Efficacy of a Laser Device for Hazing Canada Geese from Urban Areas of Northeast Ohio[1]

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ABSTRACT. Complaints about Canada geese in Ohio have increased nearly 400% in the past decade, with 732 recorded in 2001. Harassment techniques such as pyrotechnics and mylar flagging have been used to reduce goose conflicts but are frequently ineffective, and initial experiments indicated that laser harassment may disperse Canada geese. We evaluated whether lasers could cause geese to abandon urban sites, the duration of site abandonment, and dispersal distance of harassed geese. One hundred ninety geese were banded and collared in June 2001 at 6 sites in northeast Ohio. Radio transmitters were attached to 40 collars. We conducted nocturnal laser harassment of geese in four 5-day periods from July 2001 through January 2002 at 3 treatment sites. No harassment occurred at 3 control sites. One-day surveys of collared geese were conducted 2 weeks prior to the 5-day hazing period, during the hazing period, and 2 weeks post-hazing. Geese were located through radio telemetry using air- and ground-based receivers during all 3 time periods. Laser harassment caused geese to leave the site after a mean of 4.6 (SE = 0.8) minutes of treatment. Over the 5-day treatment period, the mean number of geese observed at night decreased from 92 to 14; however, we found no differences between numbers of geese observed 2 weeks prior to initial harassment and those observed post-harassment. Telemetry indicated that geese moved <2.0 km from all but one banding site. Laser harassment was more effective in reducing goose numbers at night rather than reducing numbers during the day. Site characteristics such as ambient lighting, human disturbance, and size of pond appeared to be the primary factors determining the laser's effectiveness.

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INTRODUCTION

Numbers of resident Canada geese (*Branta canadensis maxima*) in Ohio have increased from 15,000 on 5 goose management areas in 1990 to 142,000 statewide in 2001 (Ohio Department of Natural Resources, Division of Wildlife [ODNR] 2001). Coincidentally, numbers of goose conflicts with humans have risen from 152 complaints in 1990, to 732 complaints in 2001 (ODNR unpubl. data). This increase in goose conflicts has increased the need for effective conflict abatement techniques. Pyrotechnics, mylar flags, border collies, and physical barriers have often been used to reduce conflicts (Smith and others 1999) but are not always effective or practical (ODNR unpubl. data). Urban goose populations are difficult to manage due to their tolerance of human activity. In addition, many harassment techniques (for example, hunting, pyrotechnics) are prohibited in urban areas due to human safety and disturbance factors, whereas alternatives have demonstrated little or no success (for example, dead goose decoys) (Tom Seamans, USDA Wildlife Services unpubl. data).

Recent research has documented that long-wavelength (that is, 630-650 nm) lasers offer a safe, effective, and nonlethal means for dispersing certain species of birds (Cepek and others 2001; Glahn and others 2000; Blackwell and others 2002). During controlled pen experiments, geese avoided a Class-II, 50-mW, 650-nm laser under low-light conditions (Blackwell and others 2002). Cepek and others (2001) used the same laser on 18,000 Canada geese roosting at a Pennsylvania lake during January; over 4 nights of laser treatment, goose numbers dropped to 1,600. Blackwell and others (2002) and Cepek and others (2001) noted that Canada geese did not habituate to the lasers. Similarly, Glahn and others (2000) determined that numbers of roosting double-crested cormorants (*Phalacrocorax auritus*) were reduced by 90% for 9 weeks with 1-3 evening treatments, although large numbers of cormorants returned to some sites within 1 week.

The objectives of this study were to determine: 1) whether laser harassment could cause geese to abandon urban sites; 2) duration of site abandonment; and 3) dispersal distance of harassed geese if the harassment causes geese to leave an area.

