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Observations of neck-collared Canada geese near John F. Kennedy International Airport, New York

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Abstract: Canada geese (*Branta canadensis*) often cause significant damage when they strike aircraft. They are responsible for a reported minimum of $2.6 million in damage per year to civil aviation in the United States. Knowledge of goose movements in relation to airports would allow wildlife managers to allocate time and funds to manage those populations that pose the greatest threat to aircraft. We placed alpha-numeric neck collars on 300 Canada geese within 8 km of both John F. Kennedy International Airport (JFKIA) and LaGuardia Airport in New York, New York. We conducted weekly observations for 2 years within a 12-km radius of JFKIA at locations used by the geese. At the conclusion of the study, 45% of the collared geese remained within an 8-km radius of JFKIA, and four were killed at JFKIA during wildlife control operations. We observed birds at their original banding sites 75% of the time, and within 5 km of the banding location 95% of the time. Geese that remained in the study area were re-sighted at a mean straight-line distance of 3.6 (±3.1) km from their original banding location. We note that 78% of the re-sighting locations used by geese were within 8 km of JFKIA and that movements of these geese could take them over or onto JFKIA. Oiling goose eggs to kill the embryos, rounding up of flightless birds within 8 km of the airport, and bird-control activities at JFKIA and nearby areas all should be continued to reduce the probability of a catastrophic bird strike between aircraft using JFKIA and local Canada geese.

Key words: airport, bird–aircraft collision, *Branta canadensis*, Canada goose, home range, human–wildlife conflicts, movements, neck collars

Aircraft collisions with bats (Peurach et al. 2009), deer (DeVault 2008, VerCauteren et al. 2009), and birds (Bernhardt et al. 2009, Dale 2009, Dolbeer and Wright 2009, Dove et al. 2009, Linnell et al. 2009) in the United States cost civil aviation an estimated $628 million per year. Canada geese (*Branta canadensis*) alone cause a minimum of $2.6 million of damage per year (Dolbeer and Wright 2008). From 1990 to 2007, Canada geese caused 14 accidents with civil aircraft that resulted in human injuries (Dolbeer and Wright 2008, Dove et al. 2009). In 1995, Canada geese caused a U.S. Air Force (USAF) AWACS aircraft to crash on takeoff, resulting in the death of all 24 crew members and the complete loss of the $190-million aircraft (Wright 1997). Canada goose strikes to USAF aircraft cost, on average, $710,000 per strike (USAF 2008). In a ranking of wildlife hazardous to aviation, geese (primarily Canada geese) were ranked third out of 21 species groups (Dolbeer et al. 2000). With the possible exception of the empennage (i.e., aircraft tail assembly), no part of an aircraft can sustain a goose strike without suffering some level of damage (Dolbeer and Eschenfelder 2002).

In the northeastern United States, population trends from North American Breeding Bird Survey data show that Canada goose populations have increased from 1966 to 2007 by 12.6% per year (Sauer et al. 2008). In New York State, the resident population of Canada geese is estimated to be 200,000 (N.Y. State 2009). Knowledge of goose movements in areas associated with airports is critical for safe airport operations, given the year-round ubiquity of Canada geese throughout most of the continental United States (Washburn et al. 2007, Groepper et al. 2008). For example, Cooper (1991) identified individual Canada geese that routinely traveled into airspace at the Minneapolis-St. Paul International Airport and suggested that managers could select the individual birds that should be removed

to reduce bird-strike hazards while maintaining a local goose population. York et al. (2000) found that at least 20% of harassed geese returned multiple times to harassment sites located on an Alaskan airfield. Organizations that promote goose harassment make claims of clearing specific areas of geese, but have not documented where or how far harassed geese travel (GeesePeace 2009). In contrast, Holevinski et al. (2007) determined that Canada geese moved only about 1.2 km after harassment and showed a strong affinity to their original location. Documenting movements of harassed and nonharassed geese throughout an entire year would be enlightening because movements may vary by season and by population status (whether birds are migrants or residents). Such knowledge of goose movements will allow airport biologists to make more efficient use of time and money to control those specific individuals or populations that present hazardous conditions to aircraft. Also, by understanding goose movement patterns, biologists can avoid harassing geese in a manner that creates, rather than removes, a safety hazard.

