

Suburban goose management: insights from New York state

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Abstract: New York State Department of Environmental Conservation (DEC) conducted studies in suburban Rockland County, New York during 1993-2000 to help local officials develop strategies to alleviate conflicts associated with local-nesting or "resident" Canada geese (*Branta canadensis*). Annual counts indicated a relatively stable population of approximately 2,500-3,000 resident geese in the county, far fewer than anecdotal reports suggested. Counts tended to increase in towns where there was little or no goose management, whereas numbers declined in towns with active goose management efforts (i.e., egg-addling, capture and removal, or use of border collies). Egg-addling programs did not result in immediate reduction of goose numbers, but provided some relief at nesting sites and may have limited population growth. Removal of geese reduced total goose numbers but did not provide year-round relief at all capture locations. Use of border collies alleviated problems at many locations, but most displaced birds remained nearby. Costs of management alternatives varied widely, but all techniques were useful in a comprehensive management program. There is no quick or easy solution to goose problems in suburban areas; a coordinated community effort delivered by municipal "goose control officers" is recommended.

Key words: *Branta canadensis*, Canada goose, damage, New York, population control

Resident Canada goose (*Branta canadensis*) populations increased dramatically across North America during the past 30 years (Ankney 1996, Rusch et al. 1996, U.S. Fish and Wildlife Service 2000). Conflicts between geese and human interests are common in many suburban areas because of their shared preferences for mowed lawns near open water (Conover and Chasko 1985, Cooper and Keefe 1997, Forbes 1998). A variety of techniques have been used to alleviate these conflicts, with mixed success (Smith et al. 1999).

Local-nesting or "resident" Canada geese became established in New York State following private releases of semi-domesticated birds in the early 1900s (Benson et al. 1982). Conflicts with human interests in suburban areas were noted by the mid 1960s

in the Lower Hudson Valley and on Long Island (Dill and Lee 1970). New York's resident goose population was approximately 160,000 birds in spring 2000 (B. L. Swift, unpublished data) and U.S. Department of Agriculture (USDA) received >200 requests in 1999 from landowners seeking help with problems caused by geese in the state (R. B. Chipman, USDA Wildlife Services, personal communication).

Canada geese probably began nesting in Rockland County in the early 1960s, a period of rapid suburban development. Concerns about over-abundance of geese in local parks and other properties began in the 1970s, but it was not until early 1993 that town officials from Clarkstown asked DEC to help develop community-wide strategies to alleviate problems caused by the birds.

During 1993-2000, DEC conducted various studies to assist the local community and gain insight on management of geese in urban-suburban areas. This paper summarizes our findings and offers some thoughts on management of suburban goose populations.

Study area

Rockland County is 10 km N of New York City and is mostly a suburban residential/commercial landscape, with densely populated urban centers, large tracts of undeveloped forest and park land, and numerous lakes and ponds. Rockland County has 5 townships, of which Clarkstown is most central. Most management actions discussed here occurred in Clarkstown or at a corporate facility in neighboring Orangetown.

Methods

Population surveys

Molting-period goose counts were conducted each summer during 1993-2000, with help from Rockland County Audubon Society and other volunteers. "Molt counts" were made at every accessible location in the county where geese were known or likely to occur. More than 60 locations were checked each year. Some areas with geese were undoubtedly missed, but we believe that most areas with ≥ 20 geese were checked each year, except in 1994 when no counts were made in New York State Parks (NYS Parks). Counts were made on 1 or 2 occasions during each molting period (20 June - 10 July generally) with the highest count of total geese and goslings at each site assumed to be most accurate. Goslings may have been underestimated because some (e.g., those hatched in April) were hard to distinguish

from adults.

The number of nesting goose pairs in Clarkstown was estimated annually from 1993-2000 by a local wildlife control specialist hired by the town. Clarkstown had federal and state permits authorizing a town-wide egg-addling program (see below), so records were kept of the number of nests found and eggs treated (punctured) to prevent hatching. He also noted where other pairs were seen but nests were not found (e.g., with broods later on). This provided an estimate of total nesting pairs. Annual pair estimates were not available for other towns.

