

Numbers, age and sex of Greylag and Pink-footed Geese shot at Loch Leven National Nature Reserve, 1966 – 1981

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There is a long tradition of wildfowling at Loch Leven, Kinross, which holds the largest numbers of breeding ducks in Scotland and is the winter home of many thousands of geese and ducks. When in 1964 the Nature Conservancy Council (NCC) assumed responsibility for the management of the newly-created Loch Leven National Nature Reserve (NNR), the shooting rights were retained by the owner of the estate, who has continued the carefully controlled shooting practised with little change over the last 35 years. Through the courtesy of the estate and their shooting guests, the wildfowl shot have been made available for examination by the NCC Warden, since the season of 1966-67. This report presents details of the numbers of Greylag Geese *Anser anser* and Pink-footed Geese *A. brachyrhynchus* killed each season. Most of the geese examined have been identified as in their first winter - 'young', or older - 'adult'. From 1966 to 1976 the sex of nearly all of them was also determined, by eversion of the cloaca to determine the presence or absence of a penis. In the earliest year other measurements were also made, those on the Greylag Geese having been analysed by Matthews and Campbell (1969).

Although the numbers of geese shot on private estates in Scotland are frequently recorded in game books, regrettably few records are ever published, so that the series from Loch Leven provides an unusual opportunity to look at variations in the composition of the bag.

The shooting parties

The shooting arrangements at Loch Leven have changed little over the years. There are six parties, usually one in October (mean midpoint 25th), two in November (midpoints 9th and 28th), one in December (13th) and two in January

(10th and 24th). Each party comprises four guns accompanied by one or two estate staff. They shoot on six consecutive days, Monday to Saturday, starting each day with a morning flight, except for the first day. After breakfast they are taken out to butts on the islands or shore where they spend the rest of the day shooting ducks. In mid-afternoon they are picked up by the boat and taken to their places for evening flight. There is a fairly set pattern for each day, with occasional changes due to weather or wildfowl movements.

There were a few cancellations, due to the freezing of the loch and to foot-and-mouth disease restrictions on movements, but they only total three weeks. One or two parties terminated their week early. Until 1969 there used also to be a single day of goose shooting in early October, just after the Pinkfeet arrived.

The numbers of geese shot by each party vary considerably, not only with such factors as the weather and goose numbers, but with individual skill and inclination towards shooting geese. The first two parties are primarily interested in duck shooting, and tend to leave the geese alone.

The geese

Loch Leven is one of the few places in Scotland where large numbers of both Greylags and Pinkfeet roost. Pinkfeet start arriving in late September and rapidly build to a peak in early October. Monthly counts have been made regularly at morning flight, from October to March, as part of the National Wildfowl Count scheme organised by the Wildfowl Trust. The pre-arranged count dates do not, of course, necessarily coincide with the presence of peak numbers of geese but the monthly counts have shown significant upwards trends averaging 6.7% during the shooting season months of November-December and January (Table

Table 1. Number of goose-months at Loch Leven during the shooting season, 1966-67 to 1980-81: being the sums of the counts for November, December and January, rounded to the nearest hundred. $r_{N,t}$ = correlation of numbers with years.

Season	Greylag	Pinkfeet	Season	Greylag	Pinkfeet
1966-67	9500	9600	1975-76	8600	16900
1967-68	5900	7100	1976-77	5500	5800
1968-69	6800	8400	1977-78	5000	20000
1969-70	3800	10800	1978-79	5900	13600
1970-71	8200	9800	1979-80	7000	22800
1971-72	4900	7000	1980-81	7400	18500
1972-73	7800	9400	Mean	7000	12400
1973-74	7000	10900	St. error	1900	5000
1974-75	11500	14800	$r_{N,t}$	-0.038	0.717

1), rising from an average of 2280 in those 3 months during the first 3 seasons to 6100 during the 3 most recent seasons. The October counts fluctuated widely about a mean of 6730 ± 3010 , with 13,460 in 1979 the highest monthly count at any time during the 15 seasons. The average number present in November (4770 ± 2160) and December (4880 ± 2830) were similar but they declined to 2960 ± 2320 in January, before rising again to 3890 ± 2350 in February and 4240 ± 2300 in March. By the end of March final departures had begun and nearly all Pinkfeet had left by the end of April.

The Greylags arrived later than the Pinkfeet, mostly in the second half of October and the first week of November. The highest monthly count was 5600 in November 1980. The monthly means are: October 550 ± 540 , November 2530 ± 1260 , December 2630 ± 1410 , January 2840 ± 2390 , February 2130 ± 1170 and March 1150 ± 860 . There has been no upward trend in numbers comparable to that in Pinkfeet, even though nationally the numbers of wintering Greylag have grown rather more than those of the Pinkfeet.

