Canada geese flight patterns in the vicinity of an aerodrome: Insights and management implications

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Abstract

Wildlife on and in the surroundings of an aerodrome pose a potential hazard for flight safety. Canada geese (Branta canadensis) represent a substantial risk for aircraft, due to their size and flocking behaviour. A group of 51 Canada geese were caught and neck-collared at two moult sites in the vicinity of Paris-Le Bourget airport. Six individuals were also GPS tagged. Bird movements were monitored between July 2019 and June 2021. The flight patterns and phenology, as well as the dispersion pattern of these birds, were investigated. Flights represented only about 1 per cent of geese daily activity. Geese spent most of their time on the ground in a 10km radius area around the capture sites. More than half of the flights outside the capture sites took place at the end of the day, between 6pm and 8pm. These flights were performed on average at less than 50m above the ground, and only less than 1 per cent of them crossed Paris-Le Bourget airport airspace. The finding of this study can be of interest to airport operators and regulators for the development of a management plan to help to reduce birdstrike risk to aircraft.

Keywords

Canada geese, birdstrike, risk mitigation, spatial data, GPS tag, airport

INTRODUCTION

With the increase of urbanisation, aerodromes serve as major attractants for numerous bird species, which may increase the risk of bird–aircraft collisions. Bird movements vary daily, seasonally and annually based on ecological needs, such as foraging, breeding, moulting, dispersal and migration. Wildlife movements related to aerodromes can be direct; for example, if a bird flies on an airfield because the composition and the height of the grass are suitable for its foraging needs, or indirect, if birds fly over an aerodrome to reach a nearby location. In order to better assess potential hazards to aviation safety posed by avifauna, there is a growing need for information on bird flight activity at and around aerodromes. GPS tagging is a promising tool for characterising bird flight patterns and better understanding the behaviour and movement dynamics of avian species.

Large size and gregarious birds pose substantial risk to aviation safety, particularly when their flight trajectories overlap with that of aircraft. The Canada goose (*Branta canadensis*) is a massive (typically weighing 3.6–4.5kg) and gregarious bird, easily recognisable by its white cheeks and throat, in contrast with the rest of the head and neck, which are black (Figure 1). The species was introduced in Europe in the early 17th century for ornamental purposes, and it has quickly spread throughout the continent, starting from the 20th century, when it was released into the wild in several European countries for hunting purposes.[1] Nowadays, Canada geese are present in almost the entire European continent.

The species was declared an 'invasive alien species' in France in 2010, due to the damage caused to water bodies, as well as because of its aggressive behaviour against native species. In 2012, a

Figure 1 Canada geese (*Branta canadensis*) (copyright Richard Metzger DGAC/STAC)

national control plan was established, and a variety of management techniques have been implemented to limit the expansion of Canada goose populations: modification of the environment to make it less attractive, scaring techniques, hunting and egg sterilisation.[2]

The presence of Canada goose populations near airfields poses a serious threat to flight safety. This species is among the most frequently struck in the USA. About half of the birdstrikes caused by Canada geese produced damage to the aircraft, and 40 per cent of them involved more than one bird.[3] In France, no collision with this bird has yet been reported: however, Canada geese have been observed on, or in the vicinity of, several French aerodromes.

Information about the factors driving geese movements near and on airfields is still limited. The Canada goose is a herbivorous species that feeds primarily on meadows and lawns with low cover, thus it may be attracted to aerodromes for grazing and resting. Moreover, intersections of geese flying trajectories and aircraft airspace may be associated with movements between green spaces near an aerodrome[4] or movements to and from foraging and dormitory sites.[5]

Canada goose populations in France do not migrate, but dispersive movements can take place in spring and autumn.[6] The region Île-de-France, where the capital city Paris is located, is one of the areas with the highest number of Canada geese in France. Several populations of this species reside in parks and other green spaces in the vicinity of Paris airports.

The objective of this study was to investigate the movement patterns of non-migratory Canada geese in the vicinity of Paris-Le Bourget airport, where the species has been established for several years, to quantify the frequency and amplitude of their flights (altitude, trajectories), and determine their phenology (seasonality, daily schedule).

CANADA GEESE SURVEY

Paris-Le Bourget airport is located 7km north-east of Paris; it covers a surface of more than 550 hectares, and it has three runways. The aerodrome is surrounded by two large parks classified as Natura 2000 sites: the Georges-Valbon departmental park (400 hectares), and the Sausset departmental park (200 hectares). The population of Canada geese in these two parks is of about one hundred and fifty individuals.

Canada geese moult completely in early summer, losing all their remiges. During this period, they are unable to fly. Two capture sessions were organised in July 2019, during the moult, in the Georges-Valbon and Sausset departmental parks. Capture and handling times were minimised to reduce stress to the geese.