Christmas Bird Counts (CBCs) for Rockland County (centered in Clarkstown) from 1970-1999 were reviewed to assess long-term trends in goose numbers. CBCs were assumed to include mostly local resident geese, because neck-banded geese from other areas were rarely seen in Rockland County during our studies (see below).

Neckband observations

During summers of 1993-1998, DEC staff captured and neck-banded approximately 450 adult (≥ 1 year old) geese in Rockland County, including 330 at 8 different sites in Clarkstown and 38 at the corporate facility in Orangetown. Neck-banding was done as part of an Atlantic Flyway Canada goose study, in which $> 44,000$ geese were banded throughout eastern North America (J. B. Hestbeck, U.S. Geological Survey, unpublished data). On numerous occasions (all seasons) from July 1993 - July 2000, DEC staff searched for neck-banded geese throughout Rockland County. Observations were reported by local residents also. Origins of all banded birds were determined and sighting histories of

locally banded geese were analyzed.

Goose management

This paper focuses on management actions applied on a large enough scale to have potential impacts on local goose populations of an entire town. For the most part, these were goose control measures implemented in Clarkstown and at the corporate facility, which was home to many of the geese in Orangetown.

First was an egg-addling program conducted throughout Clarkstown from 1993-2000. A wildlife control specialist was hired by the town to locate as many nesting geese as possible (on public and private lands) and puncture every egg in those nests to prevent hatching. This work was carried out from late March through mid May each year. Landowners rarely denied access to personnel conducting this work. A similar egg-addling program was conducted at the corporate facility in Orangetown during 1994-2000. Some egg-addling was reportedly done at several NYS Parks during the study, but effort was not well documented and numbers of nests and eggs treated were not readily available.

In 1996 and 1997, Clarkstown conducted "round-ups" to remove geese from specific problem areas. In June 1996, approximately 250 molting geese were removed from 3 town parks, and in June 1997, approximately 200 geese were removed from those parks and 4 residential locations. All birds were killed and processed to provide meat for charitable organizations. In 1996, however, the meat became contaminated during processing and was not distributed for human consumption.

In October-November 1997, Clarkstown and DEC investigated use of border collies to chase geese from a town park (Kings Park). Patrols were frequent (several visits per day, 7 days/week) and sustained for 7 weeks, during which time numbers of geese and neck band observations were documented on every visit. In June 1998, the town hired a border collie service to continue the program year-round in 3 town parks (and occasionally at 3 other parks). We conducted a similar study at the corporate facility in Orangetown from February-June 1998. A border collie service was subsequently hired year-round by the corporate facility and several other property owners in Orangetown that together accounted for 25-50% of the town's molting goose population.

Results

Christmas counts of Canada geese in Rockland County increased rapidly during the 1970s and 1980s, followed by much slower growth in the 1990s (Figure 1). Mean CBC increased 9-fold between 1970-75 (\bar{x} = 388 geese) and 1993-1999 (\bar{x} = 3,385 geese).

Molt counts in Rockland County ranged from 3,077 in 1996 to 2,489 in 2000 (\bar{x} = 2,784 geese; approx. 6 geese/km²) (Table 1). Goslings accounted for 9-19% of annual counts (13% overall) in Rockland County, but proportions in Clarkstown (7% overall) and NY State Parks (8% overall) were lower than in other towns (17-20% overall in each town).

Molt counts in Clarkstown and Orangetown declined >50% after 1995, whereas counts in other towns were relatively stable or tended to increase (Table 1).