During the depths of winter the loch may freeze over, but the geese remain, roosting well out on the ice. If deep snow covers their feeding fields they may desert the loch altogether for as long as it lasts: February 1978 was the only monthly count in which no geese were found on or near the loch.

A precise comparison between the numbers of geese killed by the shooting parties and the number of geese available to them is quite impracticable because

it would require a great deal of detailed information that was not recorded and would also involve many subjective assessments. We use instead a very crude index, the sum of the regular counts in November, December and January (Table 1).

Seasonal and monthly bags

The number of geese taken each season are shown in Table 2. Omitting 1967-68, for which the records are incomplete, the mean total seasonal bag of Greylags was 124 ± 50.3 ; the mean bag of Pinkfeet was 88 ± 41.1 . The total bag of Greylags was 1754, of Pinkfeet 1490 (117:100), the bag of Greylags being greater in 9 consecutive seasons, from 1968-69 to 1976-78, and less in the 4 most recent seasons.

For the Greylag the monthly bags in November and January, as well as the seasonal ones, tended to increase until 1974-75, then fell. For the Pinkfoot the seasonal bags and those in each month except October tended to increase over the period as a whole.

Though the year to year variations in the numbers of Greylags killed showed no clear association with variations in the numbers of geese wintering at Loch Leven, the growing kill of Pinkfeet paralleled the increase in the winter population ($r_{K,N} = 0.807$, $p > 0.001$). The poor fit in the case of the Greylag is not surprising given the random-seeming changes in wintering numbers and the very low ratio of the kill to the numbers of geese present.

The proportion of young in the bag

The annual percentage of young in the identified bags is given in Table 2. The percentage was higher for the Greylag (mean 41.5 ± 7.6) than for the Pinkfoot (mean 34.2 ± 9.0) in 12 seasons, lower in only 3 (1966-67, 1967-68 and 1979-80). There was no trend in the proportion of young Greylags. The percentage of young Pinkfoot was markedly lower in the middle 5 seasons (29.1%) than in the first 5 (41.6%), with the means of the latest 5 (34.8%) close to that for the entire period.

Table 3 shows that the average proportion of young found in the bags of Pinkfeet made by successive parties was well over 40% in late October and early November, falling to around 25% in January. No comparable within-season decline was found in the Greylag.

The proportions of young in the bag were much higher than the corresponding percentages found in observations on flocks of geese made each year around the time of the annual national goose census, carried out on the first, or occasionally the second, weekend in November. Ogilvie (1978) reported the proportions

Table 2. Numbers of Greylag and Pink-footed Geese shot at Loch Leven NNR, 1966-67 to 1980-81, mostly classed by age.

Season	Greylag Goose				Pink-footed Goose			
	adult	young	total ¹	%young ²	adult	young	total ¹	%young ²
1966-67	47	28	75	37.3	26	49	75	51.2 ⁴
1967-68 ³	10	8	18	44.4	11	10	21	47.6
1968-69	58	27	102	31.8	52	13	73	20.7 ⁴
1969-70	84	77	166	47.8	40	35	80	43.8 ⁴
1970-71	63	44	109	41.1	63	39	102	38.2
1971-72	58	56	115	49.1	58	32	90	35.6
1972-73	87	63	155	42.0	53	11	64	17.2
1973-74	82	69	199	45.7	49	27	94	35.5
1974-75	102	69	235	40.4	79	36	127	31.3
1975-76	73	34	123	31.8	75	32	121	29.9
1976-77	77	34	154	30.6	60	24	110	28.6
1977-78	43	40	96	48.2	71	26	128	26.8
1978-79	23	24	64	51.1	34	14	100	29.2
1979-80	30	12	51	28.6	90	55	157	37.9
1980-81	44	48	92	52.2	90	57	157	38.8
Total	881	633	1754		851	460	1499	
Mean (n=14)			124.0	41.5			88.3	34.2
St. error			50.3	7.6			41.1	9.0

1 In some seasons the total bag included geese not examined for age and sex.

2 Of those aged.

3 No records were kept in October and November 1967, so that 1967-68 total is incomplete.

4 Does not include kill in early October.

Table 3. Percentage of young in the bag within season, all seasons included.

