

# Band Encounters of Canada Geese Banded in Ottawa, 1987–2011

*Courtney A. Young, Shawn W. Meyer  
and Christopher M. Sharp*

## **Introduction**

Prior to European colonization, the nesting range of Canada Geese (*Branta canadensis*) in southern Ontario was probably limited to prairie areas in the extreme southwest since much of the rest of the province was completely forested (Hanson 1965, Lumsden 1981, Dennis 1999). With colonization, early settlers harvested Canada Geese for food leading to a decline in their numbers until they were extirpated by the 1890s (Lumsden 1981, Dennis 1999). In the 1960s, a formal reintroduction program began and since then, the temperate-breeding population (TBP) in Ontario has increased dramatically and these geese are now thriving throughout southern Ontario (Lumsden and Dennis 1998). The highly adaptable behaviour of this bird, in conjunction with habitat changes such as clearing of forests for agriculture and the development of golf courses and manicured waterfront parks and lawns, has favoured the growth and range expansion of TBP Canada Geese in Ontario (Smith *et al.* 1999, Hughes and Abraham 2007). Now, TBP Canada Geese breed throughout southern Ontario to the extent that human-goose conflicts are a management concern in some areas (Environment Canada 2010).

Canada Geese demonstrate strong breeding, staging and wintering philopatry. During breeding, if a pair successfully raises a brood, they will often return to the exact same nesting site (Anderson *et al.* 1992). Moreover, goslings of both sexes exhibit strong natal philopatry (*i.e.*, return to breed and nest



*Canadian Wildlife Service, Ontario Region*

close to their natal site) but females return at much higher rates than those demonstrated by males; males commonly disperse from their natal area if they pair with a female from a different geographical area (Lessells 1985). During migration, TBP Canada Geese also consistently use traditional migration routes but there is some annual vari-

ability in site selection due to water and food availability (Lessells 1985, Mowbray *et al.* 2002). Finally during winter, Canada Geese consistently return to traditional wintering areas such as Chesapeake Bay.

Annually in Ontario, TBP Canada Geese have been banded by a number of organizations including local bird

observatories, individuals and government agencies. Within the City of Ottawa (hereinafter referred to as Ottawa), Innis Point Bird Observatory banded TBP Canada Geese from 1987 until 1991. The Canadian Wildlife Service has banded TBP Canada Geese in Ottawa annually since 1999. Auxiliary coloured-plastic tarsal markers were also attached to Canada Geese at a few locations in Ottawa from 1999 to 2002. Band encounter data provide an opportunity to investigate the philopatric behaviour of these birds in Ontario. Our objective is to examine movement patterns of TBP Canada Geese from a long-term banding location in Ontario. We predicted that TBP Canada Geese, which were banded as goslings, and later encountered as adult females would have the shortest distance between banding and encounter locations, followed by second year females, adult males, and second year males due to the strong natal philopatry that exists in this bird.

### Methods

Banding and encounter data from Canada Geese banded as goslings between 1987 and 2011 in Ottawa were extracted from GameBirds (USGS Bird Banding Laboratory [BBL] 2012). Only encounter data from Canada Geese banded as goslings were used to ensure that natal origin was known. Banding and encounter locations were identified as 10 minute blocks in the BBL database. To examine movement patterns, encounters were summarized into four time periods: May – August

(brood rearing), September (local movements near natal or breeding sites), October – November (peak fall migration), and December – January (wintering). For each time period, encounters were summarized by type: (1) foreign recapture — a goose recaptured during banding outside of Ottawa, (2) geese found dead and reported, (3) geese which were shot by a hunter and reported and (4) sight record which represent an encounter where either the band number or an auxiliary coloured tarsal marker was reported. To summarize average distance travelled during each time period, the distances between each banding site and the location of its encounter were measured and the mean ( $\pm$  standard error) for each time period was calculated using ArcMAP (vers. 10). Lastly, we summarized encounter data for *unexpected encounters* which were defined as encounters outside of expected movement patterns (*e.g.*, an encounter during May – August or October – November on the wintering grounds, an encounter during October – November north of the banding location, or an encounter outside of the Atlantic Flyway).