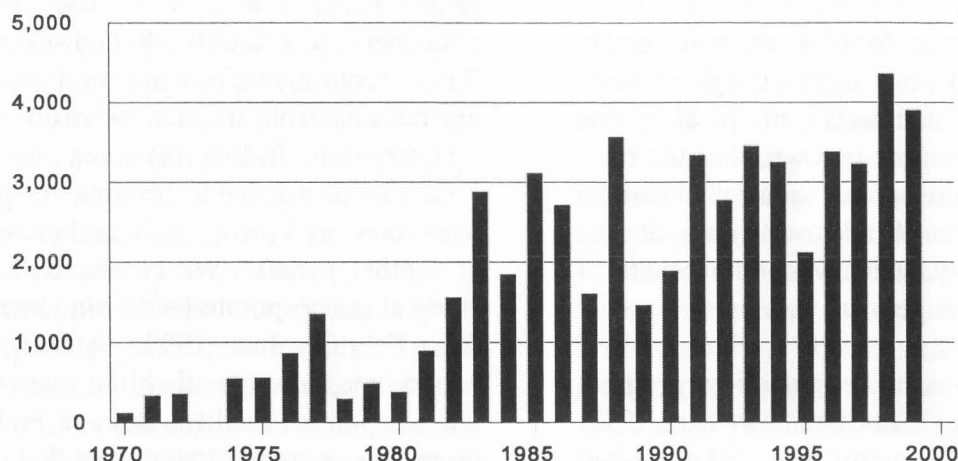


Figure 1. Number of Canada geese counted during annual Christmas Bird Counts in Rockland County, New York, 1970-1999.

Total molt counts at 11 "managed" (removal or border collie patrol) sites declined 91% between 1996 (726 birds) and 2000 (64 birds), compared to a 14% decline at other (no management) sites in Clarkstown and a 1% increase at other sites in Orangetown (Table 2).

A total of 144-204 goose nests, and 10-19 other nesting pairs, were found each year in Clarkstown (Table 3), and > 6,000 eggs were punctured over the 8-year period. Most nests were located in woodlands bordering a water supply reservoir (Lake DeForest) and other lakes, ponds, streams and wetlands in town. Two small islands (total area <2.5 ha) in the reservoir had 60-100 nests per year. Number of nesting pairs peaked in 1996 and increased every year during 1994-2000 except 1997 and 1998. Number of nests found at the corporate facility in Orangetown also peaked in 1996 (40 nests), and declined annually thereafter (Table 3). Most nests at

the corporate facility were on open ground next to trees, buildings, or other structures, and many were located >10 m from water.

During short-term border collie studies at Kings Park and the corporate facility, geese always flew out of patrolled areas when pursued by dogs. Some birds always returned (usually the same day), but numbers of geese encountered daily declined >50% after 2 weeks, and >67% after 4 weeks (B. L. Swift, unpublished data). Some neck-banded geese were chased away >20 times, whereas others did not return to the site after < 5 chases.

Most (12 of 21) neck-banded geese chased from Kings Park during fall 1997 were found at a nearby school, where they had been seen before. In December, after patrols ceased, nearly all (18 of 21) neck-banded birds were found within 2 km of Kings Park, including 7 in the park. Geese chased from the corporate facility during spring 1998

Table 1. Total Canada geese (including goslings in parentheses) counted during annual molting period surveys in Rockland County, New York.

| Town/Area* | Total geese (goslings) | | | | | | | |
|-------------|------------------------|--------------|---------------|---------------|---------------|---------------|---------------|---------------|
| | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 |
| Stony Point | 162 (37) | 110 (51) | 177 (44) | 278 (13) | 221 (29) | 298 (52) | 277 (30) | 242 (27) |
| Haverstraw | 310 (65) | 189 (15) | 148 (34) | 255 (50) | 259 (43) | 321 (28) | 293 (56) | 262 (45) |
| Ramapo | 685 (159) | 496 (79) | 691 (138) | 670 (93) | 547 (99) | 764 (128) | 749 (209) | 825 (181) |
| Clarkstown | 666 (26) | 657 (44) | 643 (49) | 734 (41) | 557 (36) | 339 (19) | 336 (28) | 283 (27) |
| Orangetown | 355 (83) | 519 (93) | 605 (73) | 527 (36) | 522 (69) | 392 (69) | 351 (73) | 283 (61) |
| NYS Parks | 589 (73) | na** (na) | 679 (16) | 615 (41) | 594 (16) | 677 (50) | 711 (130) | 594 (42) |
| Total | 2767 (443) | na (na) | 2943 (354) | 3079 (274) | 2700 (292) | 2791 (346) | 2717 (526) | 2489 (383) |
| % goslings | 16% | na | 12% | 9% | 11% | 12% | 19% | 15% |

* Town totals do not include NYS Parks.

