) in the case of wild duck and wild geese in or over any area below high water mark of ordinary spring tides, the period in any year commencing with the twenty-first day of February and ending with the thirty-first day of August ;

' (d) in any other case, subject to the provisions of section nine of this Act, the period in any year commencing with the first day of February and ending with the thirty-first day of August ' : with the proviso that the close season may be extended (but not reduced) in any area by an Order made by the Secretary of State. Shooting in Scotland on Sundays and Christmas Day remains illegal, and the Secretary of State may make orders prohibiting shooting on Sundays in any County or County borough in England or Wales.

Sanctuaries

Section 3 deals with the power of the Secretary of State to establish bird sanctuaries and the necessity of obtaining the consent of owners or occupiers of land before an order under this section can be made.

Ringing and Damage

Section 4 contains some exceptions to the general principle of the Act. It is not unlawful to catch any wild bird for ringing and marking and then releasing it, nor to kill any bird except those on the First Schedule if the person responsible can satisfy the court before which he is charged that his action was necessary to prevent serious damage to crops, vegetables, fruits, growing timber or any other form of property or to fisheries. The word ' serious ' is of some significance.

Methods

Section 5 prohibits certain methods of killing or capturing wild birds. These include the use of live birds as decoys, if these are tethered or in any way maimed. Shot-guns ' of which the barrel has an internal diameter at the muzzle of more than one and three-quarter inches ' (i.e. large punt guns) are prohibited. Paragraph 3 of this section declares that the use of any mechanically-propelled vehicle or boat or any aircraft in ' immediate pursuit ' of a wild bird for the purpose of driving or killing that bird is unlawful. The inclusion of the word ' driving ' in this clause should be noted. Paragraph 4 provides that the use of cage-traps or nets for capturing birds for ringing shall be lawful. Rocket-propelled nets are specifically excluded from the methods of capture permitted by Section 5, but Section 10 provides that they may be used to catch birds for the purpose of ringing by persons licensed to do so. Duck decoys which are shown to have been in use immediately before the passing of this Act can continue in operation (for the capture of birds for the market, as well as for ringing).

Sale

Section 6 imposes restrictions on the sale of live and dead birds and their eggs. This section makes it illegal to sell or offer for sale during the close season any dead wild duck or goose. Section 7, restricting the importation of certain birds and their eggs, makes it an offence to import dead wildfowl during the close season.

Licences

Section 8 is concerned with the protection of cage-birds. Sections 9 and 10 deal with the powers of the Secretary of State to alter the lists of scheduled birds, to vary the close season in prescribed areas, and to grant licences for the collection of birds for scientific and educational purposes and for the use of otherwise prohibited methods of capture (such as artificial lights, stupefying baits, etc.) for approved purposes.

Advisory Committee

Section 11 established an Advisory Committee on the Protection of Birds for England and Wales and another for Scotland, to be appointed by the Secretary of State.

Sections 12 to 16 deal with enforcement, penalties and various administrative problems.

Changes

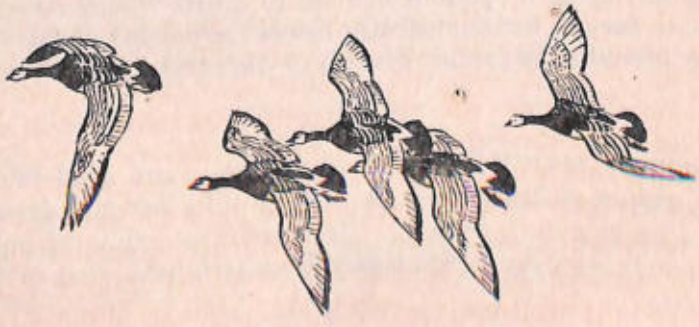
In considering the changes in law effected by this Act, it is convenient to discuss separately the protection of various species, the meaning of 'close season' and the restrictions on methods of killing birds.

The principal change in the protection afforded to individual species of wildfowl is that the Brent Goose and the Barnacle Goose are now protected throughout the year. This measure has been the subject of considerable controversy. It has been agreed that the period of complete protection should be limited to five years to begin with. Before the end of that period the status of the two species will be reviewed by the Home Office Advisory Committee, which will recommend whether the continuation of complete protection seems desirable. The power given to the Secretary of State to vary the application of the Act to particular species and particular localities by statutory orders gives useful flexibility to this legislation. Earlier orders affording additional protection to various species in prescribed sanctuaries remain in force.

Local orders can be consulted at the offices of the appropriate County or County Borough Council.

The new restrictions on methods of killing or capturing birds which affect wildfowl are the prohibition on the use of power-driven boats and the limit placed on the size of punt-guns. The latter will affect very few people. Punt-gunning itself has not been prohibited.

The prohibition on the general use of rocket-propelled nets, so that they may legally be used only for catching birds for ringing, and then only by persons licensed to do so, may be considered a tribute to the efficiency of the goose-catching operations of the Trust (which has succeeded in obtaining such a licence).



THE INTERNATIONAL COMMITTEE FOR BIRD PRESERVATION

THE Trust has recently been accorded the status of a Constituent Society in the British Section of the I.C.B.P.

The Ninth International Conference of the I.C.B.P. was held at Scanfs, Switzerland, 23–28 May 1954. A number of the discussions dealt with wildfowl problems and we wish to draw attention to some of the reports made and the resolutions carried. We are grateful to the Chairman of the British Section, for permission to reprint the following extracts from the Annual Report of the Section for 1954.

The Numbers of Brent Geese in Europe

Dr. Finn Salomonsen contributed the following statement :

'The Dark-bellied Brent Goose (*Branta bernicla bernicla*), which breeds in Spitsbergen and on the continent from East Russia to eastern Siberia is threatened with extinction. In its high Arctic breeding-places it is subject to extensive egg-collecting, and in its wintering grounds and along its migration routes it is heavily persecuted by hunters in many places, although it is now protected in a number of countries. The main wintering ground extends from southern Scandinavia westwards along the North Sea coasts to the British Isles. While the Light-bellied Brent (*B. b. hrota*) has been strictly protected in its American winter quarters and the future existence of this form is assured, and while the population of the Pacific form (*B. b. nigricans*) amount to about 175,000 individuals, according to a recent census carried out by Leopold and Smith (*California Fish and Game*, **39**, 1953, pp. 95–101), the decrease in the number of the Dark-bellied Brent wintering in N.W. Europe is alarming. The experienced ornithologists constituting the National Committees for Bird Preservation of the main wintering territories are unanimous that the total numbers of the Brent have seriously diminished and that the wintering population in N.W. Europe has probably now fallen below 20,000 individuals. The Brent has been badly hit not only by the still growing disturbances on its Arctic breeding-grounds, but still more severely by the widespread disappearance (since 1931) of its favourite food-plant, the Eel-Grass (*Zostera marina*), and by vast land-reclamations in its wintering grounds. In Denmark, where the Brent was not protected and where consequently it was heavily persecuted, a gradual decrease has taken place in the last 50 years. According to the Danish Game Statistics (started in 1940) the annual bag has dwindled from about 7000 in 1941 to 2500 in 1951. In Holland, where the Brent has been fully protected since 1950, more than 10,000 wintered before 1931 (when the Eel-Grass disappeared), but in recent years the number has decreased, and the wintering population now does not (in 1953) exceed 1000 birds, while during spring migration (in April-May) the number may increase to about 3000. Large land-reclamations are being carried out in Holland at present, and if the so-called " Delta Plan " is carried out all tidal areas of the Wadden of the S.W. Netherlands will be closed from the sea and all Brents' haunts in this region will vanish. (Information from Netherlands Wildfowl Inquiry Sub-Committee (Dr Lebret) and the Staatsbosbeheer (Dr M. F. Morzer Bruijns).) According

to verbal communication by Prof. R. Drost, Wilhelmshaven, the Brent is a scarce bird in the German part of the Wadden Sea, but is not subject to any serious persecution. The possibilities for recovery of the ill-fated European stock of the Brent are comparatively good in Danish waters, because the parasitic disease organism (*Labyrinthula*) of the Eel-Grass does not penetrate into brackish water. Consequently the Zostera vegetation of the brackish (Baltic) parts of the inner Danish waters is only slightly or not at all infested, according to information from Prof. Spärck, Copenhagen.'

