

Urban Wildlife in Toronto: Species, Threats and Attitudes
Towards Human-Wildlife Coexistence

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FOREWORD

This major paper touches on all three components of my plan of study. The ‘urban wildlife’ component is most notably captured in this research paper as I have thoroughly investigated all three of the learning objectives: to develop an understanding of human-wildlife conflict (a main objective of this paper), to acquire knowledge on a variety of species, and to display wildlife data. Moreover, my learning objective to understand how humans are affecting wildlife in Canada, from the ‘anthropogenic threats to wildlife’ component of my plan of study, is researched in this paper as I examine the Toronto Wildlife Centre admittance charts detailing threats to wildlife in Toronto. Finally, the ‘wildlife management strategies for conservation and coexistence’ component is also explored in both my literature review and recommendations, which fulfills my learning objective to ‘explore strategies to coexist with wildlife’.

ABSTRACT

Urbanization has resulted in ever greater human-wildlife interaction, which can lead to human-wildlife conflict. Hotline data from the Toronto Wildlife Centre between 2001 and 2013 was analyzed to understand relationships between the public and wildlife in the Greater Toronto Area. Results indicate that the public are largely concerned with sick, injured and orphaned animals as well as nuisance situations, and animals are admitted mostly due to being orphaned, experiencing bleeding or injury and due to hitting windows. Most species in the dataset can be categorized as urban exploiters. Comparing types of calls, species, threats, location and extracting attitudes towards wildlife, main results show that raccoons are largely disliked in Toronto and perching birds are liked. Perching birds, however, experience the most anthropogenic consequences in downtown Toronto, as shown by admittances resulting from window strikes. To promote human-wildlife coexistence, recommendations include: educating the public about wildlife and wildlife situations, including wildlife in management decisions, increasing green spaces and preserving natural habitats.

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Chapter 1. INTRODUCTION: OBJECTIVES AND SIGNIFICANCE

1.1. Objectives

The objectives of this paper are:

1. to explore human-wildlife encounters and attitudes towards wildlife in Toronto, and
2. to study possible correlations between factors (correlations between attitudes, species, geographic location, threat type and/or species characteristics) relating to caller attitude towards wildlife and specifics on the species, and
3. to understand how animals occupy space in the city and what this entails for the people of Toronto (and vice versa).

To meet these objectives, I analyze encounters from a database of calls made to the Toronto Wildlife Centre [TWC] between 2001 and 2013.

For the first objective, I am guided by the transcripts of the calls to analyse how people react to wildlife in urban areas: are wildlife considered a nuisance, or are injured animals objects of empathy to be helped? For the second objective, I am guided by the question: in what ways are humans affecting wildlife in Toronto? For example, what are the major threats for wildlife in the city? For the third objective, I aim to find and explore these correlations and answer questions such as, do people have attitudinal favourability towards baby squirrels, as opposed to foxes? Is there geographic significance to my findings? And finally, is there any change through time?

1.2. Significance of Research

Human-wildlife relationships cannot be ignored as natural habitat is increasingly converted to urban areas. Studying the ways in which humans affect wildlife in a large city like Toronto can help to understand the consequences of urban sprawl. People do not view wildlife as belonging to the city nor conforming to desirable urban ideals, which creates conflict (Hadidian, 1991; Philo & Wilbert, 2000). Thinking about how animals occupy space and place, and what this means for people living in the city, is also worth researching as it gives insight into how we manage and view urban wildlife, and how this, in turn, affects animals in the city. Attitudes on urban wildlife specifically are interesting to parallel with other factors, such as place and species present, to understand relationships between these interlinked elements. Kymlicka & Donaldson (2011) have stated that, “currently, there is an utter lack of transparency and consistency in human responses to liminal animals [wild animals living among humans]” (p. 249). The responses of callers are can be considered more spontaneous, even more “natural” than answers given to interviewers.

1.3. Scope

1.3.1. Temporal

The TWC caller data includes information spanning over 12 years, between 1 January 2001 and 3 July 2013, with the exception of missing data for a few months in 2001 and 2011 as well as the years 2005 and 2006 in the intake data spreadsheet (see Figure 1).

1.3.2. Spatial

The TWC data spans the Greater Toronto Area (GTA), with the majority of points within this spatial boundary. However, some animals within the dataset were found outside of the GTA and in rare cases, the TWC takes in animals found farther away within Ontario where there are no other options or centers available (“FAQ”, n.d.). Because the TWC is the only wildlife rehabilitation center in Toronto, inquiries of injured/sick/trapped/orphaned wildlife are likely to be referred to the center. Locations of all animals admitted are recorded as the closest main intersection (i.e. information on where the animal was found).