	1st party	2nd party	3rd party	4th party	5th party	6th party	Season
mean date	Oct. 25	Nov. 9	Nov. 28	Dec. 13	Jan. 10	Jan. 24	
days from Oct. 1	25	40	59	72	102	116	
Greylag	40.3	42.5	42.6	41.5	44.1	37.6	41.5
Pinkfoot	43.2	45.3	34.2	30.9	23.7	27.1	34.2

of young found in 1966-67 to 1977-78 and has provided up-dates. The means for 1966-67 to 1980-81 were : Greylag $15.4 \pm 7.8\%$. Pinkfoot $16.8\% \pm 6.7\%$.

The discrepancy between the proportions of young in samples of dead and live geese reflects the greater vulnerability of young birds to shooting. The disparities between the percentages in the bag and in the field can yield a measure of that vulnerability. Using the period means there were 70.9 young:100 adults in the bag of Greylags and only 18.2:100 adults in the live birds, suggesting that young Greylags were 3.9 times as likely to be shot as older ones. The corresponding proportions for Pinkfeet were 52.0:100 adults in the bag and 20.2:100 in the field, leading to an estimated vulnerability quotient of 2.6.

A method of estimating juvenile vulnerability that is more likely to be reliable compares the first year recovery rates of ringed adults and young: $V = (R_1/M_1)/(R/M)$, where M and M_1 are the numbers of adults and of young marked at the start of the shooting season and R and R_1 the corresponding numbers of recoveries reported. No ringing of British-wintering Greylags or Pinkfeet took place during the period 1966-67 to 1980-81 so that we must draw on results of earlier marking by Wildfowl Trust rocket-netting teams. For Greylag marked in Scotland from 1952 to 1963 $M=693$, $M_1=385$, $R=52$ and $R_1=35$ so that $V=(36/385)/(52/693)$, about 1.25. For Pinkfeet marked in 1950-59 $M=10,278$, $M_1=3674$, $R=591$ and $R_1=280$, with $V=(280/3674)/(591/10,278)=1.325$.

Adjusting the observed mean age-ratios in the bag by this vulnerability quotient still leaves the age-ratios in the kill far higher than those in the live samples: Greylag adjusted mean 33.2%

(cf. 13.4%), Pinkfoot 25.8% (16.8%). Presumably these discrepancies reflect differences in effective availability. For example, one of us has found that, in all species so far examined, there is a tendency for the first group of geese leaving the roost in search of feeding areas to include relatively large numbers of family parties, young geese needing to spend more time feeding than older ones. If the shooting parties are also eager to pay most attention to early-moving birds this could lead to higher proportions of young geese in the bag.

The data of Table 3 suggests that, while the young of both species are proportionately very likely to be shot soon after arriving at Loch Leven, the surviving young Pinkfeet soon become less vulnerable while young Greylags remain far more easily taken than adults throughout the winter. Yet the ringing results, showing young Pinkfeet rather more vulnerable than young Greylags, suggest that this was unlikely to have been the case throughout the winter ranges in the 1950s.

Associated with the wide disparity between the average proportions of young geese shot and those seen in the field, the finding is that in neither species was there a significant correlation between the yearly variations in the age-ratios in the Loch Leven bag and in the field counts. This is surprising because in other geese, the Lesser Snow Goose *Anser c. caerulescens* for example (Boyd *et al* 1982), those age-ratios have tracked each other closely, at least when large samples taken widely across the range have been used.

Numbers of males and females in the bag

The data of Table 4 demonstrate that

Table 4. Numbers of males and females in samples of adult and first-winter Greylag and Pink-footed Geese shot at Loch Leven, 1966-67 to autumn 1976.

	Greylags			Pinkfeet		
	adult	1st winter	total	adult	1st winter	total
males	378	266	644	281	149	430
females	329	226	555	263	156	419
total	707	492	1199	544	305	849
males:100 females	114.9	117.7	116.0	106.8	95.5	102.6

there was an excess of males amongst both adult and first-winter Greylags shot at Loch Leven of about 116 males: 100 females. Matthews and Campbell (1969) found the same ratio in a sample of 203 first-winter Greylags examined at a game dealers in Perth in 1966-68, but a very different ratio of 155 males: 100 females in 227 adult geese from the same source. They found a 1:1 ratio in 242 adults in rocket-netting samples from Kinross and the Solway Firth in 1953 and 1959. In the same catches 113 juveniles had a ratio of 117 males:100 females.

The departures in shot birds from the 1:1 sex ratio of the live-trapped adult Greylags suggest that the preponderance of males in the kill is due to some positive selection of males by the hunters or greater wariness of, or more rapid evasion by, females.

The sample of 849 Pinkfeet yields inconclusive results, the recorded sex ratios not departing significantly from 1:1 in either age category.

