

USE OF ALARM/ALERT CALL PLAYBACK AND HUMAN HARASSMENT TO END CANADA GOOSE PROBLEMS AT AN OHIO BUSINESS PARK

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Abstract: Burgeoning resident Canada goose (*Branta canadensis*) populations have led to increased goose/human conflicts. Playback of recorded goose alarm/alert calls coupled with human harassment was used to attempt removal of resident geese from a 24.2 ha business park, Dayton, Ohio, 26 February-15 August 2002. Many geese present were reusing nest territories of previous years. Removal efforts began following territorial establishment. Call playback used 3 "Goosebuster" units (Bird-X Corp. Inc., 300 N. Elizabeth, Chicago IL 60607). Goose use of the property dropped from an estimated 1600-1800 goose hrs/day before testing to fewer than 150 goose hrs/day by week three and to 0 hours by May. Reports of goose aggression or injury to employees fell from 32 and 2 cases in 2001, respectively, to 0 for both in 2002. Harassment effort declined from a maximum of 3-4 hrs/day to under 15 min/day by week 5. Goose droppings counted per 100 m of walks fell significantly $F_{3, 24} = 30.048$, $P < 0.0001$, from a mean of 195.7 on 26 February to 3.28 on 24 March 2002, a 97.88 % reduction, and remained low. Continued alarm call playback at random 10-20 min settings appeared to help prevent return/recolonization of the property by geese

Key words: alarm/alert calls, *Branta canadensis*, dispersal technique, harassment

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INTRODUCTION

Expanding resident urban Canada goose populations have led to concomitant increases in human/goose conflicts in business parks, municipal parks, golf courses, and airfields. Geese in all such locations have proven difficult to displace and keep away. Their preference for short, highly fertilized grass, golf courses, ponds and parks, and protection from hunting in urban settings, are all factors that attract geese to these environs (Smith et al. 1999). Numerous non-lethal techniques have had limited long-term success as means to disperse Canada geese in both agricultural and urban settings. A recent summary of such techniques has been collected and published by Smith et al. (1999). Live

trapping and relocation or euthanasia programs have provided some respite or reduction in problems (Cooper and Keefe 1997). Recently Blackwell et al (2002) tested lasers on this species for dispersal potential.

Complete descriptions of call form, duration, and frequency of alarm and alert calls and associated behaviors of giant Canada geese, *B. c. maxima*, have been made previously (Whitford 1987, 1998). Mott and Timbrook (1988) and Whitford (1987) indicated some preliminary success at Canada goose dispersal using alarm call playback. However, long-term studies of the efficacy of this technique have not been reported.

To date, there have been no reports of a consistently successful dispersal technique, especially one that offers hope of preventing re-colonization of areas after resident geese dispersal, or removal by transplanting, or lethal methods. To address this problem of recolonization and examine options for initial dispersal of geese from urban nesting sites, playback of alarm and alert calls of giant Canada geese were combined with several harassment techniques in preliminary tests. These tests were designed to determine whether together they would: 1) effectively remove nesting resident Canada geese from a business park in Dayton, Ohio; and 2) perhaps inhibit goose return and/or recolonization of the site.

The research was opportunistic, initiated by a January 2002 request from a large corporate campus to assist them with reduction of goose problems; simultaneously it provided an opportunity for further testing of playback units that had shown some potential for goose dispersal in tests the prior summer (Whitford unpublished). Teaching load and distance from the research site meant that study design and oversight of the data collection were not as controlled as I prefer; I had to rely on assistance in record-keeping and harassment effort from the head of security for the central corporate property on days I could not be present. The only negative aspect to the project was that, in granting study permission, the corporate legal office restricted use of the company's name, precise location, and Security Director's name, in any publications generated.

In spite of concerns about the travel distance, need for assistance and limited time I had available, I proceeded with the study because the opportunity allowed me to simultaneously address several important questions: 1) Could geese be moved off established territories by our combination of

techniques after breeding season began? 2) Could the geese be taught to avoid the central campus complex if no effort was permitted to displace them from adjacent properties? 3) Would call playback alone continue to keep geese away from the property once daily harassment efforts ceased? 4) And, finally, could the harassment techniques be effective at removing geese when the majority were to be carried out by an untrained, non-wildlife specialist, acting as a research volunteer, one who had many other corporate duties; this was essentially a real world test of results?