MATERIALS AND METHODS

Eight potential study areas were selected in northeast Ohio. Each area was located in an urban/suburban setting where hunting and firearm discharge was prohibited and had a long-term history of goose conflicts without recent (≤1.0 year) active goose harassment. We randomly selected 3 sites for laser harassment (treatment sites); 3 sites were monitored without any harassment (control sites); and the remaining 2 sites were designated as alternate sites. The 3 treatment sites included Locust Grove Golf Course in Mayfield Heights (6 ha with 2 ponds <1.0 ha); Holden Arboretum in Kirtland (26 ha

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with 2 ponds of 6 ha and <1.0 ha); and Lake Nesmith in Akron (20 ha, 1 lake of 18 ha). The 3 control sites included Summit Lake in Akron (63 ha, 1 lake of 37 ha); Avon Reserve at Summerville in Avon (5 ha, 1 pond of 4 ha), and Pleasant Lake Nursing Home in Parma (2 ha, 1 pond <1.0 ha). The mean (SE) distance between nearest sites was 46.4 (14.8) km for laser sites, 39.3 (9.7) km for control sites, and 43.8 (5.2) km across all sites.

One hundred ninety molting geese were captured while flightless at the 6 sites. All geese were banded with standard US Fish and Wildlife Service leg bands and outfitted with a white plastic collar inscribed with a 4-digit, black alphanumeric code in late June 2001 (Table 1). Forty geese (6-7 at each site) were marked with radio transmitters (Advanced Telemetry Systems, Inc., MN) attached to their collars (Table 1). The number of collared, uncollared, and radio-marked geese present at each site was recorded during a two-week period prior to laser harassment, the harassment period, and a two-week period following the last day of harassment. Goose collar observations were conducted at all 6 sites during: 22 July 2001 through 23 August 2001; 24 August 2001 through 23 September 2001; and 8 October 2001 through 9 November 2001. Goose collar observations were only conducted at Summit (control) and Nesmith (treatment) during 1 January 2002 through 31 January 2002 because ponds at other sites were frozen with no geese present.

TABLE 1

Canada geese marked at study sites in northeastern Ohio during June 2001.

Location	Collared Geese	Radio-Collared Geese	Total Marked Geese
Locust Grove	37	6	43
Holden Arboretum	30	6	36
Lake Nesmith	33	7	40
Summit Lake	33	7	40
Avon Reserve	6	7	13
Pleasant Lake	11	7	18
Total	150	40	190

We used the Avian Dissuader™ laser (Sea Technology, Inc., Albuquerque, NM) as our treatment. The laser is a handheld, battery powered, Class-IIIB, 50-mW, 650-nm diode laser. In general, Class-IIIB lasers are not a fire hazard and are generally incapable of producing a hazardous diffuse reflection except for conditions of intentional staring at close distances (OSHA 1991). We also followed the laser use guidelines presented by Glahn and Blackwell (2000) to minimize potential for injury to participants.

Laser harassment was conducted at each treatment site during 3 separate, but continuous 5-day harassment periods: 5 August 2001 through 9 August 2001; 5 September 2001 through 9 September 2001; and 22 October 2001 through 26 October 2001. We conducted laser harassment only at Nesmith during 21 January 2002 through 25 January 2002 because the ponds at Holden and Locust were frozen and no geese were present. Any collared and/or radio-marked birds and total number of birds on the site were recorded prior to harassment. Harassment ceased after 30 minutes of treatment, or if no response was evident. The investigator used a night vision scope (ITT Night Enforcer G3™) to assist in locating geese and detecting the laser beam. The laser produced a continuous beam of red light which was directed at the ground or water close to the geese. The beam was then moved in an erratic fashion towards the birds. Geese occasionally did not move until the laser beam was placed directly on them. If geese flew or swam to the far side of the lake after harassment, the investigator moved to another part of the shoreline and continued harassment until geese departed the area, became non-responsive to the laser, or 30 minutes had passed. We calculated mean time of actual laser harassment and the percentage of birds that left the area due to harassment for each site and for all sites combined.