We measured the average distance between banding and encounter location for geese reported during the May – August period for (1) first year birds, (2) second year birds and (3) adults ( $\geq 3$  years of age) to compare differences in natal philopatry among age and sex classes. We analyzed the effect of sex and age on distance between banding and encounter locations using a non-parametric Kruskal-Wallis ANOVA on

ranks because the data were not normally distributed. All statistical analysis was conducted using R (R Development Core Team 2008) and results were considered significant at  $p < 0.05$ .

## Results

A total of 1,662 Canada Geese was banded as goslings between 1987 and 2011 in Ottawa. Of these bands, 26.6% or 443 encounters were reported between 1989 and 2011; there were no encounters during 1987 and 1988. Foreign recapture and found dead encounters represented 5.6% of all encounters combined, while shot birds and sight records represented 68.4% and 26.0%, respectively (Table 1). Most sight record encounters occurred during May – August with the majority (95%) reported from geese that were marked with an auxiliary coloured tarsal marker. Shot birds were encountered mostly during September and December – January. The number of foreign recaptures and birds found dead were similar during

May – August; shot and sight record encounters were also similar during October – November.

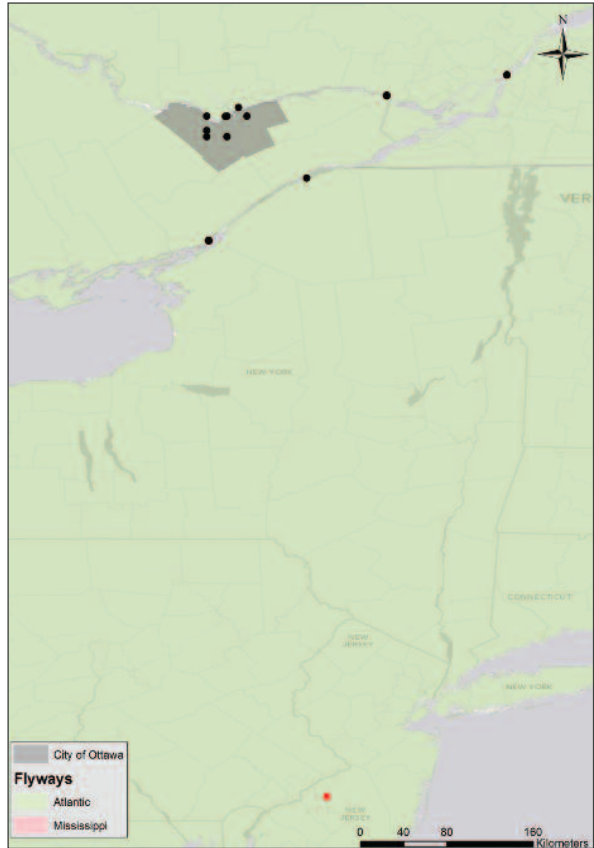
### *May-August*

Between 1989 and 2011 during the months of May – August, 94 encounters of goslings banded in Ottawa were reported (Table 1). During this timeframe, the majority of the encounters were from sight record (75.5%), followed by foreign recapture (11.7%) and found dead (10.6%). Canada Goose goslings were banded in five locations, three along the Ottawa River and one each in Nepean and Stittsville. Eighty-four of the reported encounters occurred in Ottawa while seven were reported in Québec, two occurred along the St. Lawrence River and one in New Jersey (Figure 1). The maximum distance between banding location and its encounter was 616.4 km and occurred in New Jersey (Appendix 1). During these months, the average distance between banding and encounter location was approximately 24 km (SE = 7 km).

Table 1. Band encounters (by type) of Canada Geese banded as goslings in the City of Ottawa during each time period, 1987 – 2011.

TIME PERIOD	TOTAL BY ENCOUNTER TYPE				TOTAL
	FOREIGN RECAPTURE	FOUND DEAD	SHOT	SIGHT RECORD	
May-August	11	10	2	71	94
September	0	1	65	9	75
October – November	1	2	38	34	75
December – January	0	0	198	1	199
<b>Total</b>	12	13	303	115	443

Figure 1. May to August band encounter locations of Canada Geese banded as goslings in the City of Ottawa, 1987 – 2011. Unexpected encounters are shown as red.