My hypothesis, based on unpublished 2001 research results, was that playback of species-specific alarm and alert calls would prevent transient geese from landing or feeding at new sites, and would also make resident geese apprehensive, and easier to displace via human harassment. The prior tests had been done to determine how long it took for habituation to the calls to arise when nothing else was done to assist call playback intended to keep geese away from preferred turf-growing feeding sites. In this new study I hoped to determine whether harassment coupled with call playback could produce long-term avoidance of prior use sites by resident geese, and to discover whether those geese would learn to associate the call playback with harassment (via learning or conditioned response training). Would they avoid the area even after human harassment efforts ended, as long as alarm and alert calls continued to be played sporadically on the property? If successful, the technique would offer a new means to deal with current resident goose problems and possibly to prevent establishment of resident flocks where they aren't desired.

STUDY SITE

The study site was a 24.2 ha corporate park with a 0.2 ha pond, soccer and baseball fields, 6 buildings, and paved

parking facilities for 1400 cars. It was situated between two other properties: 1) a 12 ha corporate park with a 0.5 ha pond, landscaped and grassy areas and parking for several hundred cars, roughly 120 m across undeveloped land from the study site; and 2) an apartment complex with >1 ha manmade lake lying just across the highway from the primary corporate campus. The study area was bordered to the west and north by fenced interstate highways and several hectares of 20-30 year old dense second growth forest, and to the east and south by 60+ ha of overgrown weedy, shrub lands considered unattractive to geese. Thus, the population of the three properties was largely isolated from other resident geese, which meant I would be working with a limited set of individual geese. Corporate records of past goose aggression problems and nesting history, and the promise of assistance all made the site attractive for the research.

Resident geese used all three properties at the onset of the study. As determined by preliminary counts conducted 31 January and 24 February 2002, roughly 85-100 were present at any one time on the central property. Another 80-140 used the adjacent properties for daily activities and night roosting. Exact figures were impossible to obtain due to the exchange of geese between sites, daily feeding movements, and transient resident geese visiting the property. No migrant flocks comprised of smaller goose races were observed on the property during the study. Since only success at removing geese from the central property was important for my study, I considered a precise tally for all three sites to be unessential, though the adjoining properties did serve as "quasi-controls" I could use to monitor local goose numbers at non-test sites during my research.

Records indicated geese had been present as year-round residents on the corporate properties for more than a decade, with recent numbers being adequate to cause requirements of daily walk sweeping in spring and summer, annual re-sodding of lawns near pond margins, and employee complaints about extensive dropping contamination of the baseball and soccer fields, parking lots, and entryways. Facilities records for 2001 indicated 32 reports of aggression to humans. There were two cases of injury requiring hospital treatment that resulted when employees attempted to avoid goose attacks. Egg addling records indicated 43-45 active nests annually for the previous 5 years on the primary campus, and 18-25 annually on the smaller one. Past nesting data, or goose use information were not available for the apartment complex.

METHODS

Alarm and Alert call playback used digitized forms of calls recorded from captive giant Canada at Milwaukee County Zoological park. These were geese originally live trapped at Rochester, Minnesota, for my 1981-87 dissertation research (Whitford 1987). These calls were copied and digitally elongated and compressed 0.01 second, producing 3 slightly different call frequency and duration series. The resulting calls were then rerecorded onto microchips of three "Goosebuster" units from Bird-X Corp. Inc., Chicago IL 60607. The digital alteration and microchip production were designed to alter goose perception of the sound and to foster the impression that several individuals were giving alarm or alert calls. Call units play up to 4 different call series, mixes of varied alarm and/or alert calls, in randomized sequence, one series via each of four dispersed speakers, each time playback is initiated. It was hoped these call and unit modifications would enhance goose

response and reduce/delay the probability of habituation to the calls. My unpublished 2001 research with the system found habituation occurred in 5-7 days when flightless geese and goslings were unable to escape the sound of the original call recordings. Harassment was not used to reinforce the calls in that test to help keep geese from returning to preferred gosling feeding sites on 3.4 ha grass growth test plots of a major Ohio lawn chemical corporation.

Two playback units employed in the current study used AC power sources. The third, easily moved to wherever problem geese were located, used a 12 volt marine battery and solar panel power source. The AC powered units used commercially available 24 hr plug-based outdoor timers to control daily hours of operation. All playback units had three internal timer settings, "test," "short," and "long," providing the option of call playback at randomized times within base intervals of 1-3, 5-10, or 10-20 min, respectively. The volume controls for all units were set to make call playback consistent with natural goose alarm call volume, and to avoid disturbing employees in the adjacent buildings or attracting attention to the call units.