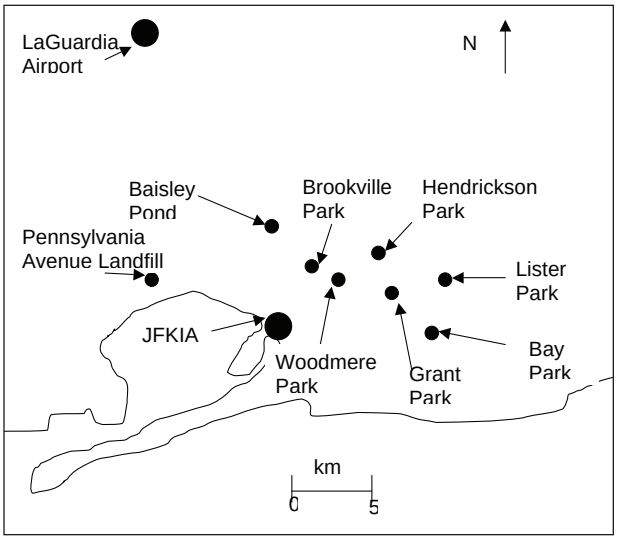

Figure 1. Nine Canada goose-banding locations in relation to John F. Kennedy International Airport and LaGuardia Airport, New York, New York.

The Federal Aviation Administration (FAA) has established a distance of 8 km around airports in which hazardous wildlife attractants should be avoided (FAA 2004). Therefore, the purpose of this study was to document movements of Canada geese originating within about an 8-km radius of the John F. Kennedy International Airport (JFKIA) to determine which geese pose a threat to aircraft there.

Methods

United States Department of Agriculture/Wildlife Services (WS), the Town of Hempstead, New York City Department of Environmental Protection, Port Authority of New York and New Jersey, New York State Department of Environmental Conservation, New York City Parks and Recreation, and the WS National Wildlife Research Center collaborated to capture and neck-collar resident Canada geese within Nassau and Queens counties on Long Island during June 2006. Healthy birds at 9 locations <9 km from either JFKIA or LaGuardia Airport (LGA; Figure 1) were captured, aged, sexed, banded with a standard aluminum U.S. Fish and Wildlife Service (FWS) leg band, fitted with a yellow alpha-numeric auxiliary neck collar, and released at the capture site. Additional Canada geese at the Pennsylvania Avenue Landfill were banded only with FWS leg bands.

Once per week, from August 2006 to July 2008, we observed collared and non-collared geese at the 9 original banding sites by using binoculars and spotting scopes. We drove or walked throughout each location at random times of the day to locate the geese, then counted them and record our observations on a standardized data sheet. Additionally, we weekly searched up to 10 additional parks within a 12-km radius of JFKIA for collared geese, as time and resources allowed. We gathered public sightings that were reported and hunter harvest data from the U.S. Geological Survey, Bird Banding Laboratory.

We compiled and separately recorded observations for each individual collared goose into 3 categories: weekly observations at the original banding site, weekly observations at additional locations, and weekly observations in which the individual was not located. Also, we used Google Earth™ and converted recorded observations into straight line movements from