Protection at present

The present situation with regard to the protection of the Brent Goose in Europe is that it is protected all the year round in two countries, the Netherlands, which accorded this species full protection in 1950, and Great Britain, which did so in 1954, under the new Wild Birds Protection Act. It is also protected all the year round in Sweden, except in four provinces. In addition in 1951 the Danish Government accorded complete protection to the Brent Goose on its breeding-grounds in North-East Greenland and Northern Ireland gave it complete protection for a period of three years.[1] That the need for further protective measures for the Brent Goose is fully realised was shown by the general agreement on the urgency of the matter not only at the international meeting of bird preservationists at Scanfs in Switzerland but also at the international meeting of sportsmen at Dusseldorf in Germany.



Resolution

The Conference of the I.C.B.P. passed unanimously a resolution in the following terms :

'The Ninth Conference of the International Committee for Bird Preservation has resolved to invite Governments concerned to take note of the serious decline during the past few decades of the numbers of Brent Geese (Branta bernicla) *wintering in North-Western Europe. This species has been badly hit not only by the widespread disappearance of its favourite food plant the eel-grass* (Zostera marina) *but also by land reclamation in its winter quarters and by growing disturbance on its Arctic breeding-grounds. The experienced ornithologists constituting the National Committees of the main wintering territories, are unanimous that the total numbers of the Brent Goose have very greatly diminished and (while precise comparative figures are difficult to obtain) it is their considered view that the wintering population in North-West Europe has probably now fallen below* 20,000. *The I.C.B.P. accordingly propose to initiate a detailed international investigation into the status of the European Brent Goose.*

[1] In Denmark all geese have recently been protected from 1 January till 31 July for ten years. This means that the open season on Brent in Denmark is confined to the months of October, November and December.

Meanwhile the Conference

(*a*) *urges the Governments concerned to recognise that the Brent Goose at present be regarded as in danger of extinction ;*

(*b*) *urges the Governments controlling the wintering and breeding areas as well as the migration routes of the Brent Goose to give it complete year-round protection as an emergency measure, to remain in force unless and until it becomes clear beyond possibility of doubt that the future existence of the Brent Goose is assured.*' [1]

Oil Pollution of the Sea

After an International Conference held in London from 26 April to 12 May, 1954, 20 Governments signed a Convention resolving the avoidance as soon as practicable of the discharge of persistent oils into the sea and laying down restrictions on the discharge of oil both from tankers and from other ships. Before the Convention becomes effective it must be ratified by the Governments concerned. Delegates to the Scanfs Conference reported on the effects of pollution on birds in their respective countries, and at the final session passed the following resolution :

The Ninth Conference of the International Committee for Bird Preservation has noted with interest the results of the International Conference on Pollution of the sea by oil held in London from 26th April–12th May, 1954. *The Draft Convention represents in the opinion of the I.C.B.P. an effective step towards the solution of the problem. The Conference invites the President and Officers of the I.C.B.P. to endeavour to secure the most rapid possible signing and ratification of the Convention by the Governments concerned, to request these Governments to follow up the additional resolutions contained in the Final Act of the London Conference, and to inform these Governments that the I.C.B.P. will carefully study the future trend of oil pollution and will keep Governments informed of its findings.*

The National Sections are requested for their part to make representations to their Governments in the same sense.

In Britain the auks and divers are the species most affected, but reports from Denmark, France, Germany and Norway all emphasised the losses inflicted on Scoters and Eiders. We would urge Trust Members to assist the British Section of the I.C.B.P. and the Royal Society for the Protection of Birds in their efforts to secure the abatement of this nuisance by sending to the R.S.P.B (25 Eccleston Square, London, S.W.1) details of oiled birds found by them. The information required is : date, place, numbers and species (where possible) of birds affected.

Despite the signing of the Convention in May, the R.S.P.B. report (*Bird Notes*, vol. 26, no. 5, p. 154) that some of the severest pollution of our beaches and seabirds for several years occurred in October 1954.

[1] In October 1954, La Commission de la Chasse des Oiseaux migrateurs, a committee of the Conseil Internationel de la Chasse, comprising representatives of the sportsmen of most of the countries in Western Europe, met in Düsseldorf. The ten resolutions and recommendations passed unanimously by the members present included one in the following terms :

[The Commission] ' Having noted the continued diminution in the numbers of the Brent Goose (*Branta bernicla*), and the danger of extinction of this species, urges that in all countries where no such provision already exists, the shooting of this bird should be entirely prohibited, at least for a preliminary period of three to five years, being of the opinion that under present conditions this is the only hope of saving this once common species from extinction.'

Wildfowl Habitats in Ireland

Mr Michael Rowan, of the Irish Ornithologists' Club, stated that schemes for the removal of peat and for extensive drainage which were planned would reduce the winter habitats of wildfowl by 100 square miles. A resolution passed unanimously by the Conference '*recommends that the Government of the Republic of Ireland be requested to reserve suitable areas where wildfowl may winter safely especially during severe seasons, in view of the fact that extensive drainage schemes planned in Ireland will drastically reduce the winter habitats of many European and some Greenland wildfowl.*'



Flightless Shelducks during moult

THE ROYAL AIR FORCE BOMBING RANGE ON THE KNECHTSAND, N.W. GERMANY, AND ITS EFFECTS ON MOULTING SHELDUCKS

DURING the last year a good deal of publicity has been given to reports of large-scale destruction by bombing of Shelducks on their moulting grounds in the Heligoland Bight. In view of the concern to which this has given rise, we think it desirable to reprint the account of the inquiries made by the International Committee for Bird Preservation, which first appeared in the Annual Report for 1954 of the British Section of the I.C.B.P.

When in 1951 Heligoland was given up as a bombing range it was mutually agreed with the Government of the German Federal Republic that this range should be transferred to the Grosse Knechtsand in the mouth of the Elbe. In December 1951, at the request of Professor Dr Drost, the position with regard to the moulting Shelduck on Knechtsand was brought to the attention of the Air Ministry and certain precautionary measures were undertaken. In March 1952, protests against bombing practice on Knechtsand appeared in the German Press but on inquiry the Vogelwarte Helgoland dissociated themselves from the matter. These protests were somewhat premature, as in point of fact no bombing practice at all was carried out that year. In June 1954, a letter of protest against bombing practice on Knechtsand and the possible destruction of Shelduck was forwarded by Dr Panzer, of Bremerhaven, to the President of the I.C.B.P., the Chairman of the European Continental Section I.C.B.P., the Secretary of the British Section, and several others. This was later followed by a series of articles and statements by various authors in the German Press concerning the enormous massacre of Shelduck on Knechtsand and expressing

the view that the birds would soon be exterminated—the number stated to have been killed grew from 40,000 to 70,000. As a result of these Press reports protests were received by the British Section from various organisations in Germany, from the Danish, Netherlands, Swedish, and Swiss National Sections, from the International Union for the Protection of Nature, and also from private individuals. In the meantime the British Section had communicated with Professor Dr Drost and on learning that he was also of the opinion that large numbers of Shelduck were being destroyed as a result of bombing practice, asked him to supply exact data as to the numbers of dead birds found, dates, names of observers, and so on, for naturally no action could be taken merely on the evidence of Press reports. A report was duly submitted by Professor Dr Drost giving the total number of birds found by his observers as 12,484, but setting forward reasons, such as conditions of tide, wind, etc., to support the view that the actual number was in fact much larger. This report was forwarded by the Chairman of the British Section to the Secretary of State for Air asking for his sympathetic consideration, and a prompt reply was received inviting the Chairman and Secretary of the British Section to meet him and discuss the matter. At this meeting the Minister expressed his interest and sympathy regarding the Shelduck and stated how anxious he was to do whatever possible to ensure that these birds were not menaced in future years, and also pointed out the necessity of securing accurate estimations as to what extent they were affected. Various points were discussed and subsequently agreed upon. These were publicly announced in the House of Lords by the Secretary of State for Air, Lord de L'Isle and Dudley, on 16 February 1955, in reply to a question put by Lord Tweedsmuir.

'This bombing range was selected with the co-operation and agreement of the German Federal Government to take the place of Heligoland which was used for bombing training until 1951. It is located on sandbanks off the north-west coast of Germany, the target area being about five miles from the shore. It was first used for bombing training in the autumn of 1953. The Shelduck appear to use these sandbanks during their moulting season in July and August. The duck are flightless during this season which is thus the period of danger. Reports have been made from German sources of heavy destruction of duck during the moulting season of 1954, the first such season when bombing has taken place. There are, however, other estimates throwing doubt on the number of duck reported as destroyed.