Call playback and harassment started 26 February, 2002 and continued until 14 May 2002. Thereafter only call playback was used until the study ended 15 August. The two AC units were set up in areas of greatest goose/human interaction near the pond outside the main building entrance, and set for 1-3 min random "test" playback cycles on 24 hr/day operation for the first week. They were reduced to 5-10 min "short" settings, operating 6:00-18:00 hr daily operation for the second and third weeks, then to "long" playback intervals, playing only from 08:00-10:00 and 17:00-20:00 hrs for the duration of the study to

determine: 1) whether geese habituated or returned once harassment ended; and, 2) whether call playback alone would prevent re-colonization of the site once harassment ended. Lacking a DC timer, the DC unit was set for "daylight only" operation using an internal light sensor control, and set for "short" timer setting for the first 5 weeks, and "long" thereafter until study termination.

Due to prototype production delays, the study began roughly three weeks after territories were first established for the spring breeding season. This, and knowledge that many geese present were nesting in territories they had used in previous years, increased the probability that geese had strong site affinity for their territories. I expected this to make these geese very difficult to permanently disperse with non-lethal methods.

Human harassment consisted of one person (either me or the Security Director) chasing geese on foot and waving their arms to encourage geese to fly. A vehicle was often used to check for birds present in the 1.2 km circuit around the buildings and parking lots. I did this harassment 3-4 days/week; the Security Director covered the days I was not present. We chased the geese until they left the property entirely, even if they landed at multiple locations before leaving. Geese were chased off again within minutes of return if they came back – to prevent them from possibly habituating to call playback, and to reinforce the association of call and harassment. This effort was assisted by continual monitoring on the entire property by personnel using rooftop surveillance cameras and video displays housed in the security office. In the study design, a combination of persistent pursuit and zero tolerance of geese on the grounds was considered essential in getting geese to abandon the site for the long term.

Geese present on arrival were to be completely removed from the property by harassment between 06:30 and 08:00 daily, varying with effort needed, sunrise time, and personnel and goose arrival times. Our one problem with the harassment program was lack of free access to the building roofs to permit chasing geese from them. Several pairs of geese developed the habit of taking refuge there to avoid ground-based harassment. Furthermore, removal of geese from roofs required two people - one on the roof and one on the ground- or geese would merely fly up and down, but not leave the property. Several mornings in March and early April we used a 22 caliber propelled retriever training "dummy launcher" to scare inaccessible geese off the roof edges of buildings. Two Chesapeake Retrievers (belonging to the Security Director and initially brought in without consulting me) were used sporadically on 7 mornings 5 March to 1 May.

To discourage nesting on the campus, once egg laying began we placed heavy owl decoys, sticks, or mylar balloons directly in nests to prevent further laying or incubation. We did this as soon as each nest was discovered, and did not wait for clutches to be completed or onset of incubation. This forced geese to either abandon the area or to construct another nest near the first and begin laying again. All nests and renests, dates of nest discovery, number of eggs, and nest fates were recorded on a site map for analysis. Once nest construction began, we focused chasing efforts on the female, driving her from the nest area repeatedly, in hopes she'd abandon her territory. This decision to focus harassment on the female was based on reports indicating that male's inadequate defense of the female was the primary factor in nest abandonment by the goose, and abandonment was most likely to occur

during the egg laying stage of nesting (Cooper 1978).

Evaluation of success of the alarm/alert calls and harassment technique was to be based on estimates of geese/hours/day on the property (# geese observed x length of time geese were present, summed for day). These estimates were made by me during one day/week of sunrise to sunset observations, typically conducted on Saturday along with my harassment and observation activities. Saturday was preferred for this since people and vehicles at the campus were few and geese readily visible that day. I recorded time, number, location, and distance geese were chased before flight off the campus (and individual identity when possible, based on distinctive feather patterns). This was done for all geese present on morning arrival and was also recorded for all geese arriving/chased off later in the day. The Security Director provided basic information about times and numbers of geese observed and chased on days when I could not be present. I recorded the distance geese were chased before they left the property throughout the study in hopes that a decline in number or distance of chases would provide a viable means to assess reduction in problems as birds, hopefully, became more leery of human approach and harassment. The distances geese were chased before they left the campus were recorded as estimates to the nearest 5 m for short chases, or nearest 10m for distances greater than 50 m. The time spent in harassment was recorded to the nearest whole minute spent actually chasing geese off the property for each chase. Tallies were summed for the day. Like goose hrs/day, records of time spent on harassment were based solely on my Saturday sunrise-sunset data collection to insure consistent data recording and harassment methods. Any significant reduction in daily time in

harassment activities during the study was to be considered further indication of the success of the combined call playback and harassment technique.