Fifty-one Canada geese were live-captured, leg-ringed and equipped with a yellow alphanumeric coded collar (Figure 2). Six of these individuals were also equipped with a GPS tag (GsmRadioTag-M9, Milsar), transmitting data via the GSM network (Figure 3). The GPS transmitter was programmed to collect data 24 hours a day with a location every 10 minutes. More intensive data collection periods, with a location taken every 5 seconds, were scheduled for two hours a day to gather more accurate data on flight altitude and trajectories. The analysis presented in this study was conducted on data collected by the tags between July 2019 and April 2021.

In addition to the GPS monitoring, a bi-weekly visual survey of all

Figure 2 Capture operations. A group of Canada geese were gathered in a corral before being ringed and equipped with collar

collar-marked geese was conducted from July 2019 to June 2021 in a 10km radius area around Paris-Le Bourget airport. Moult, feeding and all potential attractive sites for geese were visited to determine the presence and movements of marked birds. Moreover, the survey was advertised on an ornithological website, and opportunistic observations of marked geese made by volunteer birdwatchers were collected throughout the survey.

CANADA GEESE MOVEMENT PATTERNS

Canada geese spent the largest part of their time on or in the vicinity of Paris-Le Bourget airport, even though a few long-distance flights were recorded. Based on the GPS data, geese spent on average 1 per cent of their time flying. Two main flight corridors were identified. One of them was adjacent to the aerodrome, the other was at about 4km from the main runway. Both corridors

Figure 3 Ringing operations. A goose is equipped with a neck-collar and GPS tag

linked one of the capture sites to a golf course (Figure 4).

Flights outside the capture sites (hereafter 'long flights') represented less than 1 per cent of the data, distributed as 0.11 per cent during the breeding season (March to May), 0.07 per cent during the moulting season (June to July) and 0.74 per cent during the non-breeding season (August to February). Long flights were mostly recorded in August and December.

Less than 1 per cent of the geese flying trajectories overlapped Paris-Le Bourget airport airspace (0.7 per cent in 2019 during the period of highest frequency of long flights). This data represents less than 0.007 per cent of the total dataset. Only six GPS locations of a single tag-equipped goose were recorded inside the aerodrome's boundaries during the two-year survey. Even though groups of Canada geese were observed on the aerodrome during the survey, no collar-marked individuals were observed, thus this data was not included in the analyses.

Geese flew mostly during the day. More than half of flights outside the capture sites took place in the evening, between 6pm and 8pm. Another smaller peak of long flights was detected in the morning, between 8am and 10am (Figure 5). This pattern probably indicates that geese moved towards the feeding areas in the morning and returned to their nocturnal dormitory areas in the evening.

A few complete long flights could be accurately recorded from take-off to landing. These flights lasted between two and six minutes, with an average of three minutes and fifty-five seconds. The speed was on average (± standard deviation) 53.8±2.1km/h. This average

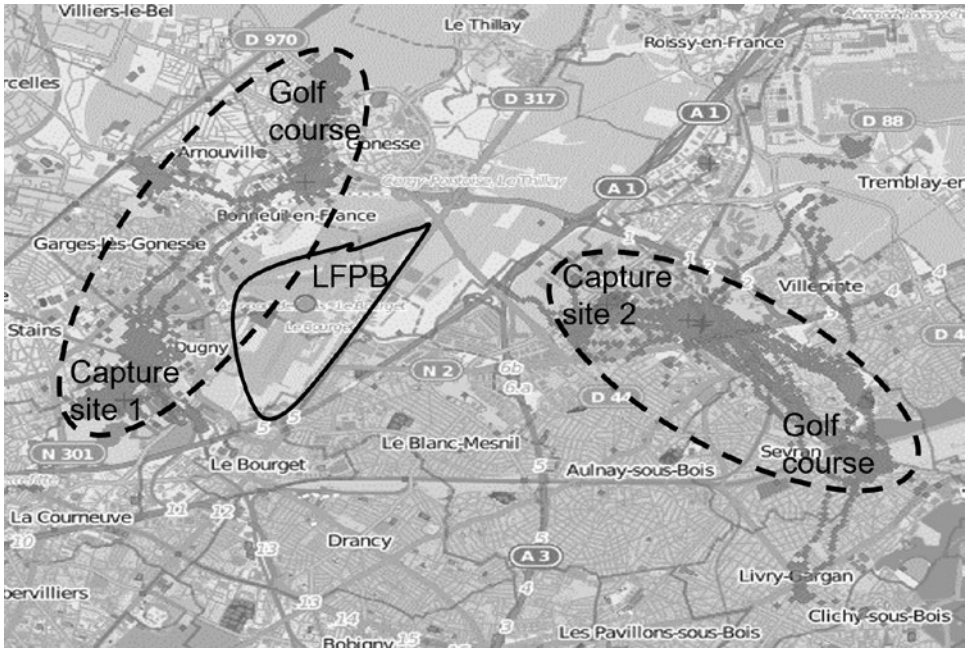

Figure 4 Paris-Le Bourget airport (LFPB) and the two main Canada geese flight corridors (dotted lines)