'As a result of discussions which I have had with the Chairman of the British Section of the International Committee for Bird Preservation, new arrangements will be made for the use of the range during the next moulting season. Only practice bombs will be dropped containing only a small charge to set off a smoke marker, which will mean that there will be no blast effect. The Royal Air Force will co-operate with ornithologists under arrangements to be made with the British Section of the International Committee, to inspect the range before and after bombing has taken place to establish its effect on the Shelduck. By these measures there is every hope that in the future the species will be able to moult without being seriously molested.'

Most unfortunately, a statement issued to the Press on 28 February, 1955 by the Brussels headquarters of the International Union for the Protection of Nature announced that the Royal Air Force had agreed not to use the bombing range in the summer of 1955. This is quite incorrect and is due to a misinterpretation of the statement by Lord de L'Isle and Dudley.



GENERAL ACTIVITIES AND ADMINISTRATION

VISITORS TO THE NEW GROUNDS

The numbers of schools and organised parties which visited the Trust between April 1953 and April 1954 were 374, an increase of nearly 100 on the previous year. The numbers of other visitors also increased very substantially, the gate-takings totalling over £3,500, which indicates an attendance of between thirty and forty thousand people.

DIRECTOR'S LECTURES

The Director has undertaken a series of talks on Television which illustrate the various expeditions and activities of the Trust. During the year these included two broadcasts from the New Grounds. The value of these Television broadcasts in spreading interest in the Trust's work need hardly be emphasised.

In January 1954 two lectures were given by the Director in the Royal Festival Hall on his visit to South America. A different film was shown on each occasion and the Hall was filled almost to capacity both times. Photographs by Miss P. Talbot-Ponsonby illustrating the visit were exhibited in the ceremonial foyer of the Hall. The organisation of these lectures was undertaken once more by Miss E. R. Gregorson to whom the Council is extremely grateful for the successful outcome.



SEVENTH ANNUAL GENERAL MEETING

MINUTES

THE Seventh Annual General Meeting of the Severn Wildfowl Trust was held at the Royal Society of Arts, John Adam Street, London, W.C.2, on 24 March 1954.

The following officers and Council Members were present :

President : Field-Marshal the Rt Hon. the Viscount Alanbrooke, K.G., G.C.B., O.M., G.C.V.O., D.S.O. (in the Chair).

Hon. Treasurer : Sir Archibald Jamieson, K.B.E..

Hon. Director : Peter Scott, Esq., C.B.E., D.S.C.

Council : Guy Benson, Esq., James Fisher, Esq., K. Miller Jones, Esq.

Hon. Secretary : Michael Bratby, Esq.

1. Apologies for absence were received from the Duke of Beaufort and Sir Percy Lister and a telegram of good wishes was read out from James Robertson Justice, Esq.

2. The Minutes of the Sixth Annual General Meeting, which had been circulated with the Report of Council were taken as read and signed by the President.

3. The President moved the adoption of the Report of the Council and the Accounts to 31 December 1953. He referred to the satisfactory excess of income over expenditure for the year of £343, and thanked Members for their continued support in spite of the increase in subscription which had resulted in a fall in membership figures of only 223 during the year.

In seconding the adoption the Hon. Director, Mr Peter Scott, gave Members the latest news of the Hawaiian Geese at the Trust, and told them that 16 eggs had already been laid this season.

Mr Scott then informed Members that the new buildings were complete and that he and the staff were now in occupation. There was also a Research Laboratory and a Dark Room, which had been equipped with the generous assistance of Messrs Kodaks, to whom the Trust is most grateful. In referring to the Accounts Mr Scott explained that Dr Frank McKinney had now been released from the terms of the £700 grant from the Nuffield Foundation in order to take up the offer of an appointment at the Delta Waterfowl Research Station in Canada. Mr Scott pointed out the value to the Trust of this link with the Delta Waterfowl Research Station and hoped that it would make co-operation between the two bodies even closer than before.

During the subsequent discussion one Member suggested that a scheme for adopting birds in the collection by paying for their food would perhaps provide a useful source of revenue to the Trust. Mr Scott thought the suggestion was well worth looking into, so long as it did not seem likely to be confused with the adoption of ringed ducks, which was at present organised by the Wildfowl Inquiry Committee.

Mr J. Death then raised the question of the purchase of hens for sitting and noticed that there was no figure in the accounts to cover the sale of these hens after the close of the breeding season. The Director explained that these were not re-sold but were kept for use again the following year.

The Report of the Council and the Accounts were adopted unanimously.

THE SEVERN WILDFOWL TRUST

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31 DECEMBER 1953

1952	EXPENDITURE	£ s. d.	£ s. d.
£			
8,475	To Valuation, 31 December 1952		7,725 0 0
2,314	„ Food for Wildfowl	2,081 17 11	
622	„ Purchase and Transport of Wildfowl and Eggs	1,016 4 3	
3,996	„ Wages and National Insurance	4,517 4 5	
180	„ Rent, Rates and Insurance	347 7 6	
39	„ Purchase of Hens for sitting	45 8 0	
875	„ Materials, Repairs and Replacements	1,742 0 0	
69	„ Carriage on Birds sold	58 11 10	
269	„ Land Rover Expenses, etc.	445 12 8	
353	„ Staff Travelling Expenses	362 19 11	
157	„ *Narrow Boat 'Beatrice,' Running Expenses*	—	
583	„ Office Expenses, Postages, etc.	862 4 10	
565	„ Printing and Stationery, General	1,266 14 3	
389	„ Printing Christmas Cards	308 8 7	
—	„ Post Cards	282 13 9	
1,744	„ *Printing Fourth Annual Report*	—	
—	„ Printing Fifth Annual Report	2,138 16 7	
927	„ *Reprinting 'Key to the Wildfowl of the World'*	—	
1	„ *Photographs for Fourth Annual Report*	—	
71	„ *Books*	—	
—	„ Ties	370 10 0	
98	„ Telephone	147 1 4	
145	„ Bank Charges	117 14 9	
290	„ Miscellaneous	311 11 4½	
362	„ Rocket Netting	425 17 0	
14,049			16,849 1 11½
27	„ *Expenses of Research Student to Canada*	—	
61	„ *Icelandic Film*	—	
120	„ Expenses of Annual Dinner		164 15 0
—	„ Icelandic Expedition Expenses		792 0 9
—	„ Installation of Electric Main		1,000 0 0
—	„ Road-making		655 0 0
—	„ New Pool		250 0 0
—	„ Written off Buildings		400 0 0
—	„ Expenses, Festival Hall Lecture		679 16 11
1,000	„ *Transfer to Pilgrim Trust Reserve Account*		—
			28,515 14 7½
—	„ Balance, Excess of Income over Expenditure for the year		342 19 10½
£23,732			£28,858 14 6

1952	INCOME	£ s. d.	£ s. d.
£			
5,691	By Subscriptions		6,839 3 5
2,775	„ Income Tax Repayable on Covenants		2,094 8 0
57	„ Gift Tokens		37 17 9
503	„ Donations		236 11 9
—	„ Donation for construction of new Pool		250 0 0
	„ Takings:—		
2,230	Gate	3,515 13 4	
124	*Narrow Boat*	—	
2,354			3,515 13 4
60	„ Fees and Collections at Lectures		1,332 1 0
	„ Sales:—		
1,326	Surplus Wildfowl	374 5 11	
19	First Annual Report	10 6	
5	Second Annual Report	1 0 0	
361	Third Annual Report	127 19 11	
169	Fourth Annual Report	338 18 7	
—	Fifth Annual Report	258 2 2	
341	'Key to the Wildfowl of the World'	31 5 5	
88	Booklets	27 17 10	
70	Books	41 17 0	
—	Post Cards	235 8 9	
873	Christmas Cards	745 18 5	
285	Prints	185 7 1	
172	Paintings	236 5 0	
—	Ties	442 4 3	
3,709			3,632 0 10
135	„ Receipts, Annual Dinner		165 5 0
—	„ Receipts, Iceland Expedition		826 9 4
153	„ Dividends and Interest		15 14 1
	„ Installation of Electric Main:—		
—	Contribution from Mr. Peter Scott	250 0 0	
—	Transfer from Pilgrim Trust Reserve Account	750 0 0	
—			1,000 0 0
5	„ *Surplus on Realisation of 3% Defence Bonds*		—
7,725	„ Valuation, 31 December 1953		8,513 0 0
23,716			28,858 14 6
16	„ *Balance. Excess of Expenditure over Income for the year*		—
£23,732			£28,858 14 6

NOTE.—The figures in the margin are those for the year ended 31 December 1952 and are given for the purpose of comparison only