I used dropping counts/100 m on a fixed set of 10 100-m segments of sidewalk as an indirect means to evaluate success at reducing goose problems. Winter cleaning of droppings from walks was sporadic and tied to snow removal needs, rather than daily as reported for spring and summer 2000 and 2001. Since my first dropping count was made 8 days after snow removal, I only did subsequent counts at irregular intervals when walks had not been cleared for 8 days, so there was equal time for dropping accumulation.

Final, but major, options for evaluation of our goose removal effort, relied upon comparison of numbers of nests created/incubated, and reports of goose aggression, and injury to employees between years before and during the study period.

RESULTS

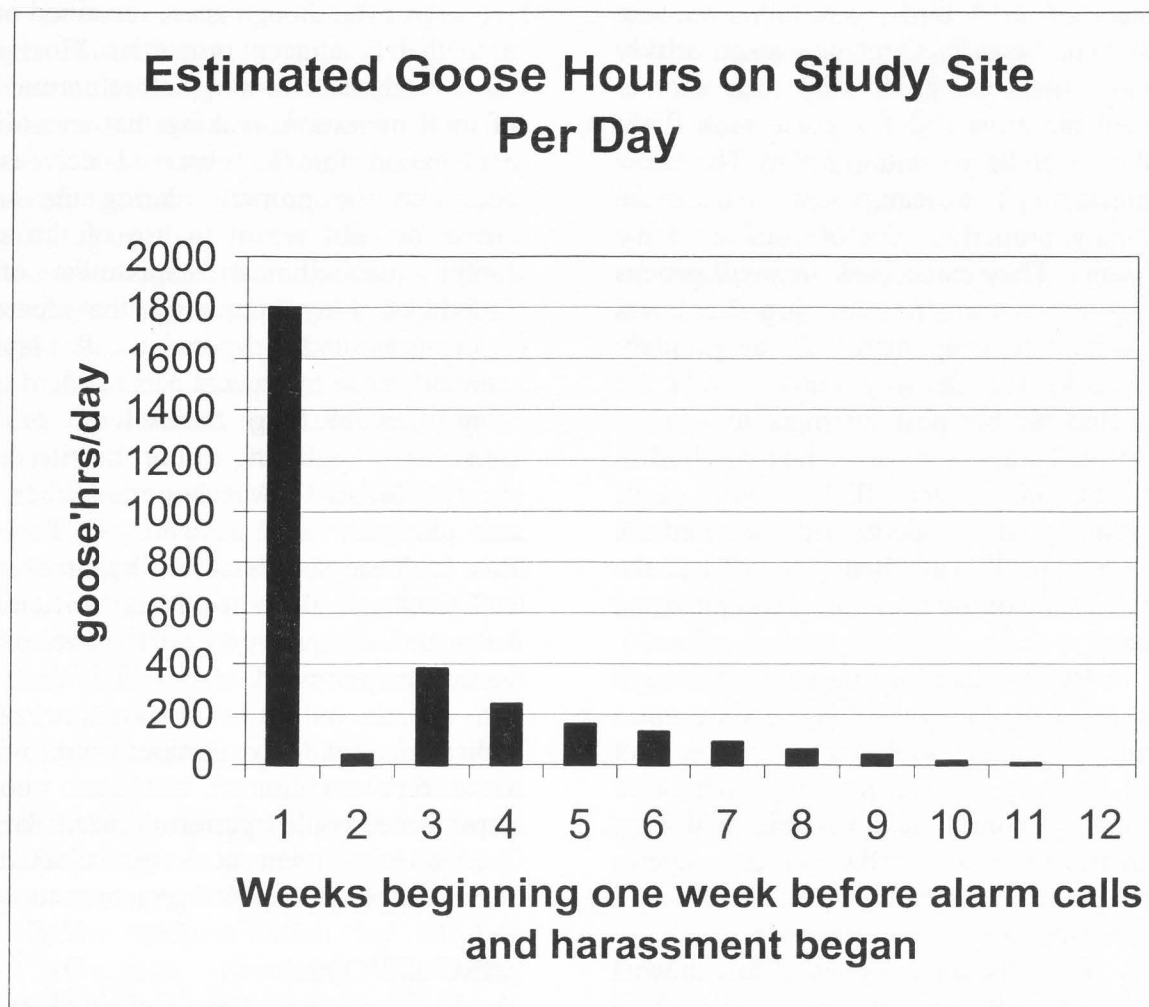
Alarm/alert call playback coupled with our physical harassment and nest obstruction efforts resulted in a decline from a conservative estimate of 1600-1800 goose hours per day (100 geese times 16 - 18 hrs present per day in preliminary observations) on the property, to fewer than 150 hrs/day by the third week of harassment, and declining to 0 hrs/day by 14 May (Figure 1). Goose droppings per 100 m of walks, based on the same 10 sample units (1km), fell significantly $F(3,24) = 30.048$, $P < 0.0001$, from a mean of 195.7 to 3.28 per 100 m between 26 February and the next counts on 24 March, a 97.88 % reduction. They remained below the 5/100 m level on subsequent counts in April and May, and were not visibly increased through the summer to the study's end on 15 August, even though harassment and dropping count efforts were terminated on 14 May.