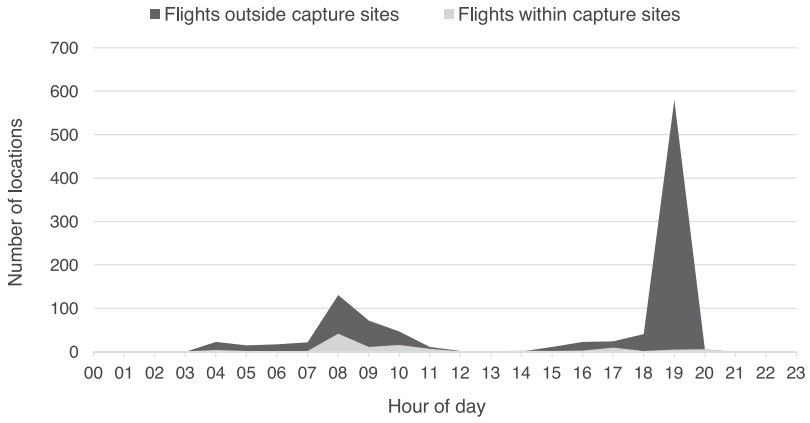

Figure 5 GPS locations recorded in geese flights outside the capture sites (dark grey) and within the capture sites (light grey) according to the time of day in 2019

is representative of the average speed calculated on all the flights (within and outside the capture sites), evaluated at 50.6km/h.

The average flight altitude calculated for long flights varied between −30 and +21m. These results indicate that geese fly on average less than 50m above the ground. Due to the accuracy of GPS tag measurements (standard error ±50m), the estimation of altitudes could not be more accurate.

The regular survey and the opportunistic observations resulted in over 800

re-sightings of individual birds. Dispersion has been recorded in all directions. Most of the geese were regularly observed in a 10km radius area around Paris-Le Bourget airport. A few geese were detected at more than 20km from their capture site. The maximum distance at which a marked goose was observed was 30km. Geese that made long dispersion flights came back to their capture site after a certain time.

MANAGEMENT IMPLICATIONS

The results of this study indicate that Canada geese spent most of their time on their moulting and foraging sites, and in a 10km radius area around them. This is consistent with the movement patterns of resident Canada geese in North America.[7]

Sites with short grass and water provide feeding and nesting opportunities for Canada geese, and the presence of such land-uses in the vicinity of an aerodrome increases the likelihood that geese cross the aerodrome airspace while moving from and to them. The identification, the monitoring and, when possible, the removal of sites that may encourage geese presence is thus recommended. For example, reducing open water sources in the vicinity of aerodromes and restricting a goose's ability to access the existing water bodies will deter Canada geese from the area.[8]

Active repellent techniques, such as pyrotechnics and vegetation management have proved effective in dispersing geese on the airport property. Canada geese feed on grass, especially young shoots. Since it is more difficult to access the young shoots if the vegetation is dense, geese avoid grazing on tall grass.[9] Therefore, maintaining intermediate to tall grass on the aerodrome will discourage geese presence.

However, to control or reduce the number of Canada geese, management practices should occur over an extensive area outside of the airport boundaries. For this purpose, Canada goose management programmes involving all stakeholders (airport operators, local authorities, park directors, golf club managers) should be established.

In addition to environment modifications, effective management techniques include egg sterilisation, by pricking them with needles or coating them with paraffin and removal programmes. Egg sterilisation is already performed in several parks surrounding Paris-Le Bourget airport, including the two sites where geese were captured for this study.

The average flight altitude of the geese monitored in this study was below 50m above ground level. Even though flights over Paris-Le Bourget airport were infrequent, with less than 1 out of 10,000 locations recorded by the GPS tags, geese flying altitude was in the aircraft take-off and landing height range, resulting in a higher strike risk during the most crucial phases of flight.

Canada geese pose the greatest strike risk during early morning and evening hours, when they move between foraging and dormitory sites. Consequently, awareness of geese movements by airport operators is particularly important during these periods, when the risk of birdstrikes is higher.

Although this study focused on Canada geese movements around Paris-Le Bourget airport, its findings may be applied to other airports with a comparable Canada goose presence and environmental context.

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