THE SEVERN WILDFOWL TRUST

BALANCE SHEET FOR THE YEAR ENDED 31 DECEMBER 1953

LIABILITIES

£		£ s. d.	£ s. d.
	Sundry Creditors :—		
1,568	On Open Accounts	2,831 11 5	
1,000	Berkeley Estates Company	—	
2,568			2,831 11 5
	Bank :—		
	Overdraft. Westminster Bank Ltd.	344 2 6	
	Less Cash at Lloyds Bank Ltd.	45 11 3	
—443			298 11 3
1,000	Loan Accounts		10,405 0 0
	Grant from Nuffield Foundations :—		
	Amount received	700 0 0	
	Less Expenditure incurred to date	88 0 0	
			612 0 0
	Reserve Account :—		
	Grant from Pilgrim Trust :—		
	Balance, 31 December 1952	4,000 0 0	
4,000	*Less* Transfer to Income and Expenditure Account	750 0 0	
			3,250 0 0
	Income and Expenditure Account :—		
	Balance, 31 December 1952	5,121 7 1½	
	Add Excess of Income over Expenditure for the year	342 19 10½	
5,121			5,464 7 0
£12,246			£22,861 9 8

ASSETS

£		£ s. d.	£ s. d.
27	Cash in Hand		10 4 10
	Sundry Debtors :—		
119	On Open Accounts	483 18 3	
—	Inland Revenue for Repayments on Covenants ..	2,094 18 0	
2,584	Messrs. J. & A. Scrimgeour (Deposit)	2,190 0 3	
2,703			4,768 16 6
	Investments, at Cost :—		
500	£500 2½% Funding Stock, 1956–61	500 11 4	
200	£225 Northern American Trust Co. Ltd., 3% Redeemable Debenture Stock, 1965–75 ..	199 17 0	
—	£400 Tate & Lyle Ltd., 4¼% Debenture Stock, 1968–78	394 0 0	
700			1,094 8 4
	Valuation :—		
6,450	Wildfowl	7,353 0 0	
230	Land Rover	160 0 0	
1,045	Coops, Henhouses, Huts, etc.	1,000 0 0	
7,725			8,513 0 0
	Narrow Boat :—		
1,000	Valuation, 31 December 1951	1,000 0 0	
	Less Rent to 31 December 1952 .. 25 0 0		
	Rent in year ended 31 December 1953 .. .. 100 0 0		
25		125 0 0	
975			875 0 0
	NOTE.—The Narrow Boat is hired from the Trust under a ten-year agreement at £100 per annum, payable by quarterly rents of £25 in advance, as from 21 October 1952, with the option to purchase for ten shillings, after rents amounting to £1,000 have been paid.		
	New Buildings, etc., New Grounds, Slimbridge, Gloucestershire	8,000 0 0	
	Less Written off	400 0 0	
			7,600 0 0
	NOTE.—The New Buildings, etc., to be written off over a period not exceeding that of the proposed lease.		
116	*Festival Hall Lecture*		
£12,246			£22,861 9 8

We have examined the above Balance Sheet of The Severn Wildfowl Trust, dated 31 December 1953, together with the accompanying Income and Expenditure Account and find them to be in accordance with the Books and Vouchers produced to us and the information and explanations given to us.

Stroud, Gloucestershire.
19 February 1954

(Signed) S. J. DUDBRIDGE & SONS,
Auditors.

4. The re-election to the Council of the following retiring Council Members was proposed by Mr Michael Bratby, seconded by Mr Guy Benson, and carried unanimously :

C. T. Dalgety, Esq., H. H. Davis, Esq., K. Miller Jones, Esq., Miss P. Talbot-Ponsonby.

5. The election of officers for 1954–55 was, at the wish of the Meeting, taken en bloc, proposed by Mr Atkinson-Willes, seconded by Major Rufus Clarke and carried unanimously.

6. The President called upon the Director to propose the following motion under item 4 (i) and (ii) on the Agenda for the Meeting :

(i) That Rule 1 shall be altered to read : ' The name of the Trust shall be THE WILDFOWL TRUST.'

(ii) That the first of the definitions in Rule 4 shall be altered to read : ' The Trust ' shall mean ' THE WILDFOWL TRUST.'

Mr Scott explained that the growth of the Trust from a local society into an international organisation called for a change in the name which at present had the effect of misleading people about its sphere of activity. Government and other grants would be easier to obtain if the Trust was listed as a national organisation. He was well aware of the arguments against a change and mentioned the parallel in the field of cricket where a local club now exercised national control and still retained its local name. It could be argued that it was a pity to change a name when things were going well as there was a risk of people mistaking the reason for the change and tending to assume that things must be going badly.

In spite of these arguments, however, he still felt, and Members of the Council, including Mr Max Nicolson, Director-General of the Nature Conservancy, supported him, that it would be advisable to drop the name ' Severn.' It would facilitate the plans to establish branches of the Trust in other parts of the British Isles and particularly in Scotland. The motion was seconded by Mr Miller Jones.

The Meeting was thrown open to discussion and ' The Wildfowl Trust of Great Britain ' was suggested. Major Rufus Clarke pointed out that by changing the name of the Trust, its very nature would be changed. Mr T. L. Outhwaite supported the motion because he said people who were ignorant of its existence were continually asking him where was the ' Sixth ' Wildfowl Trust ? Mrs Rait Kerr said she felt it was a pity to drop a name which was so well-known now and suggested it might be better to call it ' The Severn and International Wildfowl Trust.' Mr Death said he was in favour of another prefix if the word ' Severn ' was to be dropped and suggested ' The British Wildfowl Trust.'

Major Knight supported the motion on the grounds of brevity and said that those who know it well already referred to it as ' The Wildfowl Trust.' Another member suggested it might be called ' The Peter Scott Wildfowl Trust.'

The President then asked Lord Hurcomb for his opinion in the matter and he said that development was bound to take place as the amount of scientific work to be done by the Trust increased. It was therefore necessary to depart from the localised name of the Trust although its origin need not and should not be forgotten. He thought the advantages to be gained by the change outweighed the sentimental objections and further added that the new name would be much more accurate.

Mr Scott again mentioned the plan to establish a branch in Scotland which it was hoped would be financed by Scottish interests—in which case it would be absolutely vital to overcome the localisation problem.

The Motion was put to the Meeting and carried by 55 votes to 7.

The President then called upon the Director to propose the following Motion —under item 4 (iii) on the Agenda for the Meeting.

(iii) That in Rule 12 (1) the second sentence shall be deleted and the following shall be substituted therefor :

'The Council shall be chosen from the Members and shall consist of not less than five or more than ten Councillors, elected by the Members in General Meeting on the nomination of the Council, and not more than five additional Councillors who may be co-opted each year by the Council.'

Mr Scott explained that the broadening of the Trust's scientific programme led to the necessity for appointing a Scientific Committee as approved by the Council and consequently the appointment of new Members to the Council—hence the proposal to increase its maximum number.

The Motion was seconded by Mr Miller Jones, put to the meeting and carried unanimously.

7. Messrs S. J. Dudbridge, of 8 Lansdown Road, Stroud, were appointed auditors for the ensuing year.

8. Under the heading Any Other Business, Mr Hardcastle proposed a vote of thanks to the Director and the Council, and in doing so asked if the policy of the Council with regard to conservation of wildfowl could be clarified. He felt himself that the best way—as the Americans had discovered—was for co-operation between the protectionists and the wildfowlers to tackle the problem amicably together, which was not being done in this country today. The progress of the Protection of Birds Bill through Parliament had shown up the discord which existed between these two groups and he felt it would be an excellent example to all if the Trust were to offer a seat on the Council to a wildfowler.

The present discord resulted in wildfowlers failing to return the rings of the geese they shot and it should be remembered that the wildfowlers were as interested in the conservation of wildfowl as anyone else. Two points stood out clearly in the discussions of the Protection of Birds Bill as bones of contention—one was the fixing of the limits of the shooting season, and the other the protection of the Brent Goose and Barnacle Goose. He asked for clarification by the Council of the Trust's policy.

Major Rufus Clarke endorsed this request. The Director thanked Mr Hardcastle for his eloquent speech and said the Trust, in steering a middle course in the present controversy, became a target for the extremists on both sides. The policy of the Trust was to collect scientific facts—entirely objectively. He said his own views and those of the Trust had recently been set out in an article which had been sent to the *Shooting Times*, whose Editor had agreed to publish it, although it had not yet appeared. He hoped, however, that this would have the effect of offsetting the distrust which obviously existed. He said the main aim of the Trust was to help to conserve the stocks of wildfowl. He was supported by the Council members present in saying that they were most anxious to carry the wildfowlers with them in pursuit of this policy of conservation.