Number of pairs actually attempting nesting during the study declined to 19 in 2002, less than half the 43 and 45 pairs reported nesting and incubating in 2000 and 2001, respectively. In 2002 the first nest was found 7 March before eggs were laid in it. The first egg was observed in another nest 9 March. In 2002, 42 nests were initiated by 19 females, representing 19 original nests and 23 renesting attempts, between 7 March and 15 May. Most females, 16 of 19, made one renest attempt, and 7 females made 2 renest efforts, after placement of materials in nests forced nest abandonment. New nests were usually within several meters of first nests. Once nests were abandoned the nesting pair was not believed to be seen on the property thereafter, based on individual appearance, location occupied, and observed decline in goose numbers present. This implies they left the property and did not return during the study.

Nest harassment resulted in all nests being abandoned before incubation was begun during 2002. Only four nests reached a 6 egg stage before detection and abandonment. In contrast, all females were allowed to incubate addled eggs in prior years. Total eggs laid on the property declined from 268 in 2001 to 104 in 2002, a 61.2% reduction. Mean number of eggs laid per female before abandoning her nesting attempts on the property in 2002 was 5.47 (SD = 3.03, N = 19, Range 0-11), representing all eggs laid by a single female in all her nesting attempts.

There were no reports of goose aggression or injury to humans from geese in the 2002 nesting season, versus 32 and 2 reports of these problems, respectively, in 2001. This decrease occurred in spite of the fact that no aggressive ganders were removed in 2002, unlike 2001, when 2 males were lethally removed.

Figure 1. Estimated goose hours/day between 21 February to 14 May 2002 on a 24.2 ha business park in Dayton Ohio. Graph based on one day/week counts of total geese observed on the property and reduction in numbers of territorial and nesting Canada geese present as harassment and alarm/alert call playback were employed in efforts to reduce goose problems.



Counts on 26 February, the day harassment and call playback began, found 44 pairs defending territories, plus 20 to 30 non-breeding birds feeding on the study site throughout the morning. On 27 February, after a single night of continual alarm and alert call playback, all night roosting on the property ceased. Only 7 geese were observed and chased from the property for the day, and 5 were chased off on 28 February. Less than 10 minutes/day was

spent in harassment those two days. This indicates that the call playback probably made a significant contribution to the removal effort. After 15 March, only 19 territorial pairs remained, with each briefly appearing on the grounds on any given day; this was a greater than 60% reduction of population, and greater than a 90% reduction in total goose hr/day on the campus in 18 days.

When call playback was initially begun all geese present immediately assumed alert postures and called. They gradually appeared more agitated with each call repetition. They grouped together into clusters of 8-10 birds, but failed to take flight. The Security Director walked briskly towards first one group and then another waving his arms and the geese took flight readily when he got within 5-8 m. They flew completely off the campus to land on the adjoining properties, out of earshot of the call units. They came back in small groups during the afternoon, requiring 2.2 hours harassment to keep them off the property until dark. The Security Director told me later that all his past attempts to remove geese by harassment alone had resulted in only 50-100 meter flights and geese resettling on the property. He attributed the difference to the calls being played and the agitated state of the geese once call playback began.