1.4. Information on The Toronto Wildlife Centre

The Toronto Wildlife Centre (TWC) was founded in 1993 and has since admitted over 270 species, operating with a team of medical staff and volunteers ranging from cleaners to rescuers to wildlife carers. TWC “promotes the peaceful coexistence of people and wildlife by providing education and expert advice about wildlife situations, and providing medical care to sick, injured and orphaned wild animals with the ultimate goal of releasing healthy animals back into the wild” (“Our Mission”, n.d., para 1). The center takes in wildlife from all over the GTA and sometimes beyond this, as it is the only wildlife rehabilitation center in Toronto. They have five

main departments, being wildlife hotline, rescue, hospital, and rehabilitation as well as education and outreach.

1.5. Nature of Data

The data I utilized for this research comes from the TWC and was acquired as part of a collaboration between TWC, the University of Toronto, and York University. The TWC collects thousands of calls every year including detailed information on all animals admitted to the center. These records provide valuable information on species seen in Toronto and the GTA on the human-wildlife encounters. Database fields include call date, time, reason for the call, species in question, location of the incident, information on the caller, urgency determination, resulting action and a transcript of the call. The purpose for calls ranges from information about a(n): sick/ injured animal, animal sighting, dead animal, trapped animal, animal in distress, domestic animal, general nuisance, donation, inquiry on an admitted animal or follow-up on a case, as well as administration information such as a returning call, information needed/given by the caller, the need for a rescue, information on a release, etc. Moreover, intake data also includes geographic location and specific circumstances of the animal. All volunteers and hotline staff at TWC are trained to work using the same procedures. Throughout the data time frame (2001-2013) the same terminology and input forms were used, without any major modifications.

When a person calls the Toronto Wildlife Centre, they are automatically directed to a voicemail service that records and saves their message, which is then transferred as an email to an inbox. A wildlife hotline staff or volunteer then listens to the call and records an exact

transcript of the message in a database (see Figure 2). Information about the caller is also input in this database and the call is given a unique hotline identification number, with the caller information also being stored in the system. Information taken by the staff/volunteer is limited to what the caller has supplied, though can include the caller's personal information (name, phone number, address), reason for call, animal in question, situation location, time stamp, referral and more (see Figure 2). Each time contact is made between a caller and TWC, the subsequent information is recorded and is linked to the original call. Moreover, when an animal is admitted, further information is recorded including location, finder and admission information (see Figure 3). All the information for calls made between 1 January 2001 and 3 July 2013 was inputted into an excel sheet, which is what I am utilizing with permission for my analysis.