Lord Hurcomb said he was interested in wildfowl from the point of view of conservation, but he had no objection to legitimate wildfowling. He said the real interests at stake were those of the *wildfowl themselves*; these were often superseded by the interests of the parties concerned who usually adopted the short term view. The wildfowlers themselves had suffered from this in the past. He could not agree with the new proposal in the present Bill to advance the shooting season on the foreshore to 21 February in all counties.

In conclusion the President mentioned the gratitude which the Trust felt for the work which the Director had done on its behalf—by expending a vast amount of energy and time he had succeeded in widening the interests of the Wildfowl Trust and increasing its membership all over the world—travelling as he did to South America, Iceland and Scotland and giving lectures in the Royal Festival Hall as well as in many other parts of the country. He felt very strongly that no one should take for granted the wonderful work which Mr Scott was doing for the Trust.

ANNUAL DINNER

After the Annual General Meeting on 24 March 1954 a Dinner was held for Members and their guests at the Waldorf Hotel. The following were present:

Lord Alanbrooke, D. W. Allen and guest, Miss B. Armstrong and guests, Michael Ayrton and Mrs Ayrton, S. Bain and guest, Miss S. Bayley and guest, Miss D. H. de Beer, G. Benson and Lady Violet Benson, A. E. V. Boggust and Mrs Boggust, J. Brading and guest, A. Bull, P. Burton, Miss U. Cameron and guest, Mrs M. D. Clayton and guest, E. Cohen and guest, Lady Craven, Miss J. Crone and guest, J. O. Death, Mrs K. Digby and guest, K. Elphinstone, J. Fisher, Miss E. Forster, Miss E. R. Gregorson, H. K. Hallam and Mrs Hallam, E. Horsfall, Lord Hurcomb, C. Ingram and Mrs Ingram, Dr M. J. Ingram, Sir Archibald Jamieson, K. Miller Jones, Miss A. Kendrew, Major-General Sir John Kennedy, Mrs H. M. Rait Kerr, Major M. Knight and guest, E. N. Kitcat and Mrs Kitcat, Osbert Lancaster and Mrs Lancaster, Miss M. Lea, Miss C. Longfield, G. Mountfort, P. R. Muxton, W. K. Oliver, T. L. Outhwaite and guest, T. C. Ribchester and Mrs Ribchester, Miss M. L. Roberts, Mrs B. M. Robins and guest, J. J. Spilman and guest, L. Spinks and guest, Miss M. Spinks and guest, Mrs M. D. Tapp and guest, Miss H. C. Thomae and guests, Miss K. Tousey, A. B. B. Valentine and Mrs Valentine, Major-General C. B. Wainwright, Vice Admiral J. W. A. Waller and Mrs Waller, A. I. Whitlock, G. Atkinson-Willes and guest, C. de Worms, J. Yealland.

The Toast List was as follows:

H.M. The Queen.

Proposed by the President, Field-Marshal the Viscount Alanbrooke, K.G., G.C.B., O.M., G.C.V.O., D.S.O.

The Wildfowl Trust.

Proposed by Michael Ayrton, Esq.
Reply by James Fisher, Esq.

The Guests.

Proposed by the Rt Hon. the Lord Hurcomb, G.C.B., K.B.E.
Reply by Osbert Lancaster, Esq., C.B.E.



Catching wildfowl with clap-nets in Ancient Egypt. (Above) from the Tomb of Sheshi. (Below) from the Tomb of Ke-gem-ni, both at Sakkara.

Lehnert and Landrock, Cairo





A catch of 675 Pinkfeet (flightless adults and goslings) being driven into the nets on the top of Oddkelsalda, Central Iceland, on 26 July, 1953.

W. J. L. Sladen





W. J. L. Sladen

Two catches of over three thousand flightless Pinkfeet in Central Iceland. (Above) Geese mustered on the top of Arnarfellsalda which gave a catch of 3,115 on 29 July, 1953.

(Below) A catch of 3,167 Pinkfeet and 1 Barnacle on Hjartarfellsalda on 21 July, 1953.

C. Sellick







(Top) Flightless Pinkfeet mustering on the top of a 'wave' in Central Iceland. (Middle) A catch of 1,892 geese on Gæsapufa on 4 August, 1953. (Bottom) The birds resting and sleeping in the corral while waiting to be ringed.

C. Sellick



W. J. L. Sladen

(Above) Ringing geese in Central Iceland. The rings are in strings of 100; those carried round the shoulder or neck are used for goslings and those hanging on the stake for adults. (Right to left) Peter Scott, Christopher Sellick, Hugh Boyd and Arni Magnusson. (Below) A leucitic Pinkfoot gosling, pale buff in colour, ringed on 4 August, 1953, compared with a normal gosling.

C. Sellick





G. K. Yeates

The main Pinkfoot nesting cliff in the Krossárgil in North Central Iceland. Beyond the gorge is the valley of the River Skjálfandafljot. The nest shown opposite, by which the gander stands on tip-toe at the approach of danger, is on a buttress at the far end of the gorge on the left (where the pale scree cuts the cliff). Another nest is at the bottom of the dark cleft at left.





R. Webbe

Catches of flightless geese in Spitsbergen, July, 1954. (Top left) Pinkfeet caught in Reindalen. In the other pictures Pinkfeet, Barnacles and Brents were rounded up together. At top right the central Pinkfoot shows new primaries beginning to grow.

J. Goodhart







(Above) Pinkfeet arriving in a stubble field in Lancashire. (Below) Pinkfeet arriving in a stubble field near the Solway Firth in which the rocket nets are set. This is the breathless time when they may or may not settle in the right place.

J. V. Beer





(Above) The rocket nets are fired. (Below) After being ringed the geese are released from the keeping cages. These are made of hessian and contain a compartment for each goose; when they are lifted the geese remain on the ground and fly off together so that the flocks and families are not broken up.

J. V. Beer









(Opposite top) Whitefronted Geese flying over the Dumbles at the Trust's headquarters in the characteristic formation adopted when they have been disturbed by aircraft—in this case a helicopter, of which they seem to be particularly scared. (Middle) Wild Red-breasted Goose among the Whitefronts asleep on the Dumbles. Photograph taken with 11-in. telephoto lens through x 40 binoculars in the Graham Robertson Tower. (Bottom) A family of Whitefronts feeds close to one of the observation huts; on the right the adult female, the five goslings with the head of the gander at top left.

J. V. Beer
P. Glasier
J. V. Beer

Many wild Pintails spend the winter in the Trust's enclosures. The highest winter count has been 87 but it seems likely that more are often present in the various enclosures. It is particularly pleasant that a bird so seldom seen in numbers on fresh water in Britain should regularly join the tame birds and (so long as they are in the pens) become tame with them. (Above) They fly over the Decoyside Pens. (Below) A drake stands on the ice in the Rushy Pen.