** No counts available for NYS Parks in 1994.

also were seen on other lawns nearby, but most neck-banded birds were not found during the summer molt. Only one pair of geese nested in the primary patrol area, compared to 10-11 nests in the same area the year before. After patrols were expanded throughout the property in 1999, geese nested primarily in areas inaccessible to dogs, including rooftops and fenced or walled enclosures.

We documented > 1,000 observations of neck-banded geese at > 50 locations throughout Rockland County. Fewer than 2%

of geese banded in Rockland County were ever seen in towns other than where they were banded (usually adjoining towns). Geese seen more than once in Clarkstown tended to use fairly discrete "home areas" (approx. 5-20 km² each) consisting of <10 sites each (B. L. Swift, unpublished data).

Table 2. Total Canada geese counted during annual molting period surveys at managed and non-managed sites in Clarkstown and Orangetown, Rockland County, New York. Removals of molting geese indicated by "r" and use of border collies to deter molting geese indicated by "bc".

| Town/Location | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 |
|--------------------|------|------|------|------------------|------------------|------------------|------------------|-----------------|
| Clarkstown | | | | | | | | |
| Kings Park | 179 | 122 | 100 | 92 ^r | 47 ^r | 10 ^{bc} | 7 ^{bc} | 0 ^{bc} |
| Congers Lake | 105 | 122 | 49 | 115 ^r | 30 ^r | 25 ^{bc} | 20 ^{bc} | 0 ^{bc} |
| Twin Ponds | 104 | 127 | 116 | 77 ^r | 48 ^r | 7 ^{bc} | 2 ^{bc} | 0 ^{bc} |
| Patriot Court | - | 36 | 15 | 23 | 15 ^r | 0 | 9 | 0 |
| Mtn View Ave | - | - | 16 | 18 | 16 ^r | 0 | 0 | 0 |
| Phillips Hill | - | - | 5 | 25 | 35 ^r | 0 | 0 | 0 |
| Swartwout Lake | 119 | 65 | 82 | 127 | 133 ^r | 62 | 30 | 61 |
| subtotal above | 507 | 472 | 383 | 477 | 324 | 104 | 59 | 61 |
| All other sites | 159 | 185 | 260 | 257 | 233 | 235 | 277 | 222 |
| Orangetown | | | | | | | | |
| Corporate Facility | 93 | 104 | 137 | 178 | 175 | 78 ^{bc} | 8 ^{bc} | 0 ^{bc} |
| Blue Hills Plaza | - | 55 | 53 | 43 | 37 | 57 | 61 | 0 ^{bc} |
| Dominican College | - | 26 | 6 | 9 | 12 | 19 | 23 | 3 ^{bc} |
| St. Thomas Aquinas | - | 21 | 19 | 19 | 21 | 0 ^{bc} | 0 ^{bc} | 0 ^{bc} |
| subtotal above | 93 | 206 | 215 | 249 | 245 | 154 | 92 | 3 |
| All other sites | 262 | 313 | 390 | 278 | 277 | 238 | 259 | 280 |

Table 3. Number of nesting goose pairs in Clarkstown and at a corporate facility in Orangetown, Rockland County, New York. Number of nests was the number found during egg-addling activities each year, excluding any presumed re-nests. Other pairs were pairs seen with broods or seen on territories where no nest was found.

| Area | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 |
|--------------------|------|------|------|------|------|------|------|------|
| Clarkstown | | | | | | | | |
| Nests | 144 | 164 | 190 | 204 | 168 | 154 | 158 | 160 |
| Other pairs | 12 | 17 | 19 | 14 | 12 | 10 | 13 | 14 |
| Total pairs | 156 | 181 | 209 | 218 | 180 | 164 | 171 | 174 |
| Corporate facility | | | | | | | | |
| Nests | na | 24 | 29 | 40 | 39 | 34 | 23 | 8 |
| Other pairs | na | 1 | 0 | 1 | 0 | 1 | 1 | 0 |
| Total pairs | na | 25 | 29 | 41 | 39 | 35 | 24 | 8 |

Discussion

Although we did not conduct rigorously controlled goose management experiments, data presented here were collected systematically during surveys and routine visits to Rockland County. As such, they represent real-world results when management actions are implemented. Following are some insights gained on management of Canada geese in urban-suburban areas that may help others dealing with similar situations.