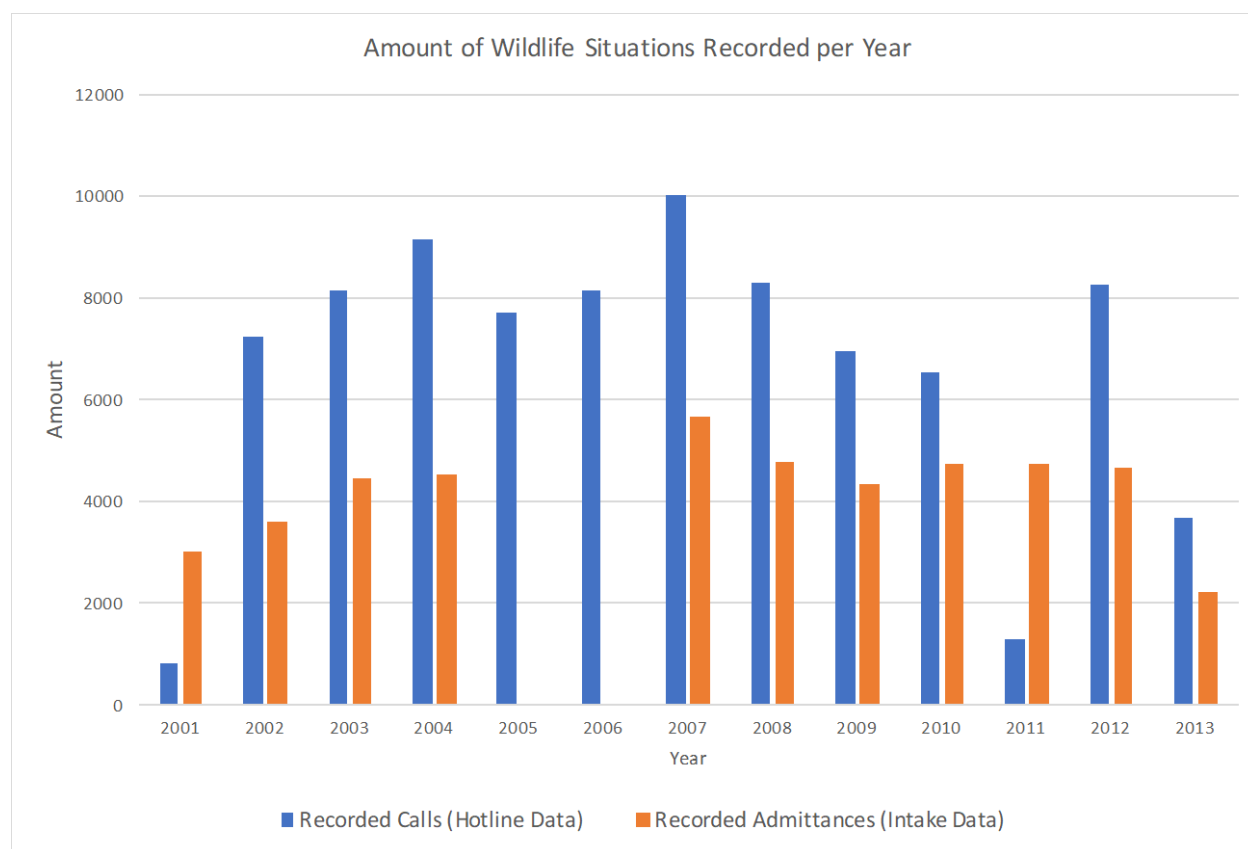


Figure 1 – Wildlife situations recorded in excel spreadsheets between 2001 and 2013

TWC_FE_Apr262013 - [Hotline]

File Edit View Insert Format Records Tools Window Help

Type a question for help

Urgent Other Rescue Nuisance Intake Form Logon Messages Other Info Follow Up Emerg Print Reports Other Forms

3 URGENT 12 OTHER
3 RESCUE
15 NUISANCE

2011 Hotline Calls July 4, 2013 13:29

Call Status: Hotline ID: 2011016506 Line 1 Line 2 Private Hang Up Call Date: 01-Nov-11 Call Time: 10:30

☒ Completed
Urgent
Exit
Refresh
New Call

Search Before New Intake
New Intake Using WILD
Operator
VEB
Select
Find Record

Caller Information

ID: Organization: Home: Work:
Title: Mr. First Name: Shane Last Name: Last Name 2: Cell:
Title 2: First Name 2: Last Name 2: Other:
Address: Apt: Phone Type:
City: Toronto Postal: Prov: ON
No Mail Indicator: Y Email: Enews:

Call Details

Reason For Call: Species: Number: Caller Type:
Sick/ Injured Animal Hawk, Unknown 1 Member of Public
Message For: Caller Referred By: Location Type: Location Description: Situation Name:
Notes:
(Originally called on rescue line).
Advised he did call our rescue line, he doesn't deal with the public. He said he got number from TAS on Sheppard. Looked like a hawk on the right hand side of road on turn going on to the 400. On the shoulder of the road, inside white line. Just sitting there.

Action Taken: Final Outcome/ Referral

Refer to Call #: (Double click to view call) Main Intersection:

Action	Date	By	Comments	Done
Need to Consult	01-Nov-11	VEB	AR willing to go check it out.	☐
Del Act	Action # 10:40			☐
Gave Info / Advic	01-Nov-11	VEB	Advised our rescue staff will go take a look and see what's going on.	☐
Del Act	Action # 10:42			☐

Record: 1 of 6
ActCount: 6

Record: 1 of 22462
Form View

NUM

Start | Inbox - Mic... | Canada Re... | Toronto Wil... | E:\Toronto... | Microsoft E... | 3 Micros... | Document1... | untitled - P... | 1:29 PM

Figure 2 – TWC call information input form

TWC FE Apr262013 - [Intake Form]

File Edit View Insert Format Records Tools Window Help

Avian Chart Mammal Chart Rep/Amph Chart Hotline Form Placement Info Incomplete Other Details Reports Email Other Forms Call History

Incomplete? **INTAKE FORM** Last Intake ID 20132287

Intake ID 20100004 ☐ Or ☐ Intake History ☐ GoTo Intake Date 01-Jan-10 Time 14:44

Finder Information

Brought in by: ☐ Finder ☐ Other ☐ Rescue ☐ Volunteer Driver Name AW Transferred From Salutation: Sheila

Admitted By AP ID 48227

Select Finder(s): ☒ Other Finder

Comments: Scarborough ON Home Work Cell Other: Phone Type Time Stamp

☐ Finder wants to release this animal ☐ Orphan ☐ Someone has been bitten or scratched by this animal ☐ Donation? ☐ MailingStatus ☐ Acquisition ☐ EMail

Animal Information

Species: Raccoon Age: MA Mammal - Adult Sex: Distinguishing Features: ☒ Typical Description:

Admission Information

Date Found: 01-Jan-10 Reason For Intake: Distemper Notes:

Location/ City: Scarborough Main Intersection: 272 Blantyre Ave.