J. V. Beer



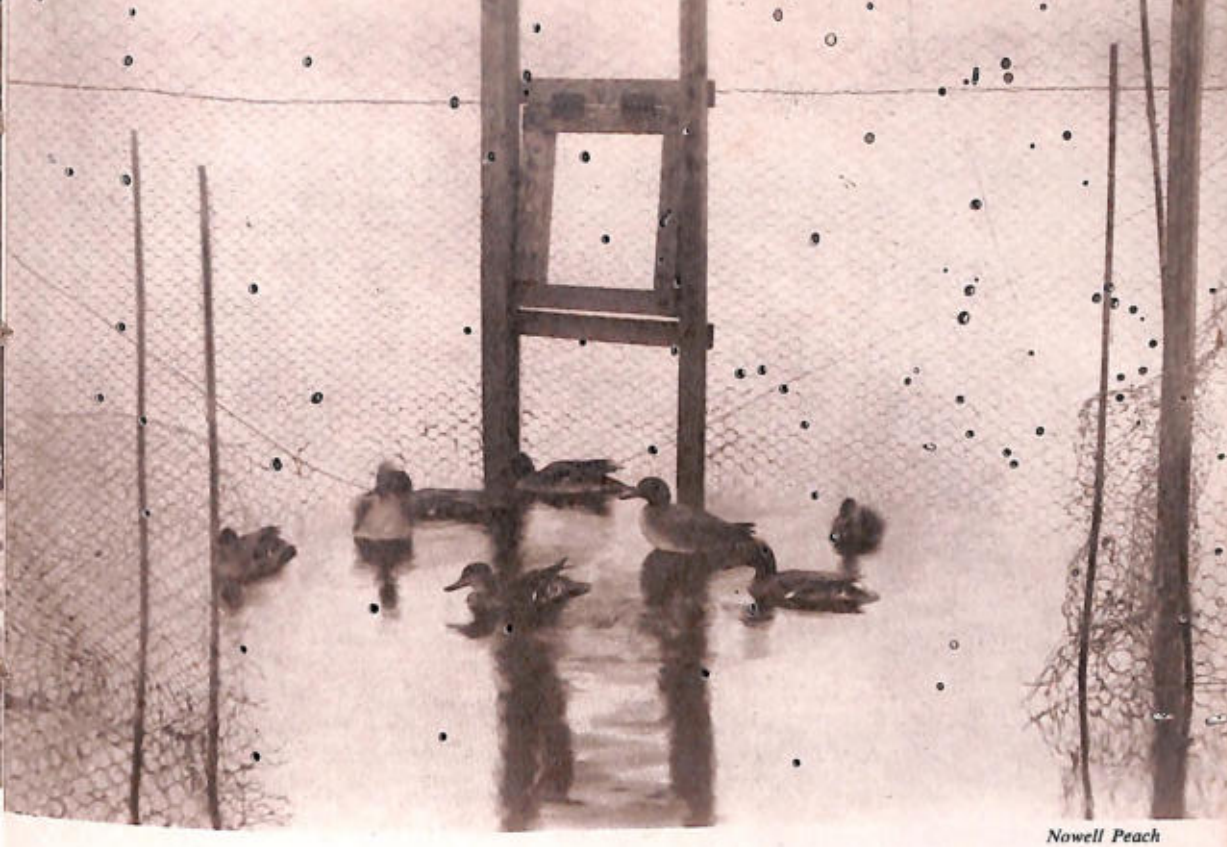
R.A.F.

(Above) An aerial view of the 17th-century 8-pipe decoy at Borough Fen, near Peterborough, Northants, which is now being used exclusively for ringing ducks for the Trust.

(Below) Ducks on the ice-covered 2½-acre pool.

F. Williams



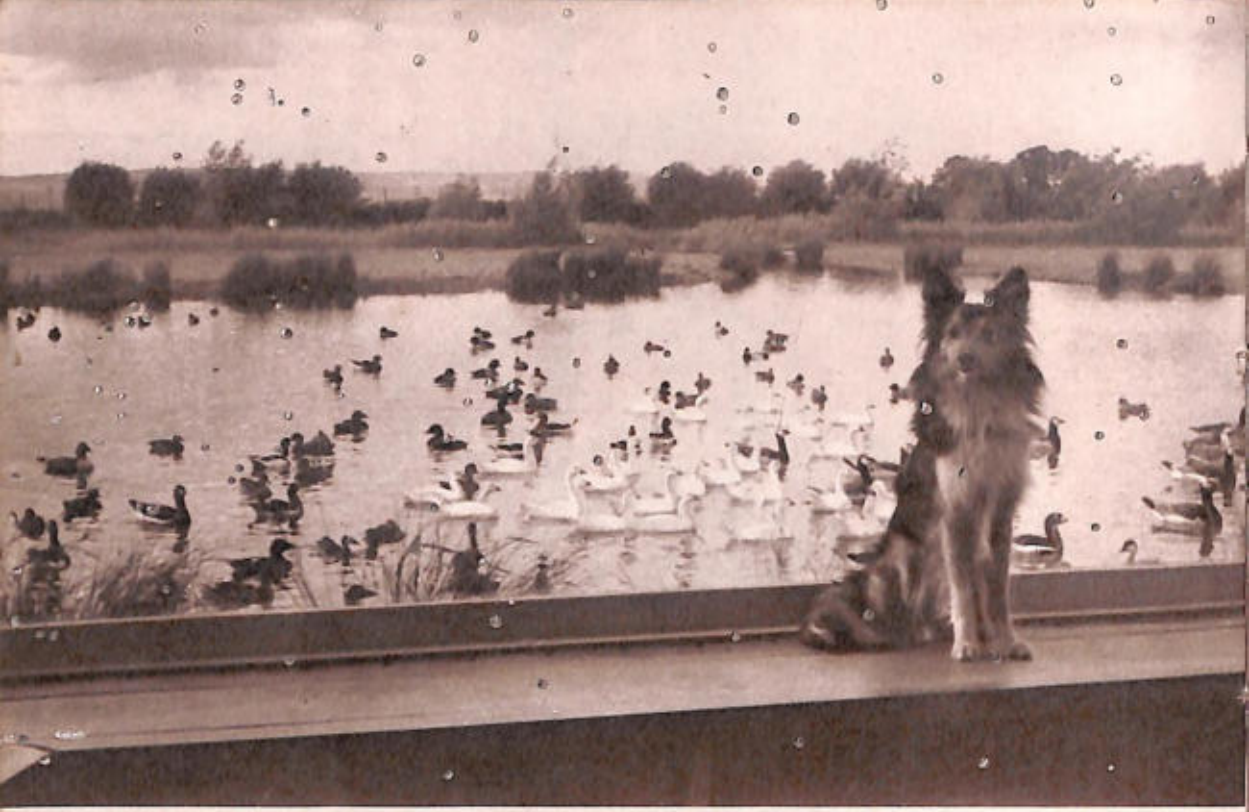


Nowell Peach

The Ringing Station on the 1,200-acre Reservoir at Abberton in Essex is now administered by the Trust. (Above) One of the 29 traps in which ducks and many other species of birds are caught. (Below) Major-General C. B. Wainwright, who founded the station and operates it, releases a drake Teal.

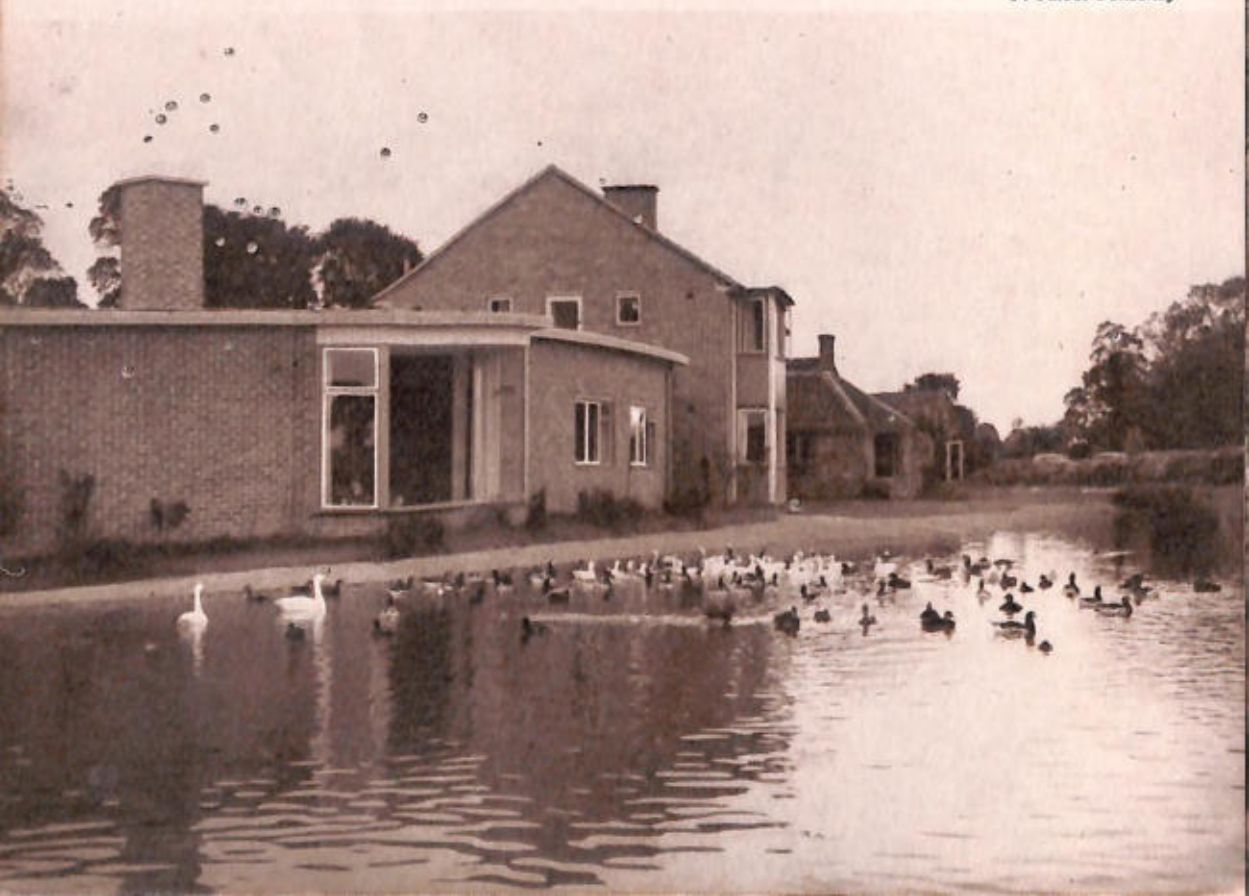
Essex County Standard





Piper, the decoy dog (a Shetland collie), attracts the birds in the Rushy Pen to the window of the Director's studio. The flock of 27 Ross's Geese is among them. The top picture is taken through the 12-foot window shown in the bottom one.