Distance between encounter and banding location was shortest for first year males ( $7 \pm 16$  km) followed by first year females ( $10 \pm 9$  km), second year males ( $19 \pm 13$  km), second year females ( $24 \pm 16$  km), adult females ( $30 \pm 11$  km) and adult males ( $30 \pm 10$  km)

(Figure 2). There were no significant differences among age and sex classes ( $H = 1.49$ ,  $df = 5$ ,  $P = 0.91$ ). Of these geese, all first year geese ( $n = 19$ ) were encountered in Ottawa, followed by 8 out of 9 second year males, 5 of 6 second year females, 12 of 15 adult females, and 10 of 12 adult males.

### September

There were 75 reported encounters of Canada Geese during September, which had been banded as goslings in Ottawa. Of these encounters, shot geese were the most numerous (86.7%) followed by sight record (12.0%) (Table 1). These goslings were banded in seven locations in Ottawa. On average, the distance between banding and encounter location was 114 km (SE = 19 km) with the majority of encounters occurring in Ontario (Figure 3). Forty encounters were reported within 40 km of where they were banded (Ottawa or Québec) with 26 other encounters elsewhere in Ontario (e.g., near Georgian Bay, Lake Huron and the St. Lawrence River) and

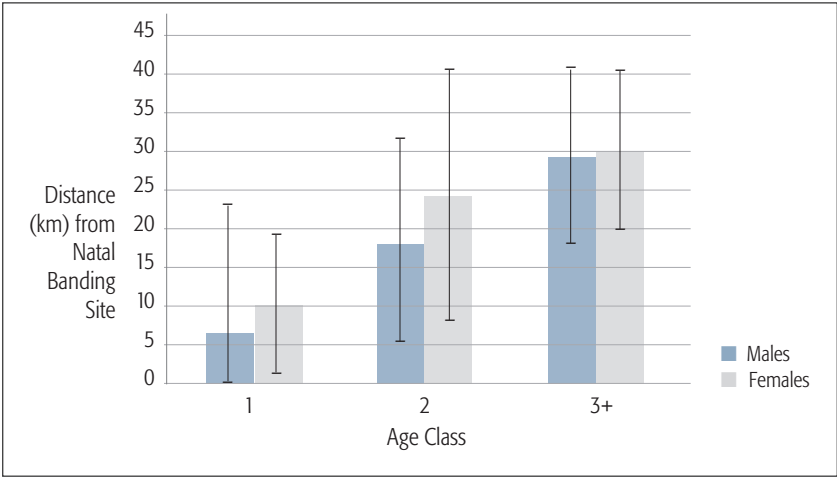


Figure 2. Average distance ( $\pm 1$  standard error) between natal banding and encounter location by age class during May – August for Canada Geese banded as goslings in the City of Ottawa, 1987 – 2011.