We attempted to locate radio-collared geese at least twice during each 2-week observation period and once during the 5-day harassment period using either a Partenavia P68C airplane or a Bell Jet Ranger 206B3 helicopter, both equipped with "H" style antennas. We also attempted to locate birds from the ground using either a null-peak twin-yagi antenna system mounted on a truck or with a handheld yagi antenna.

We calculated a grand mean and 95% confidence interval (Cherry 1996; Johnson 1999) on the mean number of geese observed per day at each site for the 2 weeks before the first night of harassment (5 August 2001), for the treatment and control sites, respectively. We then calculated grand means for treatment and control sites for the 2-week observation period following each laser harassment period, and determined whether these means were within the 95% confidence interval of the pretreatment period for the treatment and control sites, respectively. This analysis allowed for an estimate of the size of the effect and a measure of uncertainty (Johnson 1999).

Observation rates of collared geese were calculated for each 2-week observation period by dividing the number of collared birds observed by the number of surveys conducted during the 2-week period. Observation rates for collared birds were analyzed for each time period (either pre-harassment or post-harassment) to determine a mean observation rate for treatment and control sites. This mean observation rate of individual birds pre-harassment was subtracted from the observation rate post-harassment to determine effects of treatment. The Wilcoxon signed ranks test was used to compare observation rates between pre- and post-harassment observation periods for both treatment and control sites. We calculated mean time of laser harassment and percent emigration (percentage of geese that left the area during harassment) for each site and for all sites combined.

Telemetry data were analyzed with LOAS™ v.2.04 (Ecological Software Solutions, Sacramento, CA) to triangulate radio-collared goose locations and estimate location error ellipses (Ecological Software Solutions 1999). Actual locations and estimated locations with an error ellipse <1.0 ha were used to calculate the mean distances that geese emigrated from each study site during each time period. We plotted mean distances per site for each 2-week non-treatment period and the 5-day treatment period to determine emigration trends.

RESULTS

The mean time of harassment was <10 min for all 3 sites, while the mean percentage of geese that abandoned the site during harassment varied between sites (Table 2). Numbers of geese counted at the treatment sites at night declined from a mean of 92 geese to 14 geese over the 5-day harassment period (Fig. 1); however, mean numbers of geese counted at control and treatment sites during the day over the 5-day harassment period showed no trends (Fig. 2).

The mean number of geese counted during goose collar observations at 3 control and 2 treatment sites increased from 22 July through 9 November (Fig. 3). At Locust Grove, however, goose numbers during the 2-week period after laser harassment were lower than those during the 2 weeks prior to harassment (Fig. 3). Numbers of geese did not change before and after harassment at both treatment and control sites (Table 3). Observation rates of individual birds for pre- and post-harassment time periods also did not differ between the control sites (*S* = -249, *P* = 0.689) and treatment sites (*S* = -1746, *P* = 0.072).

The mean distances geese were located from banding sites peaked during the harassment period for the control sites and during the 2 weeks prior to harassment for the treatment sites (Table 4). The accuracy of our telemetry-based locations was based on mean distance between known locations (through visual contact) and the estimated locations (through triangulation) for 37 different geese, and it was determined to be 179.5 m (SE = 31.5).