☒ Found at Finder's Residence OR Exact Location:

Circumstances: found today walkin on the road in front of finder's house since 8:30am this morning. looks dazed, body condition seems healthy, walking slowly. TAs not answering phones. AW rescue

Food Offered:

Medicine/ Treatment:

Care Given:

Treatment/ Outcome

Initial Exam: ☐ Treatments: ☐ Final Disposition: ☐ Post Mortem: ☐

Final Disposition

Date: 01-Jan-10 Weight Date: Significant Problems: Virus, CDV-suspect

Suspected Cause: Virus/Disease-explain Final Weight:

DIC timeframe:

Records: 14 of 16321

Form View

Figure 3 – Intake animal input form

1.6. Significance of Data

The call logs can reveal information on the stance of the caller towards wildlife issues, as the choice of words and actions from the caller can be interpreted as positive, negative or neutral towards certain species and situations or urban wildlife in general. However, a constraint noted is that it is not always possible to accurately discern a caller's attitudes, nor do behaviours always correspond to certain attitudes. A general sense of caller attitudes towards urban wildlife can be discerned from the data, nevertheless, as I show in this paper. The insight into the attitudes of Torontonians towards urban wildlife is essentially a backwards look at the value-attitude-

behaviour model, deduced from a large database of caller behaviour. This is a different data source than interviews would be, with different social and performative pressures (i.e., it might be expected that interviewees may feel the need to conform to social norms about attitudes towards wildlife in a way that callers may not).

Some information on the situations and animals themselves are geographically significant, giving insight on urban wildlife conflict in Toronto between 2001 and 2013. Spatially significant data is useful to understand where major threats to animals are located in the GTA as well as which species are affected where. Moreover, the types of threats detailed, or reason for the call (e.g. nuisance call, injured animal or orphaned animal) are significant not only to understand the ratios between calls made due to care for wildlife versus calls made due to annoyance by wildlife, but also to reveal information on how a city like Toronto is affecting wildlife directly. This data allows for a closer look at which species are being affected and how, which is interesting to parallel with the public's attitudes towards urban wildlife.

Chapter 2. LITERATURE REVIEW: URBAN WILDLIFE, CONFLICT AND HUMAN ATTITUDES

2.1. Definitions

2.1.1. Cognitive Hierarchy

The cognitive hierarchy of value-attitude-behaviour framework has been utilized by several authors (Fulton, Manfredo & Lipscomb, 1996; Tarrant, Bright & Ken Cordell, 1997; Vaske, 1996; Whittaker, Vaske & Manfredo, 2006), often successfully, to understand and predict behaviours. This hierarchy reveals how a person's deeply rooted values affect personal attitudes, which then leads to specific corresponding behaviours, or "the notion that attitudes predispose or predict behavior" (Tarrant et al., 1997, p.16). While it has been observed that behaviour does not always accurately reflect personal attitudes (Geiger & Hovorka, 2015; McCleery, Ditton, Sell & Lopez, 2006), I am utilizing the value-attitude-behaviour model as part of factors influencing the human-animal relationship in Toronto to make general observations, as it has proved to be an effective tool when used generally and cautiously (Tarrant et al., 1997). Moreover, though the cognitive hierarchy lacks social, political and economic contexts, (McCleery et al., 2006; Wolch, 1996), these parameters are not captured in the source data of my research, hence are out of scope for my study.

2.1.2. Habitat Fragmentation

Habitat fragmentation is a leading cause of species decline (Venter, Brodeur, Nemiroff, Belland, Dolinsek, & Grant, 2006) and arguably the most harmful to wildlife. Habitat fragmentation is defined as the breaking apart of habitat (Fahrig, 2003), causing a decline in habitat quality that affects many species. This can be derived naturally, though a major cause is by human activity, and severe habitat fragmentation can also lead to complete habitat loss. Examples of habitat fragmentation include land conversions for agriculture or urbanization as well as the implementation of physical barriers such as roads, fences or railways.

2.1.3. Urbanization

Urbanization is defined as the process by which an area becomes more city-like as cities grow due to a population shift towards (or growth within) cities, also resulting in an increase in population density. Urbanization leads to the transformation of natural environments to human-driven landscapes, which is a primary consequence for wildlife (McKinney, 2002; Venter et al., 2006). For the purposes of this paper, urbanization is synonymous with this change in habitat.

2.1.4. Urban Wildlife

Urban wildlife is defined by utilizing several terms from the literature I examine in this paper. For example, Kymlicka & Donaldson (2011) refer to urban species as ‘liminal animals’, defined as “wild animals living amongst us” (p. 211), as opposed to “truly wild animals who temporarily enter into contact with humans” (p. 217). Emel, Wilbert & Wolch (2002) describe urban wildlife through “borderland communities”, which are “communities in which humans and free animals share space, and places” (p.409). For the purposes of this paper, urban wildlife is defined as species that live among humans in urban areas permanently, without being domesticated.