P. Talbot-Ponsonby





(Above) Two-year-old Miss Dafila Scott feeds the birds on the new pond in front of the new buildings. (Below) From left to right the buildings are the flat-roofed studio, the Director's house, the staff hostel sitting room and row of six bedrooms, two offices and, at the far end the original cottage now occupied by the Curator and his family. The laboratory wing is behind the Director's house and runs at right angles to the hostel.

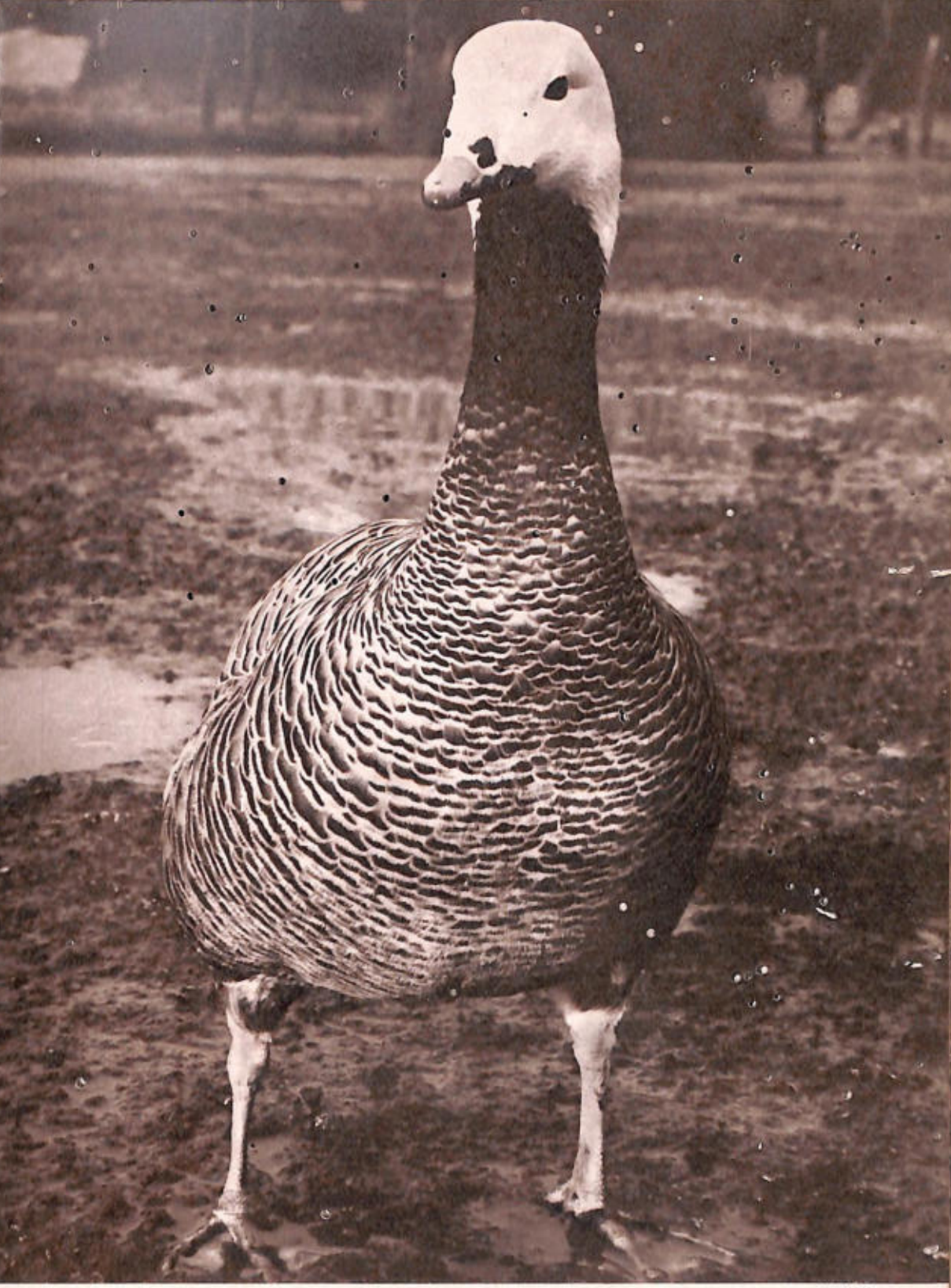
P. Talbot-Ponsonby



P. Talbot-Ponsonby

(Above) Pair of Ne-nes and friend. (Below) A pair of Black Swans from Australia each drying a foot. The cob (left) is on loan to the Trust from Sir Winston Churchill.

J. V. Beer



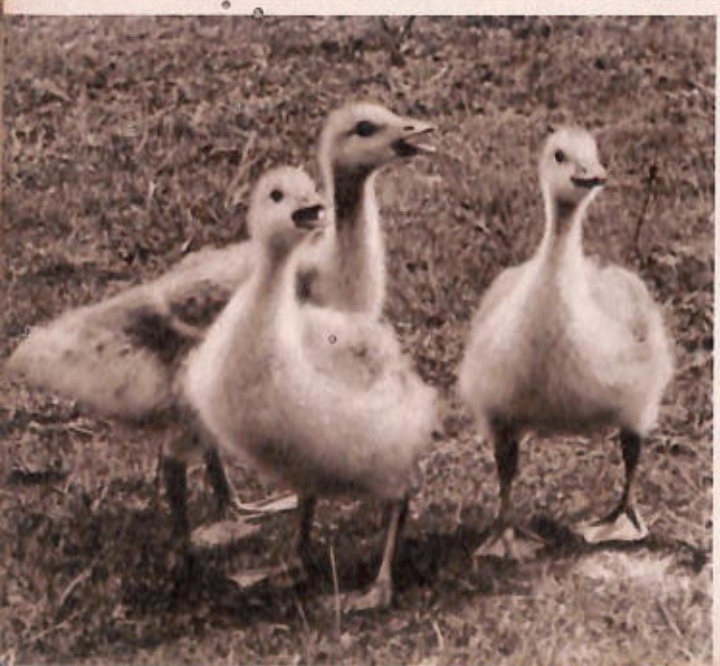
J. V. Beer

Emperor Goose from Alaska, of which a number are kept full-winged at the New Grounds.





P. Glasier
D. Farrell



Barheaded Geese from India. The sinuous neck movements of the display in this species make their appearance early in life. The small goslings are about three weeks old and the larger ones about six to seven weeks old. Opposite is an adult Barhead gander.

P. Scott
(Opposite) P. Scott





(Above) Drake Ring-necked Duck. An adult drake of this N. American species arrived on the pond a few yards from the studio window at the New Grounds on 12 March, 1955. It remained only three days and was unfortunately not photographed. It was almost certainly a wild bird and the first recorded in Europe since Donovan's description of the species from a specimen 'exposed for sale in Leadenhall Market' in January, 1801, and said to have been taken in the Lincolnshire fens. (Below) Drake Tufted Duck in eclipse plumage. Note ring on which part of the number can be read.

J. V. Beer





J. V. Beer

Pair of Tufted Ducks, the commonest British diving duck whose range extends across Europe and Asia to the Pacific and in winter from Morocco to South China. A few wild Tufted Ducks live in the pens. The male shown opposite is mated to a pinioned female and has remained in the Rushy Pen for four and a half years.



Drake Smew—the smallest of the British saw-billed ducks which breeds in holes in trees in the northern forests, from Scandinavia to Siberia, and winters from Britain to Japan. Smews are most commonly seen in this country on reservoirs in the months of January and February.