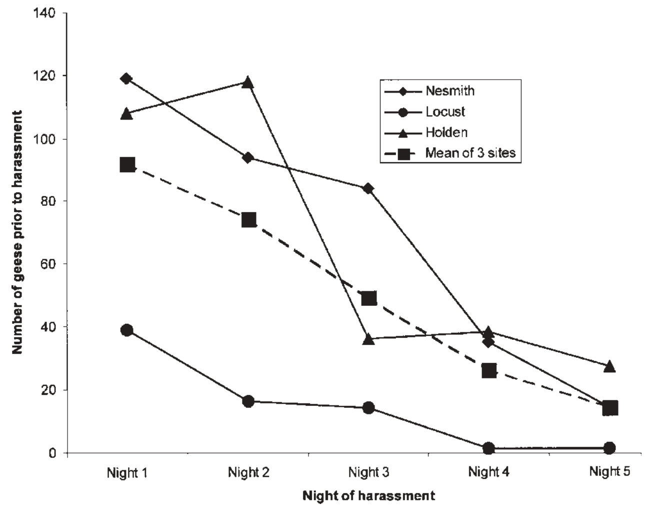

FIGURE 1. Mean numbers of Canada geese counted each night of laser harassment at 3 locations in northeast Ohio during August 2001 – January 2002.

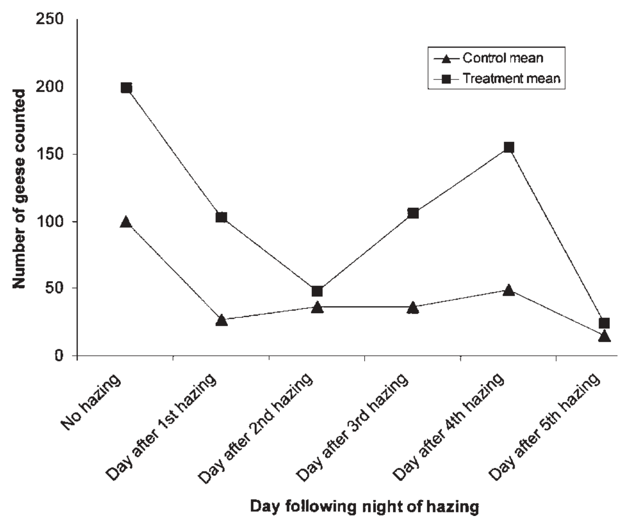

FIGURE 2. Mean numbers of Canada geese observed at 6 locations in northeast Ohio during August 2001 – January 2002.

TABLE 2

Mean (SE) time of laser harassment and mean (SE) percentage of geese that abandoned the site during harassment at Lake Nesmith, Locust Grove Golf Course, and Holden Aboretum, Ohio, 2001-02.

Site	Harassment time (minutes)						Percentage of geese that left
	Night 1	Night 2	Night 3	Night 4	Night 5	Mean	
Nesmith	7.1 (0.8)	2.2 (0.6)	4.2 (1.1)	2.9 (1.5)	2.2 (0.4)	3.8 (0.6)	34.0% (9.8)
Locust	13.6 (6.6)	6.5 (3.5)	1.8 (0.3)	5* (n/a)	1* (n/a)	7.1 (2.7)	65.1% (1.6)
Holden	10.1 (4.4)	3.5 (0.7)	2.3 (0.8)	1.5 (0.3)	3.6 (1.0)	4.2 (1.1)	93.3% (3.1)

*Geese were only present for one harassment session.