2.1.5. Urban Avoiders, Adapters and Exploiters

The urban wildlife terms “avoider”, “adapter” and “exploiter” were coined by Blair in 1996 and have since been further developed by McKinney (2002). Urban exploiters are species that thrive

in urban landscapes and modified environments, urban adapters (coined as “suburban adaptables” by Blair, 1996, p.507) do best in moderately developed environments (relying on their natural environments but utilizing human resources), and urban avoiders are more sensitive to changes in landscape and thrive in their natural environments (Blair, 1996). McKinney (2002) adds that urban exploiters (also known as synanthropes) are mostly “commensals” (p.997), as they are extremely dependent on human resources thus also have a close relationship to humans; urban adapters include “edge species” (p.887), which can live in open areas but require nearby forests (often doing well in suburban landscapes); urban avoiders include “forest interior species” (p.885), which often disappear quickly as urbanization rises, and are sensitive to human presence and changes. Urban exploiters are mostly non-native species that include the rock dove, European starling, house sparrow, house mouse, rat and insects (McKinney, 2002, p.888), as well as the cottontail rabbit, raccoon, Virginia opossum, house finch, California gull, American crow, Eurasian collared dove and grey squirrel (“Urban Wildlife Basics”, 2012). They also have the ability to move between cities (McKinney, 2002), and can be seen as pests by many North Americans as they thrive on our resources and have a large presence in city life. Urban exploiters have been observed to be more sedentary and social compared with urban adapters (as found in a study of birds by Kark, Iwaniuk, Schalimtzek & Banker, 2007). They also possess certain characteristics that may make them better adapted to living in cities, including geographic location, body size, diet, behavioural and biological flexibility (Bateman & Fleming). Urban adapters, who often possess similar features to urban exploiters, includes the bobcat, coyote, white-tailed deer, black bear, American robin, red fox, striped skunk, Northern cardinal, lesser goldfinch and red tailed hawk (“Urban Wildlife Basics”, 2012). These species however require natural habitat nearby while also utilizing human resources. Urban avoiders, on the other hand,

are “usually large mammals, especially predators, because they are actively persecuted, relatively rare, and have low reproductive rates” (McKinney, 2002, p.887), with past examples being the cougar, bison and elk who disappeared after early human settlement (McKinney, 2002). Current examples of urban avoiders include the Mountain lion, grey wolf, grey fox and Pileated woodpecker (although these are more difficult to categorize) (“Urban Wildlife Basics”, 2012). Though adapted by Fischer, Schneider, Ahlers & Miller (2015), “Blair’s (1996) avoider, adapter, exploiter terminology has become the primary means of characterizing wildlife responses to urbanization” (Fischer et al., 2015, p.1246) and thus it is used to categorize species in this paper.

2.2. Urbanization and Human-Wildlife Conflict

2.2.1. Wildlife is Affected by Urbanization

Urbanization deeply alters and even often erases habitats for native wildlife, as well as creates other challenges including increasing water, air, light and noise pollution, changing soil geomorphology and the growth of invasive species (Soulsbury & White, 2016). Extinction rates have been observed to be highest when caused by urban development and consequences of urbanization have shown to have greater long term effects than other habitat loss (McKinney, 2002). Urbanization contributes to detrimental effects to wildlife by both pushing native wildlife out of cities (urban avoider species) or alternatively forcing them to adapt (urban adapter species), and consequently making way for generalist species to enter cities and exploit human resources (urban exploiter and adapter species). Indeed, generalists have high behavioural flexibility that allows them to live in different types of habitat and survive on a variety of foods,

thus being perfect candidates for becoming urban wildlife (Bateman & Fleming; Wine, Gagné & Meentemeyer, 2015). Moreover, the absence of large predators in urban areas means these species can thrive in such environments (Wine et al., 2015). These are interesting distinctions as the species that are the subjects of the TWC data vary between urban exploiter, adapter and sometimes avoider, each with differing characteristics.

However, Ditchkoff, Saalfeld & Gibson (2006) note that on the other hand, smaller predators such as household pets may increase predatory rates on wild urban species, and that direct hazards such as vehicle collisions increase mortality rates. There are also consequences for urban exploiters specifically who utilize resources in cities, such as increased potential for human contact as well as contact with human structures and hazards. This is, in part, what contributes to such high numbers of patients admitted to TWC, as wildlife in Toronto becomes injured in the city due to manmade obstacles (for example getting stuck in buildings, fences and wells, getting hit by cars, falling from green roofs etc.), or as wildlife gets harmed directly by humans (for example through harassment). Moreover, the Ontario Ministry of Natural Resources (OMNR) states that “if you capture sick, injured or orphaned wildlife, take the animal to someone who is authorized to rehabilitate it” (“Harass, Capture or Kill a Wild Animal Damaging Private Property”, n.d.), possibly giving encouragement for the public to bring animals to TWC, the only wildlife rehabilitation centre in the GTA.