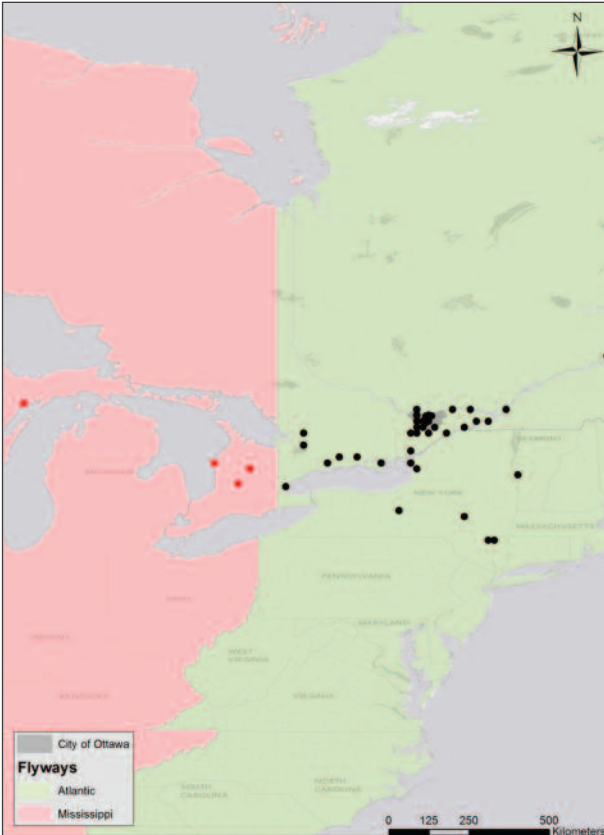


Figure 3. September band encounter locations of Canada Geese banded as goslings in the City of Ottawa, 1987 – 2011. Unexpected encounters are shown as red.

Québec (Cap Tourmente National Wildlife Area). Seven geese were shot in New York state and one each in Vermont and Michigan. The furthest distance of a reported encounter from its banding location was 885 km in Michigan (Appendix 1)

#### *October-November*

In the months of October and November, 75 Canada Geese encounters were reported, mostly as shot (50.7%) or a sight record (45.3%) (Table 1). These encounters were from goslings banded in four locations in Ottawa. Over this time period, the average distance between banding and encounter location was 155 km (SE = 31 km). Forty-seven of the encounters occurred in the Ottawa Region (Ottawa or Québec) within 40 km of their banding location (Figure 4). Of the remaining 28 encounters, 13 occurred elsewhere in Ontario (8) or Québec (5) and 15 were reported in the states of New York (8), New Jersey (1), Maryland (1), Delaware (1), Pennsylvania (1), Wisconsin (1), Michigan (1), and Missouri (1) (Figure 4). The maximum distance between a banding location and its encounter was 1,502 km and occurred in Missouri (Appendix 1).

#### *December-January*

The most encounters ( $n = 199$ ) during all time periods were reported during the months of December and January (Table 1). These encounters were almost entirely shot geese (99.5%). These encountered goslings were banded in nine locations in Ottawa. During this time

period, on average the distance between banding and encounter location was 538 km (SE = 13 km). Of the 198 shot geese, two were reported in Ottawa and the rest in the following States: New York (54), Pennsylvania (44), New Jersey (41), Maryland (27), Delaware (21) and Virginia (9) (Figure 5). The maximum distance between a banding location and its encounter location was 926 km and occurred in Virginia (Appendix 1).

#### **Discussion**

Our results show that TBP Canada Geese banded in Ottawa are highly philopatric to their natal site and almost all birds remain within the Atlantic Flyway. In Ontario, the management boundary line between the Atlantic Flyway (AF) and Mississippi Flyway (MF) is 80° longitude with the AF situated to the east of this line and the MF to the west. Our results show that 435 of the 443 encounters reported occurred east of 80° longitude. Of the eight encounters that occurred west of 80° longitude, four were reported in each of Ontario and the US. These eight encounters are unusual because we expected that Canada Geese banded in the AF would stay within the AF throughout their annual cycle. Moreover, since Ottawa is located at approximately 75° longitude (well east of 80° longitude), we did not expect any of these banded geese to be encountered outside of the AF. While it is difficult to determine whether these eight encounters were due to inaccurate reporting