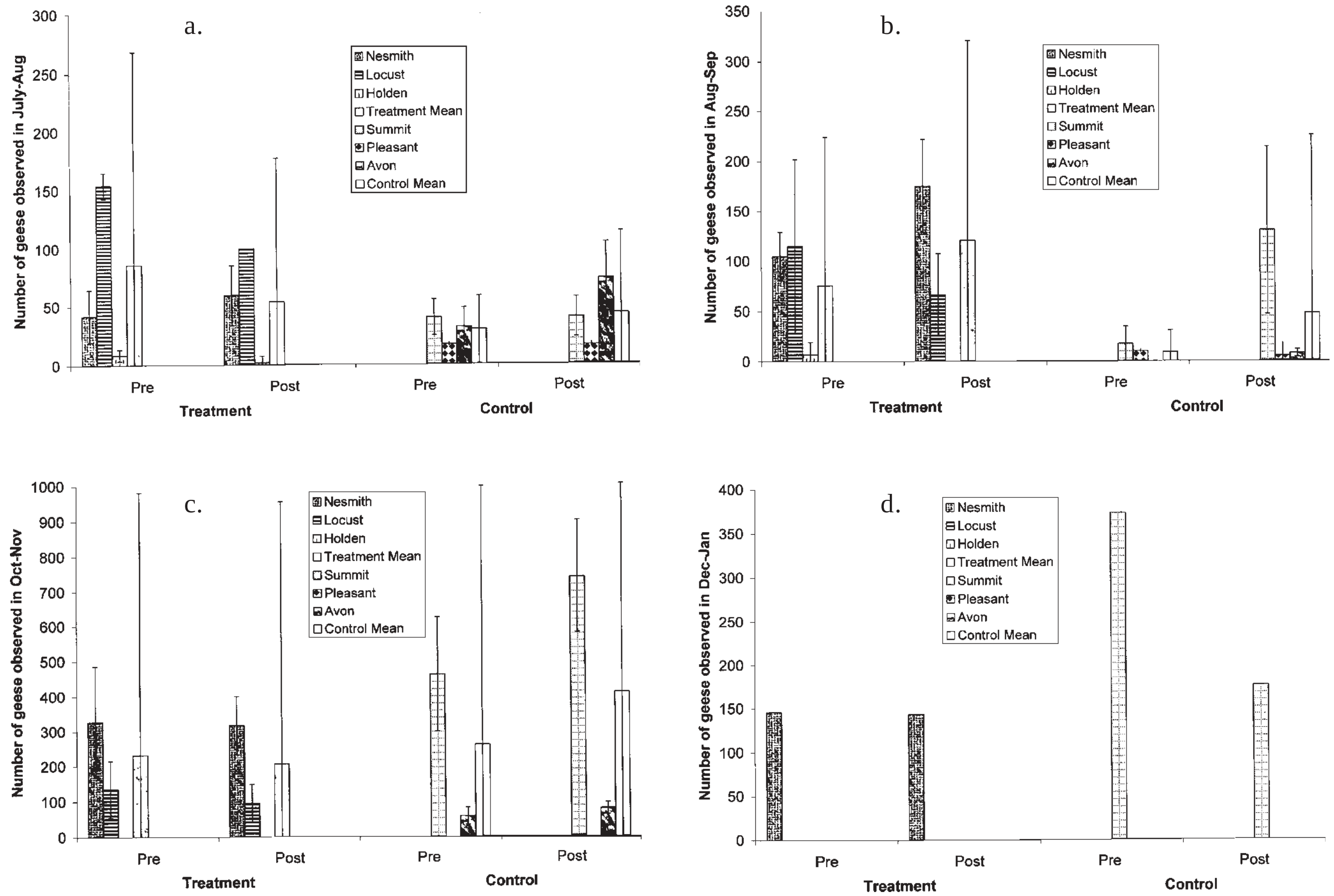

FIGURE 3(a-d). Mean numbers of Canada geese observed at 3 treatment and 3 control sites in northeast Ohio during two-week observation periods before and after 5-day hazing periods during a.) July – August 2001; b.) August – September 2001; c.) October – November 2001; d.) December 2001 – January 2002. Error bars indicate the boundaries of 95% confidence intervals.

DISCUSSION

We believe that site characteristics at Locust made the laser more effective there than at the other sites. Locust Grove had no lights where the geese roosted, so the laser beam appeared bright with high contrast against the dark water and grass. The small pond size allowed the laser operator to stand in one location, which permitted uninterrupted goose harassment. In addition, no human disturbance (other than our laser harassment) occurred at night, so the geese were probably sensitive to nocturnal activities.

Holden had similar conditions to Locust with no artificial lighting and no nocturnal disturbance. The large lake at Holden did require the laser operator to move to several different locations around the lake to disperse the geese. However, relocation of the operator did not decrease effectiveness of the laser since Holden had the highest emigration rate of all 3 treatment sites. Collar surveys were only conducted during 3 observation periods, so no conclusions could be made regarding

TABLE 3

Mean number of geese observed at the control and treatment sites 2 weeks before and 2 weeks after each laser harassment and the 95% confidence interval (CI) calculated from the mean number of birds observed before the first harassment period.