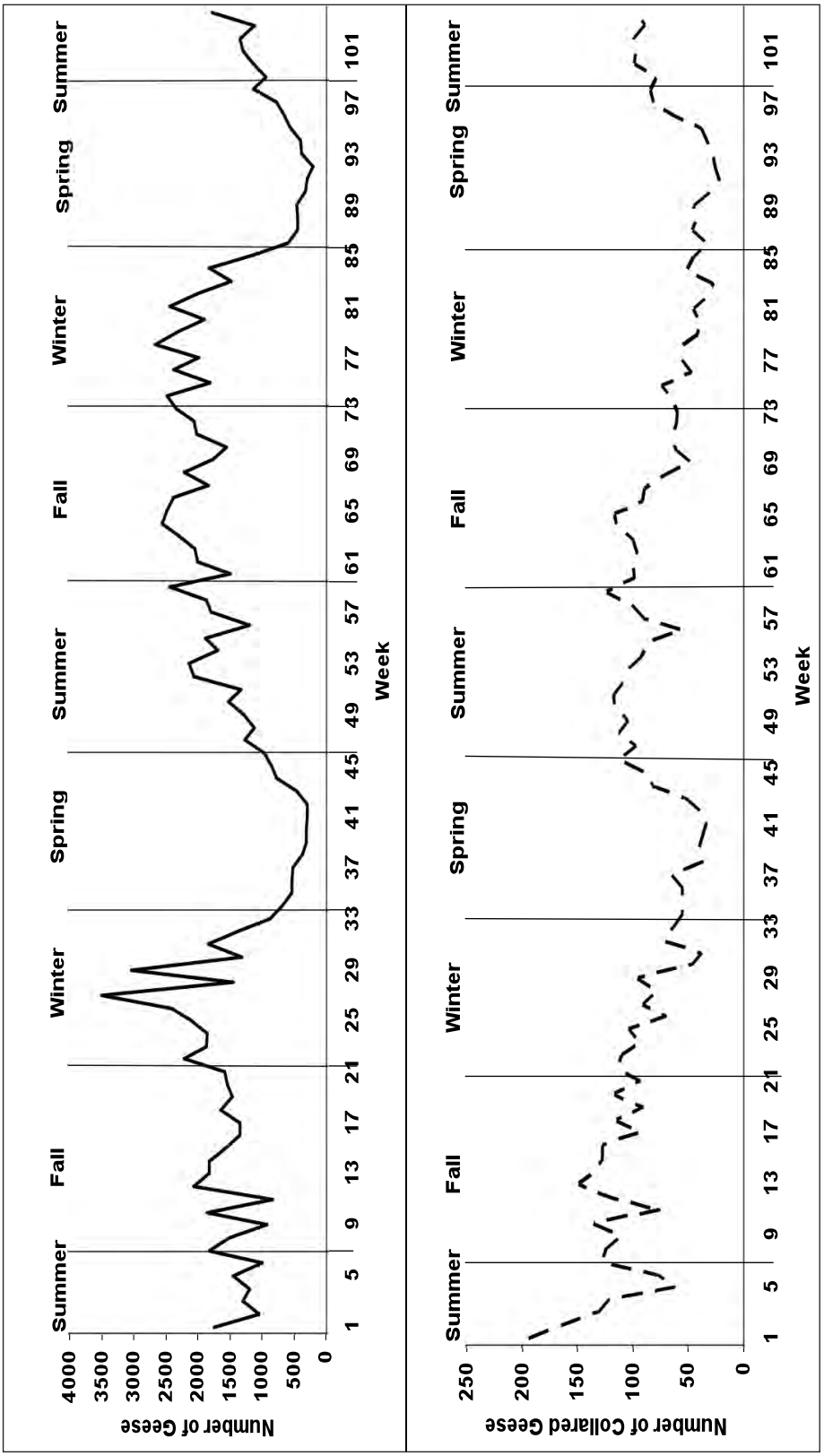

Figure 2. Weekly totals of all Canada geese and Canada geese with study collars observed at 17 parks and 1 reclaimed landfill located within a12-km radius of John F. Kennedy International Airport, New York, New York, from August 2006 to July 2008. No observation were made in week 100.

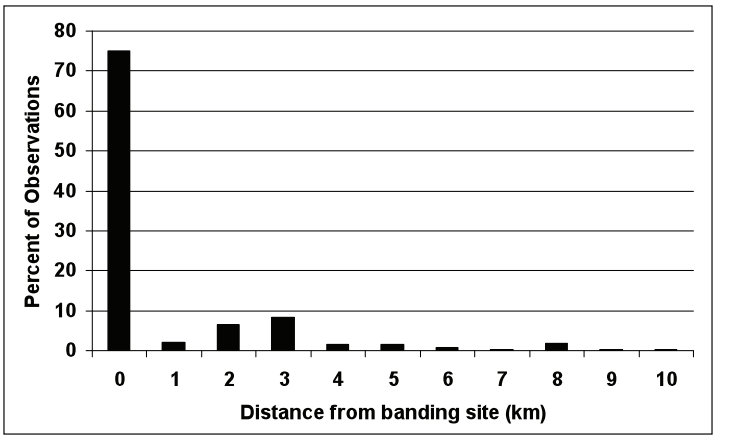

Figure 3. The percentage of observations of collared geese based on the distance (km) of re-sighting from the original banding location of 8 New York City parks and 1 reclaimed landfill within 12 km of John F. Kennedy International Airport, New York, New York, from August 2006 to May 2008.

Table 1. Number of Canada geese, by sex and age, banded and collared at 8 New York City parks and 1 reclaimed landfill in June 2006.

	Sex			Age		Total
Location	Male	Female	Unknown	After hatch year	Hatch year	
Baisley Pond Park	14	19	2	34	1	35
Bay Park	5	20	0	24	1	25
Brookville Park	16	17	0	28	5	33
Flushing Meadows Park	18	17	0	35	0	35
Grant Park	19	18	0	37	0	37
Hendrickson Park	15	23	0	38	0	38
Lister Park	18	9	0	27	0	27
Pennsylvania Ave. Landfill	15	20	0	35	0	35
Woodmere Park	18	17	0	35	0	35
Total	138	160	2	293	7	300

the original banding location to points where the birds were observed.