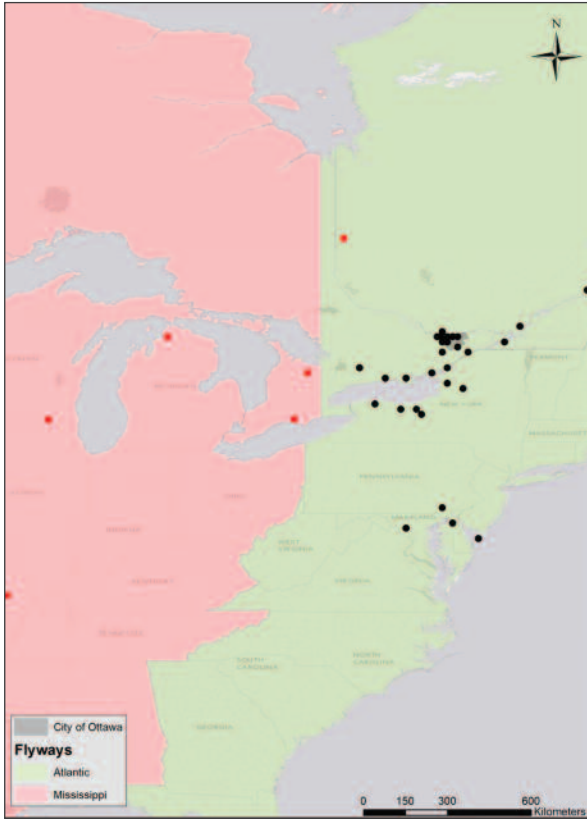
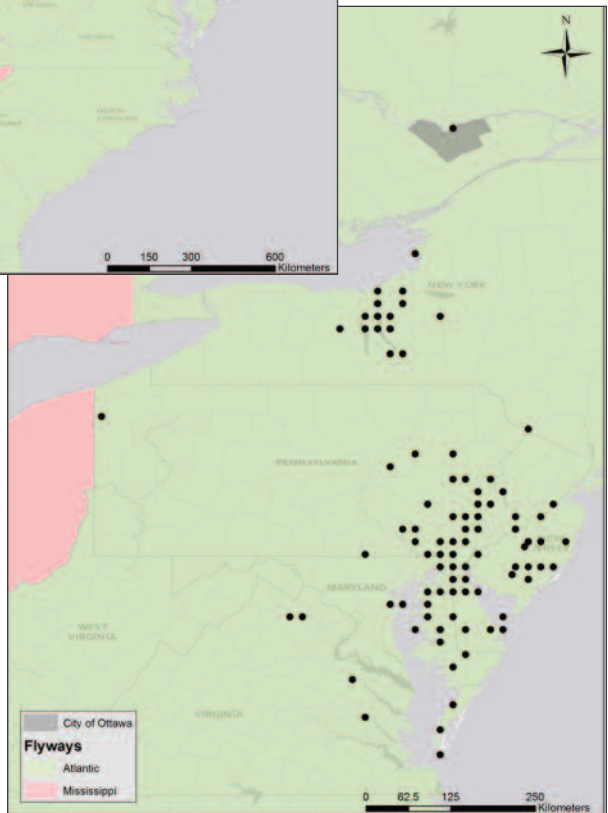


Figure 4. October to November band encounter locations of Canada Geese banded as goslings in the City of Ottawa, 1987 – 2011. Unexpected encounters are shown as red.

Figure 5. December to January band encounter locations of Canada Geese banded as goslings in the City of Ottawa, 1987 – 2011.





(e.g., a hunter reports a shot bird from their home location instead of the harvest location), our results confirm that AF TBP Canada Geese from Ottawa generally stay within the AF. This result is contradictory to TBP Canada Geese banded in the MF portion of Ontario (i.e., west of 80° longitude) which commonly winter outside of their natal flyway, with half of the US harvest occurring in the AF (Environment Canada 2010).

Pair bonding in Canada Geese occurs before arrival on the breeding grounds (Mowbray *et al.* 2002) and would commonly take place where temperate-breeding populations from various states and provinces are mixed during wintering or spring migration. Since a male will follow a female back to her natal site to breed (Lessells 1985), it is surprising that very few adult males banded in Ottawa have been encountered outside of the Ottawa area. However, Raveling (1979) indicated that in TBP Canada Geese, associations formed on the breeding grounds may last throughout the year, resulting in pairs consisting of individuals from the same natal area. Such a mechanism could help explain the results of our findings.