“Exploding” goose populations

Estimates of resident geese in the northeast U.S. increased 3-fold from the late 1980s to the late 1990s, but were relatively stable during 1997-2000, at approximately 1

million birds (U.S. Fish and Wildlife Service 2000). Our data suggest that the goose population in Rockland County was stable also during the 1990s. Thus, managers must be careful not to characterize goose population growth in urban-suburban areas as “exploding” or “dramatic” where that may not be true. Professional credibility is at stake, and acknowledging a stable population does not deny that geese are over-abundant. Although the population in Rockland appeared stable, it was at a level unacceptable to many local residents.

Managers must also beware of undocumented estimates of goose abundance. When DEC was first contacted regarding the situation in Rockland County, there were widely publicized estimates of 8,000-12,000 geese in the county. Data we collected suggested that the population was closer to

3,000 birds. Inflated estimates probably resulted from people double-counting geese at multiple locations or exaggerating goose numbers to help justify (or oppose) management action. However, accurate population estimates are needed to plan control programs and can make goose problems seem more manageable.

Despite the numbers, public perception of goose abundance also determines success of management efforts. In some situations, limited reduction of goose numbers may have little perceived benefit. People in Clarkstown disagreed whether management was successful, despite a $> 50\%$ population reduction, because geese were still seen at many problem locations at some time of year. Likewise, where goose droppings are the main concern, even small numbers of geese may be too many. A $\geq 80\%$ reduction in goose numbers may be necessary for management to be considered successful by most people. However, gradual reduction in numbers may help prevent new problems from arising, and may provide benefits (e.g., reduced nutrient input to surface waters) that the public does not readily perceive.

Effectiveness of egg-addling

Eggs were punctured in nests of $\sim 90\%$ of estimated goose pairs in Clarkstown, although not all treated nests would have produced young. Assuming nest success of 55-65% for resident Canada geese (Hanson 1965, Gosser and Conover 1999), expected production was probably reduced by 80-85%. However, the proportion of goslings during molt counts in Clarkstown (6.9%) was only 60% lower than in other towns (17.5%). This discrepancy may reflect different population structure among towns (e.g., higher proportion of breeding pairs in Clarkstown) or possible

under-counting of goslings in some areas outside of Clarkstown.

Assuming 7% goslings in summer and $\leq 85\%$ annual survival (Castelli and Trost 1996, Johnson and Castelli 1998), a $\geq 9\%$ annual population decline would be expected. However, molt counts in Clarkstown did not decline, and number of nesting pairs increased, even after several years of egg-addling. In towns where management did not occur, molt counts tended to increase consistent with 2% annual growth predicted for a population with 17% goslings and annual survival of 85%. Why egg-addling did not result in more immediate or significant reduction in goose numbers in Clarkstown is unclear. Neck-banded birds disappeared from Clarkstown at a rate consistent with $\leq 85\%$ annual survival, so it seems unlikely that the population was stable because of higher survival.

Immigration could explain why the goose population in Clarkstown did not decline, but we found little evidence that birds from other areas were coming in to nest or molt. From 1993-2000, only 4 neck-banded geese from other states (3 from north-central NJ, 1 from WV) were reported seen in Clarkstown or Orangetown during spring or summer, and only 1 was seen after 1993. Only 1 goose neck-banded in Clarkstown was reported seen outside of Rockland County during spring or summer. These data suggest that immigration into Clarkstown was negligible. However, no goslings were neck-banded, so yearling geese moving in from other areas would not have been detected.

A more plausible explanation may be molt migration (Hanson 1965, Zicus 1981, Abraham et al. 1999), where a substantial number of geese produced in Clarkstown

before 1993 molted outside of Rockland County and re-joined the population in later years when nesting sites or molting habitats became available. Several goslings leg-banded in Rockland County and other areas in the lower Hudson Valley have been reported shot a year or more later in Quebec (B. L. Swift, unpublished data). This suggests that some subadult or unsuccessful breeding geese molt-migrate to Canada, where they would not be counted during our molt counts, but would be part of the local population at other times of the year. Unless this "surplus" was depleted, reducing production would not likely result in substantially fewer nests or fewer geese molting in Clarkstown.