Results

In June 2006, we captured and collared 300 flightless Canada geese (Table 1) within 8.7 km of JFKIA and LGA at 9 locations (8 parks, and 1 reclaimed landfill; Figure 1). Additionally, we placed FWS leg bands on 32 Canada geese at the Pennsylvania Avenue landfill site. This banded goose population represented approximately 1.5% of the estimated total population in the New York City and Long Island area (B. Swift, N.Y. State Department of Environmental Conservation, personal communication).

We conducted observations during 104 weeks,

Table 2. The percentage of observations in which a banded goose was observed at the original banding location and the number of additional locations geese from a banding location were observed from August 2006 to May 2008, within 12 km of John F. Kennedy International Airport, New York, New York.[1]

Banding location	% of times observed at banding location	Additional locations where geese observed
Baisley Pond Park	25	10
Bay Park	32	5
Brookville Park	34	10
Flushing Meadows Park	58	7
Grant Park	43	7
Hendrickson Park[1]	7	10
Lister Park	39	14
Pennsylvania Ave. Landfill	27	14
Woodmere Park	18	12

[1]64% of total banded geese were molt-migrants that left the area when flight feathers grew in.

visited a mean (± standard deviation) of 17 (± 2) parks each week and observed the following each week: 1,451 (± 706) Canada geese, 80 (± 34) study collars (5.5% of the population), and 4 (± 3) nonstudy collars (Figure 2). At the conclusion of the study, 45% of the original 300 collared geese remained within an 8-km radius of JFKIA. One hundred six geese (35%) were not observed for the last quarter of the project, 14 geese (5%) were never observed after being collared, and 45 (15%) geese were killed. Three of the killed geese (one each from Brookville Park, Baisley Pond Park and Woodmere Park) were shot at JFKIA during wildlife control operations. Additionally, one of 32 geese leg-banded at the Pennsylvania Avenue Landfill was shot at JFKIA. Over this same time period, 323 additional Canada geese were shot at JFKIA during wildlife control operations.

For the birds reported to the Bird Banding Laboratory as killed, 84% were shot, and the mean distance from the original banding locations was about 107 km (3–1,162 km minimum–maximum distance). Only 14 birds were reported to the Bird Banding Laboratory as observed, and these were a mean distance of about 90 km (7–550 km minimum–maximum) from the original banding location.

For individual sites, the percentage of weekly counts in which geese were observed at their original banding location varied from 7 to 58% (Table 2). Individual geese were found at 5 to 14 locations, in addition to their original banding location (Table 2). We observed birds at their original banding sites 75% of the time, and within 5 km of the banding location 95% of the time (Figure 3). Geese that remained in the study area were re-sighted a mean straight-line distance from their original banding location of 3.6 (±3.1) km (Table 3).

Discussion

Our study objective was to determine whether Canada geese originating within an 8-km radius (as established by FAA Advisory Circular 150/5200-33A) of JFKIA could pose a threat to aircraft using the airport. We found that most of our recoveries within the 12-km radius of JFKIA that we searched occurred within 5 km of the original banding location, with 75% of the observations at the original banding location. Based on a mean straight-line distance from banding locations, geese from 3 of the 9 sites would have routinely traveled far enough to reach JFKIA. Using the maximum straight-line distance traveled, birds from 7 of the 9 sites had the potential to reach JFKIA. Therefore, 78% of the locations used by geese within 8 km of JFKIA could support geese that would travel onto or over JFKIA. The 4 banded geese that were shot at JFKIA all came from within a 5-km radius of the airport. Additionally, during

Table 3. The mean straight-line distance that collared Canada geese were observed away from their original banding location during observations conducted from August 2006 to May 2008.

Banding location	Distance of banding site (km) from JFKIA[1]	Mean (SD) distance (km) from banding site
Baisley Pond Park	2.4	4.1 (3.0)
Bay Park	8.0	4.0 (1.2)
Brookville Park	1.9	1.8 (0.7)
Flushing Meadows Park[2]	9.7	11.0 (3.3)
Grant Park	6.0	2.8 (0.3)
Hendrickson Park	5.6	3.5 (2.5)
Lister Park	8.7	6.2 (3.8)
Pennsylvania Ave. Landfill	4.8	2.6 (3.6)
Woodmere Park	1.6	5.2 (4.0)
Mean	5.4	3.6 (3.1)

[1]John F. Kennedy International Airport
[2]Flushing Meadows Park is 5.5 km from LaGuardia Airport

LGA airport bird surveys, we observed 2 neck-collared geese that moved 6.5 km from Flushing Meadows, past LGA, to Rikers Island.