By 5 March it became clear that morning arrival counts of geese were not a useful assessment tool, for once they quit night roosting on the property, arrival of geese was sporadic and variable in timing. Estimates of goose hrs/day on the property were used as a principle assessment tool of goose dispersal success thereafter.

Records of harassment effort showed very rapid declines in the first few days from 2.2 hours to under 10 min/day for the first three days, but rose to 4 hr 22 min for 8 March when territorial geese returned and nesting season began in earnest. These pairs were much harder to chase off and keep off, as the females (with male accompanying) returned in attempts to lay eggs in hidden nests. Daily harassment effort dropped continually, but gradually, to zero minutes/day from that date to 14 May as successive pairs abandoned nesting attempts and the property. Extrapolation of harassment effort data indicated that roughly

116 hours were spent in harassment between 26 February and 14 May.

In the long run, the combination of call playback and harassment proved successful at eliminating all geese from the property, even though geese remained on the immediately adjacent properties. Most geese left in early March, long before normal time of molt migration, making that an unlikely explanation for the observed decrease in geese on the property during the study. Geese did not return to use of the study campus once human harassment efforts ended 14 May, implying that learning, association, and/or sporadic call playback were adequate to prevent past resident geese from reestablishing themselves, or new geese from beginning to use the site during the 14 May to 15 August period when only call playback units were in use. Together, this evidence supported the hypothesis that call playback alone would be sufficient to keep the campus goose-free once initial geese were removed.

Last, but still of importance, results indicated that an untrained but willing volunteer without wildlife control experience could perform much of the needed harassment at levels adequate to make the goose dispersal project succeed.

DISCUSSION

Time spent per day in harassing geese was highly variable across the study, strongly influenced by weather, reproductive condition, and harassment experience of individual geese as dominant variables, as judged by observed patterns of goose behavior. After chasing all the geese from the property on 26 February, 7, 5, 8, 58, and 0 geese were observed on the campus the following 5 days, respectively. It is possible that windy 10⁰ F weather that followed shortly after study initiation may have reduced the tendency of geese to return to the property the next few days, for geese are

reported to reduce activity and movement in extremely cold weather (Whitford 1987).

On 2-6 March the first visible set backs to goose removal occurred. Weather suddenly warmed to 45⁰ F, and 58 geese were present upon my 06:45 arrival 2 March. Most prior territories had been reclaimed. Pairs appeared reluctant to leave their territories and tended to move from one area of the property to another when harassed, and then return immediately to the territory again. It required 2 hrs 12 min to remove all the geese from the campus. Only three geese returned and needed additional chasing by sunset. The following day, 3 March, was cold again and no geese were present. On 4 March, only 3 pairs of geese were present, all on 4th floor roofs. They stayed all day and I was unable to chase them off. On 5 March 5 pair of geese were chased off roofs by facilities personnel and I chased another 6 pairs from ground level territories. On 6 March, 55⁰ F weather returned, and again 58-60 geese were present upon my arrival to defend nest territories. They required 4 hrs 22 minutes of chasing during the day to remove them and keep them off the property. There followed a rapid drop in geese present from the 29-30 pairs present on 8 March (already 12-13 pairs below study initiation day tally) to only 19 pairs remaining, defending territories, and trying to nest on 15 March. That drop was presumed to be the result of combined call playback and continual harassment effort.

Even with 19 pairs still present on the campus the number of goose hours/day had dropped below 200, the majority of those being due to the presence of 6-8 pairs that occupied roofs 10-12 hours per day. All other pairs of geese remaining spent only a few minutes a day on the campus, quickly visiting the territory/nest site and departing. Eggs, if laid, were quickly covered, and the male and female left immediately. It was

largely during this period when most geese were already gone or spending little time on the property, that the 2 dogs were brought to the campus sporadically by the Security Director. Therefore, I was skeptical that the participation of the dogs contributed much to the success of the research.