2.2.2. Challenges with Human-Wildlife Conflict

With increased urbanization comes increased human-wildlife conflict. This conflict, referring to negative human-wildlife interactions, can be seasonal and occur in specific locations (for example nearby green spaces and primary residences such as airports, golf courses and lake fronts) (Hadidian, 1991; Lukasik & Alexander, 2011). As well, it may involve certain species more than others (such as generalists) (Hadidian, 1991; Wine et al., 2015). Human-wildlife conflict arises due to the effects wildlife has on humans, either directly through animal aggression or by being a nuisance (the OMNR considers nuisance animals to be wildlife that are creating damage to your own property [“Harass, Capture or Kill a Wild Animal Damaging Private Property”, n.d.]) or indirectly through the spread of disease (Bateman & Fleming; Hadidian, 1991; Hough, 2004; Soulsbury & White, 2016). This conflict is on the rise especially since urban wildlife is not usually included as part of current urban development ideals.

Allocating wild spaces to urban areas (for wildlife specifically as opposed to human uses) and acceptance of wildlife in the city typically goes against developmental projects, especially in a high real estate market such as Toronto. Management of animals in such a city creates conflicts with respect to who gets to make conservation decisions, how land is managed, rising clashes over animal rights, urban development practices, and legislation (Wolch, 1998). Moreover, animals in urban areas can be generally perceived as unwanted by the public, for example with large carnivores as they can carry disease (such as rabies, tuberculosis and parasites which can affect humans, pets and livestock), destroy private property, or be a danger to pets and humans (Bateman & Fleming, 2012). It is easy to view wild animals in terms of how they inconvenience us rather than benefit us, as Kymlicka & Donaldson (2011) explain:

We tend to see liminal animals in terms of their problem attributes (e.g., sparrows making too much noise, squirrels stealing the bird seed, pigeons fouling the park benches), while

ignoring the ways we benefit from the same animals (scavenging human garbage, seeding new trees, eating insects, pollinating plants, controlling other liminal animal populations through predation. (p.249)

Direct interactions between wildlife and humans can also be aggressive and result in injury, such as with coyote attacks in cities (Lukasik & Alexander, 2011). This further perpetuates negative perceptions of wildlife, even when the negative interaction is a result of human action.

Additionally, humans can display a desire to control and even dominate everything in their surroundings causing negative impacts with certain species of wildlife, resulting in these being further perceived negatively and rejected from acceptance within ideals of a desired city (Hough, 2004; Wolch, 1996).

Human-wildlife conflict not only poses a threat to humans, but can also affect wildlife negatively, such as with higher probability of disease among urban coyotes (Murray, Cembrowski, Latham, Lukasik, Pruss & St Clair, 2015). Moreover, conflict with wildlife can result in lethal action as a way to protect human populations (Dickman, 2010; Lukasik & Alexander, 2011). This conflict can arise due to deeply rooted human-human conflict (Dickman, 2010) and is “often caused by inadequate human behavior” (Savard, Clergeau & Mennechez, 2000, p.139), thus again suggesting that humans are at the root of the problem. Overall, humans have created the problem of human-wildlife conflict through both urbanization (conversion of natural habitats) as well as active interaction with wildlife. Though while being responsible for managing wildlife in cities (often poorly), humans are frequently blaming the animals for these conflicts, which also often results in adverse effects for wildlife.

2.3. Animal Geography and Animal Spaces

2.3.1. Where Animals Belong

Geographers have been prompted to think about animal distribution since early 20th century, which led to the current study of animal geography that evolved into understanding how animals affect our surroundings and ourselves (Hovorka, 2017b). Animal geography looks at the “spatial dimensions of human-animal interactions” (Van Patter & Hovorka, 2017, p.278) and more specifically studies how animals are shaping space, place and landscape, how they are influencing the human-animal relationship, as well as how these evolved through time and space (Emel, Wilbert, & Wolch, 2002; Wolch, 1998).

How we think about animals belonging to certain places has been explored by Philo & Wilbert (2000), who suggest that “animal spaces” are places where animals are meant to be according to us, humans. This creates the idea that animals can be in or out of place, depending on where we believe animals should be (which differs from person to person depending on their beliefs). For example, this could be places such as green spaces within cities, landscapes on the outskirts of cities, or places completely removed from cities. Once animals are seen outside of these places, such as in backyards or on city streets, it can be believed that these animals are out of place and need to be relocated or removed. This can contribute to negative perceptions of wildlife in a city such as Toronto, since we have constructed beliefs that entail this wildlife is meant to exist elsewhere. Further, as animals cross the permeable material and socially-

constructed boundary of ‘wilderness space’ and ‘urban place’, having to conform to human-constructed urban ideals, inevitable conflicts arise (Emel et al., 2002).