Approximately 1.2% of the geese shot at JFKIA during wildlife control operations were our banded geese. If our assumption of banding 1.5% of the local goose population is correct, then it is also possible that, due to the similar percentage of banded birds being shot at JFKIA, the geese shot at JFKIA were originating mostly from the New York City or Long Island areas. However, hunters preferentially select geese with neckbands (Craven 1979, Alisauskas et al. 2006). Based upon comments from personnel conducting bird control at JFKIA, shooters were selectively targeting collared geese out of flocks. This selection would bias the data and give a false impression of bird movement. Also, during the study, migratory geese came into the JFKIA area and would have been subject to control activities. Therefore, the total number of birds subject to control was actually higher than the local population, and the percentage of banded birds compared to the total population would have been <1.5%. That 1.2% of the birds shot were banded supports the proposal of the selection of banded over unbanded birds during control activities at JFKIA. Based upon our re-sighting data showing local movements (5 km), then, it is more likely that the majority of birds shot at JFKIA are originating from within the 8-km radius of the airport.

At the conclusion of the study, 55% of the banded geese appeared to be absent from the study area. We know the fate of 15% of the birds, as they were killed and their collars were reported. Approximately 5% were reported alive, but they were outside of the study area. The fate of the remaining 35% of the geese was unknown. Studies have indicated that neck collars can reduce survival of geese, although the exact cause for this reduction is unknown (Castelli and Trost 1996, Schmutz and Morse 2000). Additionally, neck collar retention is variable (average retention of 28 to 90%) over the life of the collar (Samuel et al. 1990, Campbell and Becker 1991, Wiebe et al. 2000, Samuel et al. 2001). It is possible that poor collar retention may explain some of the missing birds, although we found no lost collars, and none were reported found during the study.

The 2 counties included in the study area, Nassau and Queens, have a combined human population of 3.5 million, or about 2,000 people per km^2 when the total area is considered; however, when only land area is computed, the density is about 5,000 people per km^2 (U.S. Census Bureau 2008). With such a dense human population, potential feeding and loafing locations for resident Canada geese are limited, and most sites are likely subject to human disturbance. Open areas, such as Jamaica Bay

and the Gateway National Recreation Area, likely would provide alternative foraging and roosting locations for geese displaced from the parks around JFKIA. However, JFKIA lies between most of the parks and Jamaica Bay; thus, the geese would likely cross the airport to reach the open spaces and therefore increase the risk of a bird strikes at the airport.

Although this study did not focus on geese at LGA, Canada geese also pose a threat to aircraft using that airport. In an effort to reduce the hazard posed by Canada geese at LGA, from 2004 to 2007 Wildlife Services conducted a goose-removal program of all geese observed at Rikers Island, which is adjacent to LGA. The number of Canada geese removed from Rikers Island decreased yearly (2004, n = 518; 2005, n = 288; 2006, n = 200; 2007, n = 166) and the number of goose strikes at LGA likewise decreased by 80% (A. Gosser, USDA/WS, unpublished data). This removal is an example of management efforts necessary to reduce the risk of bird strikes posed by resident Canada geese. However, strikes that occur away from the immediate airport environment, such as the incident in which U.S. Airways Flight 1549 struck multiple Canada geese at approximately 1,000 m above ground level (AGL) in January 2009, will not necessarily be reduced by such local control. Measures to make aircraft more visible or noticeable to birds may reduce such strikes and should be investigated.

We documented Canada goose movements within an 8-km radius of JFKIA, but we did not determine how high above ground the birds fly when moving between sites. We do know that, in general, an aircraft approaching JFKIA on a 3° glide slope would be about 152 m AGL when it is 3 km from the runway (Flight Safety Foundation 2000). Because 74% of all bird strikes occur ≤150 m AGL (Dolbeer 2006), it is critical to manage hazardous bird species within this volume of air space, as they pose the greatest immediate threat to aircraft. Three of the sites in this study were less than 3 km from JFKIA; therefore, geese using those sites should be monitored and managed appropriately.

Based on this study, most of the resident Canada geese in Nassau and Queens counties remain ≤5 km from their primary foraging and loafing areas. Therefore, Canada geese within 5 km of JFKIA pose the greatest hazard. However, marked geese within 8 km of JFKIA likely crossed JFKIA airspace when travelling to areas where they were observed in this study. Therefore, goose management efforts (oiling goose eggs to kill the embryos and rounding up of flightless birds) within 8 km of the airport and bird-control activities at JFKIA and nearby areas should be continued to reduce the probability of a catastrophic bird strike with aircraft using JFKIA.

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