P. Glasier





MEMBERSHIP

Members

Annual subscription 2 guineas. Free access to pens and to observation huts. May bring one guest. One copy of Annual Report and periodical Bulletins. Vote at General Meetings.

Associates

Annual subscription 10s. Free access to pens and to observation huts. Bulletins but no copy of Report.

Corporate Membership

Annual subscription 2 guineas. Free access to pens and to observation huts, but only in parties of not less than 10. Not before 1 p.m. on Sundays. One copy of Annual Report and of Bulletins for each Corporate body. (This membership is open only to Schools, Universities, Youth Clubs, and Teachers' Training Colleges.)

Parish Members

Annual subscription 2s. 6d. Free access to pens only. May bring a guest (This membership is only open to those residing in the Parish of Slimbridge.)

Contributors

Societies, Clubs, Institutes, Libraries and other organisations not qualifying for Corporate Membership, also private firms, may be enrolled as Annual Contributors, and as such, if their contribution is 1 guinea or more, they receive Annual Reports and Bulletins. One Member's Card, in the name of a Director, Secretary or other officer, will be issued, if desired.

General Public

Admitted to the pens only, at 2s. 6d. (children under 16, 1s.), but not before 1 p.m. on Sundays. The enclosures are open from 9 a.m. till sundown every day of the week with the exception of Sunday mornings, which are reserved for Members only.

Parties

Arrangements can be made for a warden to show round parties of not less than 10 and not more than 35, but applications must be made in writing well in advance.

Enrolment in any form of membership can be arranged on the spot at Slimbridge.

OBITUARY

The Council has learned with deep regret of the deaths (notified since the last issue of the Annual Report) of the following Members :

S. Atkin
T. R. Barnard
G. van den Brink
Colonel R. V. Buxton
Miss E. F. Chawner
Col Sir Lionel Darell, Bart, D.S.O., D.L.
Miss Margaret Galbraith
W. G. Grant
W. Hardy
Mrs I. Hearle
T. L. Henderson
Air-Commodore T. C. R. Higgins, C.B., C.M.G.
Sir Reginald Hervey Hoare, K.C.M.G.
Mrs E. Hobbs
F. Howitt
Mrs J. Lewton
G. E. Lodge
L. W. Millward
Sir George Bond Morton, O.B.E., M.C.
Mrs O. Olive
Colonel Sir John Parsons, C.B.E.
Dr B. B. Riviere
W. E. Shipton
H. N. E. Spencer
Miss Joyce Whillis
Sir Walter Williamson, C.M.G.



MEMBERS OF THE WILDFOWL TRUST

JUNE 1954

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LIFE MEMBERS

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H.E. Ahmed Abboud
Mrs. Y. M. Baker
G. H. Benson
Lt.-Col. R. L. Benson, D.S.O., M.C., M.V.O.
F. A. Kemmis Betty
J. H. Bevan, C.B., M.C.
Michael Bratby
A. V. Bridgland
Major Hon. Henry Broughton
Miss Bury
R. J. Buxton
Miss D. A. Cadbury
H. G. Calkin
Major R. C. R. M. Clarke
Mrs. M. W. Clayton
G. R. Cobb
Edwin Cohen
J. M. Craster
Lord Dulverton of Batsford, O.B.E.
Lord Egerton of Tatton
C. Engelhard
A. Ezra, O.B.E.
P. Fleming
Mrs. J. H. B. Forster
Hon. Geoffrey Gibbs, C.M.G.
P. L. Gordon
Mrs. M. Greenslade
Mrs. J. B. S. Haldane
G. P. Harben
Sir Archibald Jamieson, K.B.E.
James Robertson Justice
Miss E. M. Knobel
J. A. Lister
Sir Percy Lister
J. W. Livermore
S. L. Lloyd
C. W. Mackworth-Praed
Mrs. J. M. Macmillan
I. D. Malcolmson
Miss T. A. Miller
A. F. Moody
Henry S. Morgan
P. Murray
C. D. Norton
R. W. Parkyn
Hon. Clive Pearson
G. L. Pilkington
Kerrison Preston
D. Robarts
Peter Scott, C.B.E., D.S.C.
Sir William Seeds, K.C.M.G.
Mrs. W. J. Short
R. Simpson
Sir Keith Smith, K.B.E.
W. Proctor Smith
Group-Capt. R. Smyth-Pigott
Whitney Straight, C.B.E., M.C., D.F.C.
Lt.-Col. A. H. C. Sutherland
Miss E. Tonks
Mrs. Carll Tucker
Sir George Usher
H. Whitbread
G. T. Wilkins
Capt. W. D. M. Wills

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Major C. Abbott
Rev. R. B. Abell
Miss C. M. Acland
Mrs. A. E. Adam
A. M. Adam
C. Forbes Adam
Mrs. E. C. Adam
L. M. Adam
Professor N. K. Adam
Mrs. N. K. Adam
P. G. Adam
A. W. Adams
H. Adams
Sir Michael Adeane, K.C.V.O.
S. Adlard
Mrs. S. Adlard
Mrs. H. S. Adshead
J. W. Agar
N. M. Agnew
P. M. Agnew
R. F. Aickman
Mrs. R. F. Aickman
Mrs. I. Aiken
Miss A. M. Ainger
C. J. Ainscough
A. F. Airey
Col. E. A. Airy
Miss D. Albright
Lord Aldenham
Mrs. M. Alder
Miss D. M. Alderson
Mrs. J. R. Alderson
R. F. N. Aldrich-Blake
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Mrs. A. W. S. Aldridge
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J. F. Alexander
S. M. D. Alexander
C. Aliband
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J. H. P. Allan
Capt. W. Allan
Professor A. A. Allen
A. D. Allen
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Mrs. F. M. Allen
Miss G. R. Allen
Miss L. M. Allen
Mrs. M. G. E. Allen
R. Allen
S. J. Allen
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Mrs. R. Allhusen
Lt.-Col. R. C. Allhusen
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Mrs. D. A. Allman
Mrs. A. T. Allott
C. R. Allott
J. D. Allpass
K. P. Allpress
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Hon. Mrs. H. Allsopp
Miss T. Almack
Lt.-Col. W. E. Almond
Viscount Althorp
Lady Altrincham
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R. N. H. Ambler
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D. Anderson
E. Anderson
G. F. Anderson
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W. A. Anderson
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F. E. Andrews
Mrs. H. A. Andrews
Dr. H. K. Andrews
R. Angorly
R. W. Angus
Mrs. E. R. Annett
Miss C. Anson
Sir George Anson
Mrs. M. E. Antill
R. Appleyard
Mrs. E. M. Archdale
Miss C. Archer
T. Archer
Lord Ardee
Miss E. H. Arkell
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Miss E. Armitage
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J. M. Arnold-Wallinger
G. E. Arthurs
B. G. V. Ash
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Mrs. O. Ashcroft
Cmdr. P. Ashe
Miss L. B. Asher
E. M. Ashford
Miss J. Ashmore
Mrs. A. H. Ashwin
Miss M. Ashworth
P. Ashworth
D. L. Askew
T. C. Askew
W. E. Astin
Capt. A. Astley-Jones
R. A. Aston
S. N. Aston
J. J. Astor
Hon. Michael Astor
W. A. Athey
S. Atkin
J. A. L. Atkins
R. Atkins
A. Atkinson
Mrs. H. Atkinson
Miss H. M. Atkinson
G. L. Atkinson-Willes
Mrs. N. Atteridge
Miss E. Attwell
F. W. Auburn
Miss L. Auerbach
Miss J. Aumonier
Miss W. Austen
C. E. Awdry
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Mrs. E. A. Aylmer
R. J. Ayshford-Sanford
Mrs. R. J. Ayshford-Sanford
Miss M. A. Bach
R. M. Bache
G. E. Backhouse
W. O. Backhouse
M. Baddeley
Mrs. T. R. Badger
H. A. Badham
F. L. Badman
F. C. Bagnall
J. A. Baigent
Mrs. A. G. Bailey
A. J. M. Bailey
D. L. A. Bailey
F. G. Bailey
H. D. Bailey
J. S. Bain
Canon H. W. Baines
J. F. Baines
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T. Baines
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Professor N. K. Adam
Mrs. N. K. Adam
P. G. Adam
A. W. Adams
H. Adams
Sir Michael Adeane, K.C.V.O.
S. Adlard
Mrs. S. Adlard
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