Discussion

For the most part the results here are unremarkable, and consistent with those of earlier studies. Two points seem to merit further investigation. First, why does the apparent vulnerability of young Greylags to shooting persist through the winter? Greylags commonly, though by no means always, move around in smaller flocks than Pinkfeet. Does that make a difference? Or are they more easily lured by decoys, or by bait? Second, does the identical excess of males in the Loch Leven kill of adult and young Greylags indicate that, even while remaining within their family groups,

young males tend to lead and so be fired at? Questions such as these call for more detailed observations of geese, and goose-shooters, in the field and cannot be answered by means of bag inspections alone. A ban was imposed in 1968 on the sale of dead wild geese, so that they are no longer to be found in game dealers' shops.

Acknowledgements

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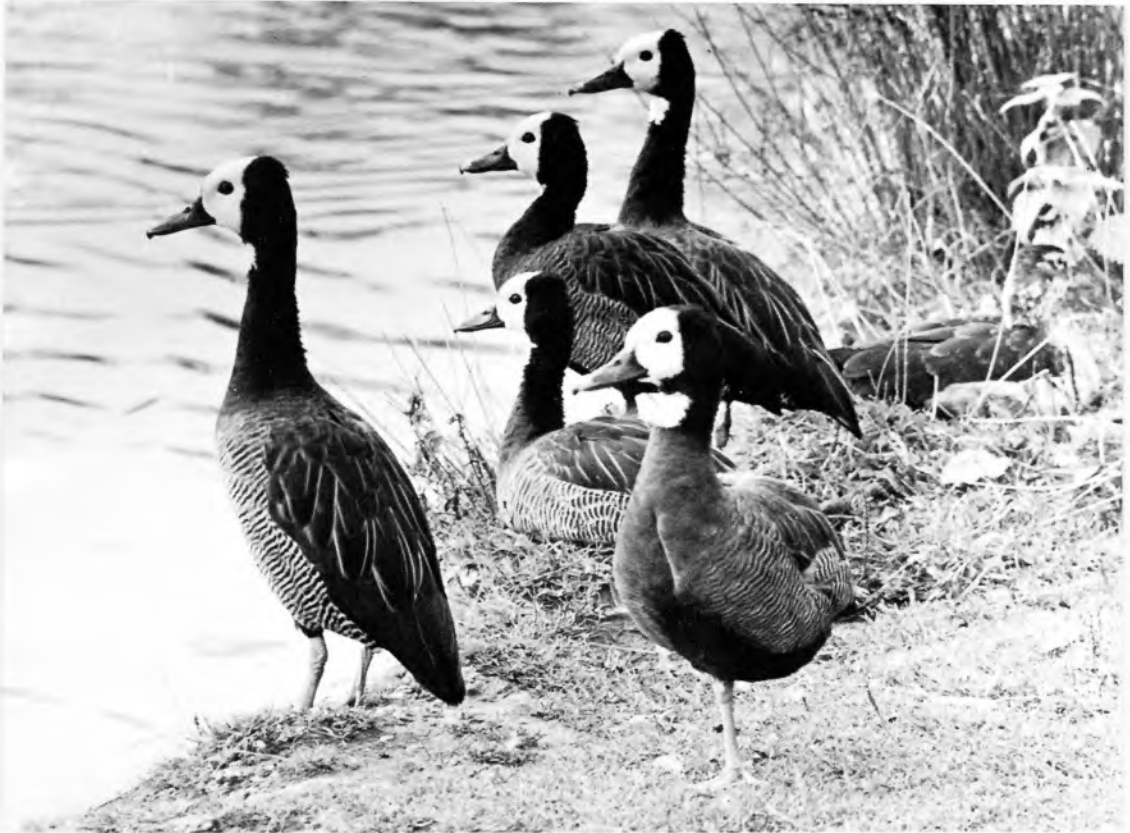
Summary

Geese are taken each winter in six separated weeks of shooting at Loch Leven, Kinross, between late October and late January. In the 15 seasons 1966-67 to 1980-81, 1754 Greylag Geese *Anser anser* and 1499 Pink-footed Geese *A. brachyrhincus* were shot, most of which were identified as first-winter or adult birds. The mean percentages of first-winter birds were $41.5 \pm 7.6\%$ of the Greylags and $34.2 \pm 9.0\%$ Pinkfeet. Year to year variations in the proportion of young in the bag were not correlated between the species, nor with the proportion observed amongst live geese in the field in early November. The proportion of young geese in the kill of Pinkfeet was much higher in late October and early November (44%) than in late November and early December (33%) and January (25%). In the Greylag bag the proportion of young remained close to the mean (41.5%) throughout the season. The ratio of males to females in 1199 Greylags examined was 116:100, in both adults and young. The ratios in the 849 Pinkfeet sexed did not differ significantly from 1:1.

