Reducing the breeding success of Canada and Greylag Geese, *Branta canadensis* and *Anser anser*, on gravel pits

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The numbers of nesting pairs of Canada and Greylag Geese have increased steadily at the gravel pits at Great Linford and it has become necessary to attempt to limit population growth because of local agricultural damage.

In 1990, gosling production was reduced by removing 817 eggs from 89 Canada and 50 Greylag nests. In the first 12 days of the nesting season, the removal of complete clutches from 58 nests of marked Canada Goose pairs resulted in 80% of the geese re-laying and, of these replacement clutches, 95% were incubated. First clutches removed after this period resulted in 21% of pairs re-laying and only 28% of these were incubated.

The clutches of unmarked pairs were replaced by two hard-boiled or wooden eggs in an attempt to prevent re-laying. Seventy-two percent of Canada Goose pairs incubated the substitute eggs for a mean of 38 days; 52% of the Greylag Goose pairs incubated these eggs for a mean of 26 days. Normal incubation period is approximately 28 days for both species. Production from 72 nests with substitute eggs was only one Canada gosling.

From these two experiments, it was concluded that a successful strategy for control through egg removal is to place substitute eggs in the nests of early laying pairs. Few geese nesting later will re-lay and incubate their second clutch.

The populations of feral Canada and Greylag Geese in Britain have increased over the last 30 years at a rate averaging 8% per annum for Canada Geese (Owen *et al.* 1986) and 13% per annum for Greylags (Owen & Salmon 1988). Population growth has been most rapid in central and southern England due to the creation of a large number of gravel pit lakes (Anon 1982) which provide breeding and overwintering sites. This has caused problems as geese feed on a variety of crops (Ogilvie 1978) and, although damage may be very localised (Traill-Stevenson 1989), they are regarded as serious agricultural pests.

Greylag Geese were deliberately introduced to the gravel pit site at Great Linford in 1972 and Canada Geese established themselves soon after (Wright & Giles 1988). The number of nesting pairs of both species has increased steadily and, in 1988, 157 nests produced over 500 goslings. Present levels of winter shooting of adult geese have not prevented population growth; about 10% of the Canada Geese in the winter flock are shot every year but the number of pairs breeding continues to rise (Giles & Street 1990). In 1989 an attempt was made to slow population growth by limiting gosling production. Considerable effort was made to remove the eggs, under MAFF licence, from as many nests as possible and this resulted in less than 50 birds fledging. In 1990, emphasis was placed on investigating the ability of geese to relay after removal of their first clutch and methods of preventing relaying. The results presented in this paper are used to suggest a practical and humane method for limiting gosling production in local populations of feral geese.

Study Area

The gravel pit lakes are in the floodplain of the Upper Great Ouse at Great Linford in Buckinghamshire (National Grid Reference SP8343). The gravel pit complex is approximately 300 ha and there are 20 lakes and ponds with a total surface area of approximately 120 ha. Gravel extraction has ceased on the site and the lakes vary in age from 6-40 years. Seven of the lakes have islands and these are preferred nesting sites for the geese.

Methods

In 1988 the moulting flocks of Canada and Greylag Geese were rounded up; each bird was aged (as 'juvenile' or 'adult' using plumage characteristics), sexed and given an individually coded plastic ring. The ring codes could be read at up to 25 m using binoculars. As a result about half of the goose population was individually identifiable in Spring 1990. This enabled pairs to be identified and their nesting behaviour followed if at least one of the geese were ringed.

The site was divided into areas and each area was searched for nests weekly from mid-March onwards. Frequent searching meant that clutches were found soon after laying and, therefore, had little embryo development at the time of removal. If the pair was marked, the entire clutch was removed on the first visit after the start of incubation and the clutch size, date when incubation commenced and the ring code(s) were recorded. If these pairs re-nested the replacement eggs were not removed and it was noted whether the clutch was incubated and the numbers of goslings hatched. If the pair was unmarked, the completed clutch was removed and replaced by two wooden or hard-boiled eggs. Any additional eggs laid were not removed so that a measure of the efficiency in reducing the number of goslings hatching by this method could be obtained. The length of time that geese sat on these eggs before deserting was also recorded. These birds, however, could not be identified if they then nested elsewhere.

The numbers of goslings hatching on the site was estimated by visiting lakes daily. It was possible to count goslings from a distance without disturbing them. Individual broods could be recognised because of the frequent visits.