2.3.2. Integrating Wildlife in City Planning

Another reason why wildlife is so unwelcome in cities is due to how we build them. Hadidian (1991) indeed explains that “our cities and suburbs are environments that have been designed and developed as habitats for one species – humans” (p.11). The author continues by suggesting “their evolution is far from complete, as are our thoughts about what we want them to be” (p.11), which can be interpreted as an opportunity to revitalize our cities with nature and wildlife in mind. One such opportunity could be described as zoöpolis, an urban theory coined by Wolch (1996) within animal geography study that describes a cohabitation with animals in a city such as Toronto. Zoöpolis is a deliberate attempt to reconnect wildlife into urban areas, favouring co-existence with wildlife by including animals and nature in the city and city life (Wolch, 1996; Wolch, 1998). Further, zoöpolis supports the goal to develop an equal relationship, not one ruled by humans, through strategic urban design (Wolch, 1996), a concept also explored by Hough (2004).

Reintegrating wilderness spaces into urban areas would ultimately and undoubtedly require a change in values and thinking that defies the current utilitarian political framework (Kymlicka & Donaldson, 2015). Overall, discussing wildlife in the city through the animal geographies lens, with an interest in zoöpolis and wilderness reintegration, provides a framework to further understand the socially, politically and ethically-charged interactions between human and animal

relationships (Emel et al., 2002). Zoöpolis challenges the idea that wildlife in a city is viewed as incompatible and non-conforming to metropolitan ideals.

2.4. Urban Wildlife and Urban Wildlife Ecology

2.4.1. Urban Adapted Wildlife

There have been several recent studies conducted on the topic of urban wildlife, highlighting how urban species differ from their rural counterparts, in terms of population, diet, behaviour, movement, disease and mortality rates. Human stresses on urban animals range between direct human disturbance to increased heat, noise and pollution, which can directly affect and alter: behavioural patterns, reproduction rates, overall health, and survival rates (Ditchkoff et al., 2006). This can result in “rapid microevolution” (Ditchkoff et al., 2006, p.9), which refers to species evolving through only a few generations due to rapidly changing environments, such as adapting to human-induced landscape changes.

Many North American species have been studied and found to have adapted well to urbanized environments. To emphasize diet, mortality, and range differences between an urban species and their natural counterpart, Kanda, Fuller, Sievert & Kellogg (2009) studied the Virginia opossum (an urban exploiter species) population in Massachusetts, United States and found that opossums that utilized human food had higher survival rates with the ability to survive winter owing to the use of anthropogenic resources, while those eating from natural habitat starved. This also consequently expanded their range and resulted in older and fatter individuals

(Kanda et al., 2009). A study by Wine et al. (2015) similarly researched coyotes and not only found that coyotes have expanded their range in the United States to include cities and suburban areas (making the species also urban adapters). The authors (2015) however also suggested that socio-economic factors including building density, household income and occupation have a role to play in determining presence and density of coyote populations, though often this data is lacking or not considered in such analyses. Coyotes have been known to become habituated to humans, adapted to urban environments as well as urban diets (such as feeding on garbage) (Lukasik & Alexander, 2011). Also researching coyotes, Lukasik & Alexander (2011) have found that higher conflict occurred during the pup-rearing season as well as in higher density communities nearby green spaces, though have concluded that humans are generally co-existing with coyotes in Calgary, as sightings far outweighed conflicts. Poessel, Breck, Teel, Shwiff, Crooks & Angeloni (2013) also concluded that coyote conflicts were disproportionately higher in open spaces, development land and suburban areas (as well as supported the notion that this conflict is seasonal). Furthermore, Murray et al. (2015) compared diets of urban and rural coyotes to find that urban coyotes had more diverse diets and ate more human foods as opposed to eating other animals (contributing to their higher population success in urban areas) though were more likely to be diseased. These findings demonstrate that urban species are both measurably dissimilar to their natural counterparts, though these adaptations can lead to higher conflict with potential negative consequences (for example with the diseased coyotes in urban areas coming in contact with humans).

2.4.1. Urban Wildlife Behave Differently

To illustrate differences in population densities for urban vs non-urban groups of the same species, an 8-year study found that for the raccoon, densities in a selected urban national park in Washington, D.C., United States were much greater than in other non-urban habitats, from twice to 100 times denser (Riley, Hadidian & Manski's, 1998). The authors reveal that a possible explanation for high population densities is that "urban environments likely provide resources, such as food and den sites, and conditions, such as greater protection from exploitation, that directly benefit and support dense raccoon populations" (Riley, Hadidian & Manski, 1998, p.1159), which supports previously discussed findings on urban exploiters, adapters and generalist species.