References

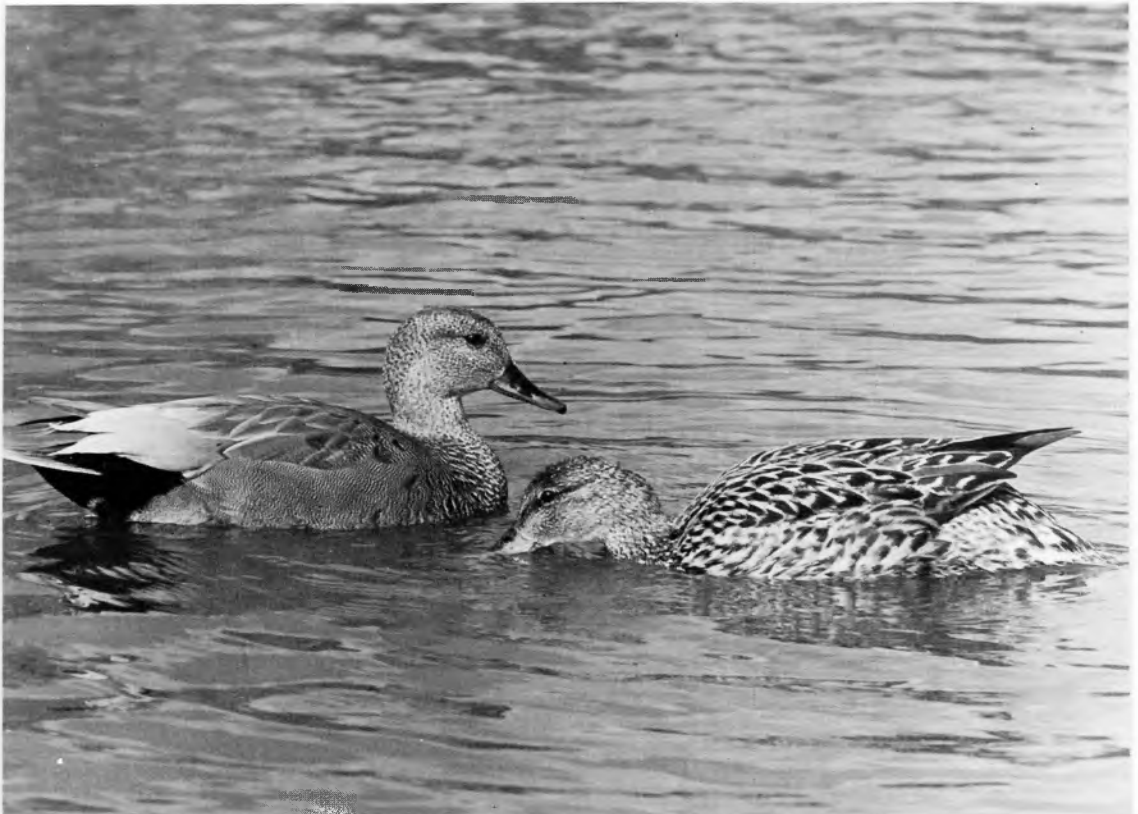
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White-faced Whistling Duck *Dendrocygna viduata* are one of the whistling duck species whose feeding ecology has been recently investigated. (see p. 20). (J. B. Blossom)

The delicate soft tones and vermiculations of a pair of Gadwall *Anas strepera*. This species is well established in Britain with perhaps 300 breeding pairs augmented by 1 - 2000 winter visitors from the continent. (J. B. Blossom)





A pair of Cape Teal *Anas capensis*. This is a well-mated pair but bigamous behaviour has been noted in this species (see p. 10). (Philippa Scott)

An Egyptian Goose *Alopochen aegyptiacus* and two Spur-winged Geese *Plectropterus g. gambensis* photographed beside the Victoria Nile, Uganda. (see pages 99 and 108). (Philippa Scott)





A pair of South Georgia Pintail *Anas georgica georgica* hand-reared on South Georgia and brought to Slimbridge, not without difficulty, in May 1982. (*Jonathan Leach*)

Two downy Magpie Geese *Anseranas semipalmata*. This species began to breed at Slimbridge again in 1979 after a long gap and has done each year since. (*J. B. Blossom*)