Although egg-addling did not reduce the local population, it did alleviate problems at some sites. Eliminating production of young limited the total number of birds at nesting sites during the summer. Lack of young geese also made it possible for some property owners to chase away adult birds after the nesting season, if they did not leave on their own.

Effectiveness of roundups

Removal of geese resulted in immediate and significant declines in the number of geese molting and nesting in Clarkstown. Mean molt counts in Clarkstown declined 54% from 734 geese in 1996 to 339 geese in 1998, following removals of approximately one-third of the population in both 1996 and 1997 (Figure 2). Total molt counts in Clarkstown parks declined from 290 geese in 1996 to 125 geese in 1997, following removal of 250 birds. Only 42 geese molted in the parks in 1998, following removal of 60 geese in 1997, although border collies and

temporary fencing around ponds were used prior to the 1998 molt (Figure 3). Nesting pairs in Clarkstown declined 25% from a peak of 218 in 1996 to 164 in 1998, but increased in all other years. Number of geese nesting in town parks declined from 13 pairs in 1996 to 5 or 6 every year after.

Effectiveness of roundups varied among sites. Molt counts at every capture location were lower a year after removal (Table 2), and this has been our experience with roundups elsewhere in New York State (B. L. Swift, unpublished data). Geese were absent for a year or more where isolated flocks of 15-35 geese were taken from residential areas that did not normally attract geese in late summer or fall. In contrast, small numbers of geese (<20 birds) were back in Kings Park within 3-4 weeks after each roundup (after the molt), and a flock of ~200 geese was seen there in late September 1996 and late October 1997. However, nearly all (23 of 25) neck-banded birds in these flocks were banded or seen in Kings Park before 1996, suggesting that few if any geese moved into Clarkstown from outside the local area.

Thus, while removing geese reduced the local population, it did not guarantee long-term relief at capture locations. Roundups need to be conducted strategically, at multiple sites or for several consecutive years, to achieve overall reductions of $\geq 80\%$ at some locations. This may be especially true at sites where many geese have been produced in the past (creating a surplus that may molt-migrate out of the area), at sites that normally attract large molting flocks, or where there are other molting flocks nearby (if they are not removed also).

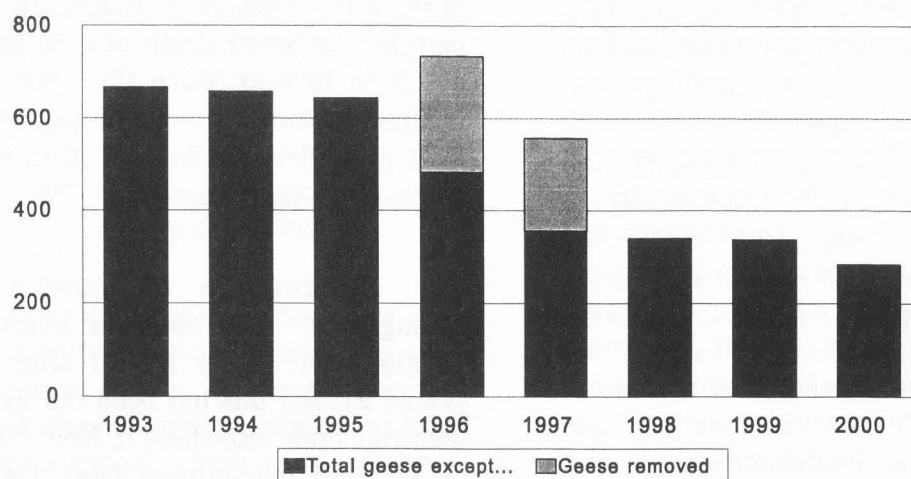


Figure 2. Number of Canada geese counted during annual molting period counts in Clarkstown, New York, before and after geese were captured and removed in 1996 and 1997.