All nests were abandoned before incubation was begun during the study, whereas in previous years geese were allowed to incubate addled eggs until well past normal hatching dates. I believe the absence of any reports of goose aggression toward employees and/or of injury resulting from aggression during the study (versus the 32 complaints, 2 injuries during this time period in 2001) may be attributable to this difference in nest treatments. Game theory, from the realm of animal behavior, suggests that animals will increase defense of resources in proportion to the amount of energy they have invested in them (Goodenough et al. 2001). If this theory is applied to geese, a nest with only a few unincubated eggs in it has far less value than one with a full clutch and 25-30 days incubation time invested in it. Thus, geese should readily abandon the former without a fight, and opt for building another nest, as most geese in this study did. Another possible explanation for the reduction in aggression toward people is that geese, having been chased repeatedly humans, were unlikely to attempt aggression toward them.

All but four territories were abandoned and the pairs gone by 20 April. These 4 pairs were the most difficult geese to remove for they spent their time on fourth floor roofs out of reach of normal harassment efforts. The Facilities Manager for the complex was reluctant to send employees to chase them off and seldom cooperated with my efforts. With full cooperation on chasing geese from the roof, I suspect the project would have been

completed by 10 April, at the latest. Also, had we been able to use selective lethal removal of females of the most tenacious 10 pairs, the males would have departed their territories. Again, we could have almost certainly have reduced time and effort expended in harassment efforts by 4-6 weeks if that had been an option for use.

All non-paired, non-territorial geese and half the original pairs quickly abandoned the property in the first two weeks, bringing about a rapid decline in daily harassment. Decline in harassment effort could also be partly explained by changes in goose response to harassment. From 6 March to 10 March geese that returned to defend territories often moved off in two or three stages, requiring prolonged chasing before leaving the property. By the third week of harassment most geese readily fled at sight of me, the Security Director, and our vehicles. All evidence suggested that the geese could discriminate individual humans and vehicles exceptionally well by the 5th or 6th time they had been subjected to harassment by each of us. They were not observed to react by flying away when approached by any of the hundreds of employees who were constantly entering and leaving the buildings (an open campus in terms of free time schedules for employee arrival and departures). Recognition of us probably contributed to the rapid initial decline in harassment effort, for geese would regularly fly off the property at the mere sight of my tan Buick, or the security director's green pickup. This aspect of harassment response underwent a major change once egg laying began.

The last 16 pairs appeared to have the highest site fidelities and tenacity. Despite harassment, they returned again and again to defend territories, construct nests or lay eggs. Even so, once only these geese were left on campus, there was a gradual

decline in time spent in harassment as these remaining pairs abandoned the property. The observed decline was not uniform, as there was an abrupt change in goose behavioral response to harassment and a concomitant rise in daily harassment effort needed that accompanied egg laying activity of remaining nesting pairs, beginning 9 March 2002. When the female was physiologically ready to lay an egg, she (and her mate) became extremely persistent about getting at her chosen site and laying. Often she required chasing 4 or 5 times in the immediate hour before she either succeeded at laying the egg in her nest or finally gave up and left the property. Females that had fled from me on sight in prior days began to "lead me away from the nest" with short 30-40 m movements, sometimes circling buildings repeatedly before laying or leaving. Since eggs are laid every 1.5 days (Brakhage 1965), both harassment efforts and distance geese were chased before leaving the property rose rapidly at this time. This behavioral change resulted in a second increase in time spent in harassment that offset most of the gain from the declining number of birds present. A great deal of effort might have been saved by simply letting the female lay her egg with our harassment, but I feared this might promote habituation by prolonging exposure to the alarm and alert calls.

Reduction of goose damage to lawns was evident in that new sod required to be planted annually in 2000 and 2001 around the pond and building entrances remained dense and healthy in 2002. Additionally, the corporation also saved expenses associated with daily cleaning of walks and internal hallways that was required prior to the study. These savings in labor and costs, if comparable at other problem sites, should more than offset employee time and expense of the goose call playback and harassment efforts for a removal project such as this.

Two people may prove more efficient for harassing geese on large properties where they move between two preferred sites when chased.

CONCLUSIONS

All evidence from this study suggests that it is possible to teach resident geese to avoid even very attractive specific urban sites if sufficient and consistent effort is made, using multiple harassment techniques coupled with broadcast of alarm and alert calls.

Based on our results, it appeared that continued alarm call playback at random 10-20 minute settings helped prevent return of residents and re-colonization of the property by other geese. Geese did not re-colonize the property during the 14 May -18 August post-harassment period when the playback units were turned on and functioning.

As a last comment, the study shows that a goose dispersal project can be successfully carried out with the majority of effort being contributed by a dedicated, non-wildlife trained, volunteer who has other daily commitments, as long as someone is present to insure continuation of harassment until dark.

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