		Harassment Period 1		Harassment Period 2		Harassment Period 3		Harassment Period 4	
Site	95% CI	Before	After	Before	After	Before	After	Before	After
Control	(0.84, 58.3)	29.5	42.7	9.1	47.6	258.6	407.0	373.0	176.0
Treatment	(-121.5, 257.8)	68.1	53.8	75.7	120.6	231.3	205.2	146.5	143.8

TABLE 4

Mean distance (SE), in meters, radio-marked geese were found from the banding sites during the 2-week period prior to laser harassment, the 5-day period of harassment, and the 2-week period after harassment, Ohio, August 2001-January 2002.

Site Type	Site	Pre-harassment	Harassment	Post-Harassment
Control	Summit	469 (165)	1445 (219)	503 (14)
	Pleasant	32 (*)	1595 (245)	
	MEAN	432 (155)	1540 (172)	503 (14)
Treatment	Nesmith	15343 (5411)	1851 (251)	5569 (3330)
	Locust	269 (203)	962 (253)	481 (177)
	Holden	874 (102)	1104 (161)	555 (83)
	MEAN	5233 (2084)	1258 (130)	1056 (412)

*Only 1 observation, so standard error was omitted.

the effectiveness of lasers in reducing goose numbers during the day.

Laser harassment at Nesmith was ineffective because of the large size of Lake Nesmith, frequent human activity in the lake, feeding of geese at the lake, and bright lighting around the lake. When harassed at Nesmith, geese often flew to the middle of the lake (approximately 125 m from shore) and remained there. Further harassment from the laser did not cause any reaction, likely because the effect of contrast between the beam spot and the background surface (that is, water) was diminished. Lake Nesmith also was surrounded by several large sources of ambient light which may have contributed to the laser's ineffectiveness. Geese did not respond as readily when they were directly in the path of the light sources compared to nearby geese that were in the shadows between the lights.

The January harassment session was effective at Nesmith when the lake was 99% frozen with a small opening near shore. This positive response is similar to what Cepek and others (2001) found in Pennsylvania. We do not know whether geese do not feel as secure on ice or if laser reflection off the ice caused a synergistic effect increasing the effectiveness of the laser.

Radio-marked geese from both control and treatment areas moved farther from their banding site during the harassment period than during the 2-week observation periods. We do not have an explanation for this movement pattern; however, excluding Nesmith, all movements by geese were less than 2.0 km, suggesting that lasers had little effect in moving geese long distances. Thus, it is unlikely that laser harassment alone could be expected to cause geese to vacate an urban area and relocate to a more rural setting in which they could be harvested.

MANAGEMENT IMPLICATIONS

Laser harassment holds promise as an additional tool for integrated wildlife damage management against Canada geese. In this study, effective dispersal was achieved at lakes <6.0 ha in size, which allowed the laser operator complete access around the lakeshore to within 125 m of the geese (maximum realized effective distance of laser). Sites which had low ambient light, were void of obvious attractants (that is, feeding), and had minimal human disturbances at night experienced the best results. Laser harassment reduced numbers of geese on a site at night, but was not as effective in reducing goose numbers during the day.

Lasers are effective at moving geese in a short (that is, 5 day) time period, but they do not produce long-term or large-scale changes in distribution. Therefore, laser harassment should be integrated with successful strategies involving habitat alteration, visual, auditory, physical, and chemical repellents, or population control in the form of reproductive inhibition or culling (Dolbeer 1999). Further testing of lasers should continue with an emphasis on integration of diurnal harassment activities with lasers, effects of long-term use of lasers, and environmental/landscape factors (for example, pond size) which influence lasers' effectiveness.

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