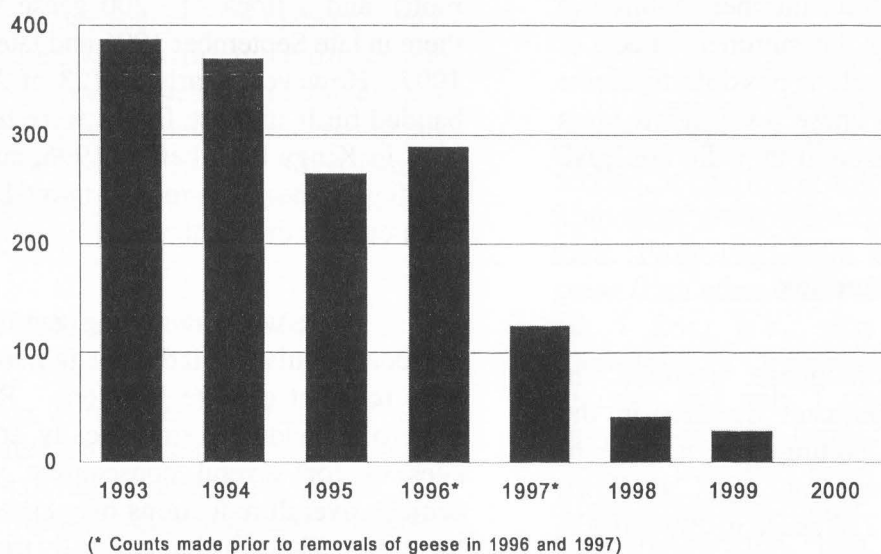


Figure 3. Number of Canada geese counted during annual molting period counts in 3 town parks in Clarkstown, New York, before and after geese were captured and removed in 1996 and 1997, and border collie patrols began in 1998.

Knowing which molting sites are used by geese that cause problems at other locations or other times of the year can help target flocks to be removed (Cooper 1991). However, removal of molting flocks may provide only seasonal (i.e., mid-June to September) relief at sites where geese from other areas congregate during fall or winter.

Effectiveness of border collies

Border collies deterred geese from established molting and feeding areas as long as patrols were maintained. Molt counts and observations at other times of year indicated that goose use of regularly patrolled sites was eventually reduced 80-100% overall. Frequently patrolled sites typically had few (<10) if any geese present, whereas flocks of 20-200 were often present before harassment programs began. Geese persisted in trying to use sites where they had some history of use, so patrols needed to be continued on a long-term basis.

In Clarkstown, use of border collies did not seem to reduce the local population, since number of nests and total molt counts did not decline after patrols began. However, number of geese molting at patrolled sites (parks) was already reduced by removals, and nesting sites were not covered by patrols, because most were located on private lands, were inaccessible, or were on densely vegetated reservoir lands. In contrast, molt counts in Orangetown and number of nests at the corporate facility declined significantly following establishment of dog patrols at key sites. We do not know where displaced nesting or molting birds went, but most with neck bands were seen near the corporate facility at other times of the year. Geese that

continued to nest at the corporate facility generally did so in locations not patrolled by dogs (e.g., rooftops and enclosed areas), and some geese began coming into the property at night, when patrols were inactive.

We found no evidence that geese displaced by canine harassment created new problem areas. Displaced neck-banded birds were seen only where geese had been seen previously; whether they spent more time at those sites is unknown. This may be typical where geese have existed for many years and all suitable habitats in the vicinity have been used some time in the past. Where geese have just recently been established, harassment may move birds to nearby habitats that have not been previously used. Whether these become conflict areas depends on desired uses of the property and whether property owners object to or value the presence of geese. If geese can be induced to molt-migrate out of suburban areas altogether, then concerns about impacts on other properties may be minimized, at least until birds return from the molt. Ideally, displaced geese would go where they were of no concern during summer and be exposed to sport harvest in fall to help reduce the population.

Interaction of control measures

In most cases, we did not document independent effects of control measures. Although this limited our ability to attribute results to each method, integrated programs including egg-addling, round-ups and canine harassment would be most effective in most situations.