TBP Canada Geese banded as goslings in Ottawa demonstrated strong philopatry to this area. Our results show that during the breeding season (May – August), almost 90% of the encounters occurred in Ottawa and all first year geese returned to their natal site. While this conclusion is interesting, it is not surprising given that family groups of

Canada Geese will often stay together for the first year and, thus, first year birds would return to their natal sites with their parents (Mowbray *et al.* 2002). For second year and adult geese, however, our results differ from other studies which demonstrated overall lower return rates and fewer males than females returning to their natal sites (Lessells 1982). In our study, more than 80% of second year and adult geese were encountered near their natal site during the breeding season independent of age class and sex. A possible explanation for the high overall return rate is the high survival rates of urban TBP Canada Geese. Iverson *et al.* (unpublished data) have shown that TBP Canada Geese in Ontario that successfully raised a brood have higher survival rates than either moulting or unsuccessful breeders. As a result, more TBP Canada Geese may be returning back to Ottawa because more are surviving compared to other geographical areas. In addition, the availability of unoccupied breeding habitat in the Ottawa region likely results in short prospecting distances for young birds from their natal site to find suitable breeding habitat. A final explanation for males is that they are pairing with local females during their second year on their natal area. These factors may explain why more males are returning to Ottawa compared to other studies.

During September, TBP Canada Geese from Ottawa are susceptible to harvest in Ontario and Québec. During late summer/early fall, Canada Geese begin to fly short distances for feeding,

roosting and strengthening muscles for migration. During this time, early Canada Goose hunting seasons open (Environment Canada 2012). Consequently, 88% of the encounters during this time period are geese shot by hunters within 100 km of Ottawa. Our results also show that approximately 21.4% of the total number of geese that were shot by hunters occurred during this time period. Similarly, other studies and analyses have shown high harvest of AF TBP Canada Geese during the early goose hunting season within the state or province in which they were banded (Canadian Wildlife Service – Ontario Region 2011, Klimstra and Padding 2012).

During October and November, the majority of TBP Canada Geese from Ottawa are still within Ontario but the number of shot encounters is substantially lower than during other periods of the hunting season. One possible explanation is that remaining TBP Canada Geese become educated to hunting and learn the locations of safe roosting and feeding sites. As a result, they may preferentially use these areas reducing their probability of harvest. October also marks the point when large numbers of sub-arctic breeding Canada Geese from the Atlantic Population (AP), which nest in northern Québec, begin arriving in the Ottawa area en route from their northern breeding areas. An influx of these geese into an area has been shown to result in a shift in harvest among Canada Geese populations with more AP Canada Geese

harvested compared to TBP Canada Geese during the hunting season (Klimstra and Padding 2012). This suggests that during this period, AP Canada Geese may be buffering the harvest of TBP Canada Geese in the Ottawa region, resulting in the decreased number of shot encounters we observed during this time period. This possibility has important management implications for both TBP and AP Canada Geese in Ontario because of the effect of hunting regulations on both populations during the regular Canada Geese hunting season in eastern Ontario.

During December and January, TBP Canada Geese winter and are heavily harvested in the States of Pennsylvania, New Jersey, Delaware and Maryland. High use of these areas by Canada Geese during winter has been historically documented during the Mid-Winter Waterfowl Survey and areas, such as Chesapeake Bay in Maryland, are renowned for their high waterfowl use during winter (Hestbeck *et al.* 1991, USFWS and USGS 2012). Of all the shot encounters reported during the hunting season, two-thirds were harvested during this time period with all but two shot in the US. These results show that management decisions in the US may have a significant effect on the TBP Canada Geese population in eastern Ontario. TBP Canada Geese in Ontario are also harvested during the late winter hunting season in Ontario (*i.e.*, late February – early March). Although we did not examine encounter data from this time period because there are

few areas with an open hunting season in eastern Ontario during this time. We suggest that future studies examine harvest of TBP Canada Geese during this season to further inform future management decisions.

Marking Canada Geese with auxiliary coloured tarsal markers is highly effective in documenting movement patterns throughout the year. Our results show that Canada Geese with coloured tarsal markers are easier to observe and are more likely to be reported by the public compared to standard aluminum leg bands. Other studies (*e.g.*, Trumpeter Swan and Great Egret) have also shown reporting rates of auxiliary markers to be high and an effective method to monitor or extrapolate population size (Lumsden *et al.* 2012, C. Weseloh, pers. comm.). Our encounter data, however, also suggest that many auxiliary coloured tarsal marked geese were shot within the first year of marking especially on the wintering grounds. To our knowledge, high harvest rates of auxiliary coloured marked waterfowl have been reported for collars but not tarsal markers (Samuel *et al.* 1990; Castelli and Trost 1996, Caswell *et al.* 2012). We suggest that future studies should examine whether coloured tarsal marked geese are harvested at higher rates compared to standard aluminum leg bands in order to help inform possible effects on future study findings.