Results

Eight hundred and seventeen goose eggs were taken from 89 Canada and 50 Greylag nests. Sixty-one pairs (68%) of Canada Geese and seven pairs (14%) of Greylag Geese were marked. The number of pairs of Canada Geese which laid a replacement clutch after their first was removed was significantly higher early in the season ($\chi^2 = 19.9$, $P<0.001$). 80% ($n = 25$) of Canada Geese completing their first clutch by 12 April re-nested after clutch removal and 95% of these replacement clutches were incubated. Of pairs nesting after 13 April only 21% ($n = 38$) produced a replacement clutch and only 28% of these were incubated. Second clutches were laid in a new nest, usually within a few metres of the first nest. None of the seven pairs of Greylags whose clutches were removed re-nested.

When the removed clutch was replaced with substitute eggs, 72% ($n = 28$) of the females continued incubation for a mean length of 37.6 days (S.E. = 2.2, $n = 23$). Fourteen percent of nests were deserted or taken by predators within the week following substitution. In 14% one or more additional eggs were laid and incubated, but only one gosling hatched from one nest.

Only 52% ($n = 44$) of female Greylag Geese sat on the replacement eggs. Incubation continued for a mean of 25.8 days (S.E. = 2.3, $n = 23$), significantly shorter than in the Canada Geese ($t = 3.65$, $df = 41$, $P<0.001$). Greylags deserted 30% of nests with substitute eggs within the first week. 1-5 additional eggs were laid in eight (18%) of the nests, but only 25% of these were incubated and all were deserted or taken by predators before hatching.

Ninety-three Canada goslings and 42 Greylag goslings hatched at the Great Linford site in 1990. Of these, 59 Canada goslings came from replacement clutches and one hatched from an additional egg laid with two substitute eggs. The remaining 33 Canada and 42 Greylag goslings hatched from nests which were not found or were found too late in incubation to remove.

Discussion

These results suggest that gosling production in feral goose populations can be limited by egg removal and substitution. Canada Goose pairs which laid early in the season were likely to re-nest after clutch removal, so timing is important in the control of Canada Goose populations by this method. None of the marked Greylag Geese relaid after clutch removal but the sample size was small.

Egg substitution generally prevented the laying of replacement clutches; extra eggs were occasionally laid but only one gosling hatched from these. Canada Geese continued to incubate substitute eggs for a longer period than Greylags and deserted less frequently after substitution. Normal incubation period is approximately 28 days in both species and, on average, Canada Geese remained sitting on substitute eggs for a further ten days.

We conclude that replacing the first clutches of early nesting pairs with substitute eggs will prevent new clutches being laid by these birds.

In later visits it would only be necessary to remove complete clutches, without substitution, since relaying would be unlikely. This procedure will be tested at Great Linford in 1991 and the behaviour of the marked pairs will be followed.

The removal or substitution of eggs seems to be an effective and humane way of reducing gosling production. This could be an attractive option in urban parks, where there is an increasing goose problem but some methods of control e.g. shooting, are not practical. Even two visits to a colony early in the season, during which clutches were removed and substituted, would substantially limit production. Early visits also have an additional advantage at sites where other species that are sensitive to disturbance nest, e.g. Common Terns *Sterna hirundo*. The control programme would be complete before these birds began to nest.

Reducing the numbers of goslings fledged each year is a potential brake on population growth. However, as the adult birds are long-lived, success would almost certainly be enhanced by combining egg removal with winter shooting.

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References

Anon. 1982. Survey of land for mineral working in England 1982. *Dept. of Environ. Report.*

Giles, N. & Street, M. 1990. Management of the feral greylag and Canada goose flock at Great Linford. *Game Conservancy Ann. Rev.* 21:116-118.

Ogilvie, M.A. 1978. *Wild Geese.* Poyser, Berkhamstead.

Owen, M., Atkinson-Willes, G.L. & Salmon, D.G. 1986. *Wildfowl in Great Britain* (2nd edn.). Cambridge University Press.

Owen, M. & Salmon, D.G. 1988. Feral greylag geese *Anser anser* in Britain and Ireland. *Bird Study* 35:37-45.

Traill-Stevenson, A. 1988. Agricultural damage by geese. *Game Conservancy Ann Rev.* 19:155-156.

Wright, R. M. & Giles, N. 1988. Breeding success of Canada and greylag geese *Branta canadensis* and *Anser anser* on gravel pits. *Bird Study* 35:31-36.

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