For example, it would be very difficult to deter geese from most nesting sites in

Clarkstown using border collies, because nest sites were scattered far and wide throughout the town and many were inaccessible. It would not be practical to have routine dog patrols at so many sites. Although geese often were not a problem at these locations, egg-addling prevented hatching of young geese that would have moved to nearby lawns where conflicts would have occurred. Canine harassment is not appropriate for geese that cannot fly away to escape or be herded safely to an alternate site (Castelli and Sleggs 2000). Without goslings, adult birds could be deterred from feeding or settling in to molt in sensitive areas.

Removal of geese reduced the total number of nesting pairs, including some aggressive pairs or pairs whose nests could not be located for egg-addling every year. This reduced costs of egg-addling, eliminated birds with strong fidelity to capture locations, and reduced the potential for birds moving to other problem sites. Removal could allow for less intensive canine harassment, assuming that birds would be less likely to come back repeatedly, or that numbers of geese returning would be more tolerable. However, effort needed to disperse small numbers of geese with dogs is often the same as for chasing away large flocks. Removal did not provide year-round relief at some sites, but canine harassment following removals of geese in Clarkstown parks have kept geese from returning in large numbers at virtually all times of the year.

Goose management costs

Costs of management options are an important consideration in any goose control program. Depending on the property owner's

objectives and ability to pay, some options may be more practical or affordable than others. Information from Clarkstown provided perspective on relative costs of management options. Costs will vary depending on level of effort involved, so estimates from Clarkstown should not be used to make management decisions elsewhere.

Clarkstown's egg-addling program cost approximately \$7,000-\$9,000/yr for 150-200+ nests (approx. \$40-50/nest). Roundups of 200-250 geese from multiple sites each year cost the town approximately \$5,000-6,000/yr (approx. \$20-30/bird) for capture, transport and processing the birds by a State-licensed poultry processor. Border collie patrols covering 3 town parks in 1999-2000 cost approximately \$36,000/yr (approx. \$30-35/site/day). These costs must be weighed against benefits that each technique can provide and the management objectives. In simple economic terms, removal of a single pair could eliminate the need for egg-addling for several years if the pair is not replaced by other birds. Costs could be lowered through use of volunteers, but results may not be satisfactory since these techniques are labor-intensive and some (egg-addling and use of border collies) require substantial or long-term commitment of time.

Public acceptance of goose management can also affect program costs. Programs using round-ups or other lethal control methods will often be met with organized opposition. This can be a considerable burden to local officials and others involved in decision-making or doing the work, due to media interest, legal challenges, disruption of management activities, citizen conflict at public meetings, and responding to frequent correspondence

from animal rights advocates. In Clarkstown, we experienced all of these anti-management efforts, including 2 lawsuits and formation of a "Coalition to Prevent the Destruction of Canada Geese" that actively campaigned against goose round-ups. In anticipation of this, local officials should consider and use non-lethal measures as much as possible (and document effectiveness) before proposing round-ups as part of a community-based management program.

Conclusion

Canada geese are likely here to stay in suburban areas. Effective management of suburban goose populations requires a long-term plan using multiple techniques to alleviate site-specific problems and reduce overall numbers of local-nesting geese.

An efficient strategy for communities with severe goose problems may be to employ "goose control officers", where local governments would hire or contract out for a full range of goose control services on public and private lands, as part of their animal control program. Those services could include enforcing "no-feeding" ordinances, harassing geese with dogs or pyrotechnics, installing fencing around ponds, egg-addling, conducting roundups, providing goose control information to property owners, recommending habitat modifications, and evaluating effectiveness of alternative techniques. This approach is suggested because control measures need to be coordinated throughout a community to reduce, not just redistribute, goose problems. A comprehensive local program would likely be more effective than general guidance from state or federal wildlife agencies or

uncoordinated actions by individual landowners, whose willingness to implement control measures may vary widely. Having a local person with expertise about goose populations, habits and control options may also result in higher credibility and community trust.

Managers need to be open-minded and objective about effectiveness and acceptability of alternative control measures. Some of our results were unexpected, including the limited impact of egg-addling, mixed success of round-ups, and seasonal disappearance of some pre-molting geese displaced by canine harassment. There is no simple solution to suburban goose problems, so managers should offer realistic expectations to people dealing with those conflicts. Wherever possible, effects of control programs should be documented, especially at the community level, with assessments based on data collected at and around problem sites.

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