Although these results show that hunting can be an effective tool for managing TBP Canada Geese, many questions remain regarding these geese

in Ontario especially in urban areas. For example, where do these geese go given that they have high survival rates ( $>0.70$ ) [Iverson *et al.* (submitted)]? Over the last five years, there has been an average of approximately 160,000 breeding TBP Canada Geese in Ontario with a growth rate of approximately 4.0% per year (Canadian Wildlife Service Waterfowl Technical Committee 2012). This growth rate is for the area south of 46°N and excludes urban areas. Consequently, how do urban TBP Canada Geese mix with rural geese and do urban geese disperse and breed in rural areas? Although band encounter data from this study suggest that Canada Geese in Ottawa do not move very far from the city to breed, deployment of auxiliary coloured markers or telemetry would help inform such movement patterns. As such, we suggest that future studies examine movement patterns of urban TBP Canada Geese through the use of these marking techniques. Results from such a study would help determine the amount of movement among different segments of the population (urban versus rural) of TBP Canada Geese in Ontario in order to inform future management decisions.

Encounter data from Canada Geese banded as goslings in Ottawa from 1989 to 2011 show that, for the most part, these geese stay within the AF. Our band encounter data also show auxiliary coloured tarsal markers work well for documenting movement patterns during breeding, staging and migration.

Lastly, these data show that harvest of TBP Canada Geese is highest during September in Ontario and during December – January in the U.S. To inform TBP Canada Geese management in Ontario, we suggest that future studies examine harvest of TBP Canada Geese in Ontario during the late winter hunting season. Moreover, encounter data of TBP Canada Geese in areas where nuisance complaints are highest and hunting is not possible, such as Toronto, should be analysed to examine possible solutions to reduce human-goose conflicts in the future. Future TBP Canada Geese banding in urban areas could be augmented with deployment of auxiliary coloured markers to help document movement patterns and harvest locations.

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*Courtney Young,* Department of Biology, Carleton University, Ottawa, ON. K1S 5B6.

Email: [courtneyyoung@cmail.carleton.ca](mailto:courtneyyoung@cmail.carleton.ca)

*Shawn W. Meyer,* Environment Canada, Canadian Wildlife Service – Ontario Region, 335 River Rd., Ottawa, ON K1A 0H3

*Christopher M. Sharp,* Environment Canada, Canadian Wildlife Service – Ontario Region, 335 River Rd., Ottawa, ON K1A 0H3

**Appendix 1. Summary of Unexpected Band Encounters of Canada Geese banded as goslings in the City of Ottawa, 1987 – 2011.**

BAND NUMBER	TIME PERIOD	ENCOUNTER LOCATION	SEX	YEAR BANDED	YEAR ENCOUNTERED	ENCOUNTER TYPE
104876068	May – Aug	Cherry Hill, NJ	Female	2009	2011	Foreign Recapture
104876349	Sept	Escanaba, MI	Female	2009	2010	Shot
094821714	Sept	Point Clark, ON	Female	2001	2006	Shot
097804861	Sept	Minto, ON	Female	2004	2005	Shot
097805898	Sept	Mitchell, ON	Male	2005	2007	Shot
104876101	Oct – Nov	Gallichan, QC	Female	2009	2010	Shot
100872444	Oct – Nov	Duck Creek, MO	Male	2006	2010	Shot
096895186	Oct – Nov	Whitewater, WI	Female	2000	2001	Shot
099857096	Oct – Nov	Little Traverse Bay, MI	Male	2006	2008	Shot
100872434	Oct – Nov	Alymer, ON	Male	2006	2007	Shot
102886078	Oct – Nov	Grey Highlands, ON	Male	2007	2011	Shot