Another study by Prange, Gehrt & Wiggers (2003) sought to understand demographic factors contributing to high densities of raccoon in urban areas in Illinois, United States and found that raccoon density was higher in urban and suburban areas than rural areas for all seasons, and that urban and suburban densities were similar for most seasons. The authors (2003) also recorded that mortality rates were higher for raccoons in rural sites as opposed to urban sites, contributing to higher urban survival and thus density. Overall, "multiple factors, including increased survival, higher annual recruitment, and increased site fidelity, are jointly responsible for high-density raccoon populations in urbanized areas" (Prange, Gehrt & Wiggers, 2003, p.3240). Moreover, Ditchkoff et al., (2006) emphasize that feeding and thus activity patterns of the raccoon differs from their rural counterparts', since feeding sites in urban areas tend to be artificial communal sites such as garbage dumps. However, the authors also indicated that

although higher food availability in urban landscapes leads to estimated higher survival for the raccoon, that this may not be true for every species (for example with urban avoiders), and thus warned against simplifying and generalizing such processes (Ditchkoff et al., 2006). Indeed, different species require different habitat types and foods, thus meaning every case is species-specific.

While many other studies have been conducted on raccoons, a notable paper includes a case study in Scarborough, Ontario, relating back to my own study area, which also includes data on the striped skunk (Broadfoot, Rosatte & O'Leary, 2001). Findings from this study suggest that raccoons preferred woodland cover and avoided industrial land, though skunk subpopulations were present, and that skunks preferred open areas and forest edges as opposed to woodland cover or field (Broadfoot et al., 2001). Most notably, it was determined that raccoon densities were much higher in urban areas compared with rural areas (Broadfoot et al., 2001), again consistent with the findings noted above. However another finding from this study illustrates the difference in the chance of disease outbreak, with higher density populations expected to be at higher rabies outbreak risk (Broadfoot et al., 2001). This shows that while racoon population densities are estimated to be higher in urban areas, that they are more likely to be diseased and unhealthy. Ditchkoff et al. (2006) also point out that with increased population density comes increased disease transmission, in addition to higher human-wildlife conflict, as populations are less likely to be isolated.

2.4.1. Larger Mammals are Becoming Urban Adapters

While many small to medium species have been known to inhabit urban landscapes, Ditchkoff et al. (2006) indicate that larger mammals, such as coyotes and white-tailed deer (that have previously been known to be intolerant of human stresses), have recently been venturing into and acclimatizing to urban areas, thus becoming urban adapters. This adaptation can create problems for both the species and people affected, such as increased anthropogenic obstacles for the animals and other potential negative consequences driven by fear and unfamiliarity of larger species, as well as increased conflict with humans such as with higher disease transmission and nuisance potential. Touching on carnivorous mammals in cities, Bateman & Fleming's (2012) findings also suggest that medium-sized carnivores such as the red fox, coyote, Eurasian badger and raccoon have higher urban population densities compared with their natural environments, and that larger carnivores such as bears, wolves and hyenas may also benefit from living in proximity to cities (Bateman & Fleming, 2012), though are often categorized as urban avoiders. It was determined that indeed, many carnivores benefit from these urban spaces as they have increased opportunity to exploit human food and shelter (Bateman & Fleming, 2012), a finding consistent with the role of urban exploiters and adapters. Bateman & Fleming (2012) notably predict an increase in carnivores present near outskirts of the city, as they continue to use human food and shelter, though that carnivore density within cities will fall due to intervened human action (again creating potential for conflict). Finally, the black bear is an example of a large species utilizing human resources, becoming habituated to humans and urban spaces. In a study that compared black bears living in urban environments versus wildland habitats in Nevada, United States, it was found that the urban black bears, while more fertile, had higher mortality

rates (often due to anthropogenic causes such as vehicle collisions), and were thus unable to repopulate vacant nearby wild spaces (Beckmann, & Lackey, 2008). This highlights negative consequences of human activity on such a large species, which can also further exemplify the notion of animal spaces since it is not uncommon for cities to kill bears if they come too close to human dwellings (i.e. bears do not belong in cities). Moreover, Beckmann, & Lackey (2008) also found that black bears have been enticed to urban areas due to the abundance of human garbage available for food, as confirmed by fatter deceased bears with stomachs filled with garbage, thus also causing a redistribution of populations and further exemplifying negative consequences of human activity on native species.

Finally, behavioural changes can be exemplified by a study on tigers that aimed to understand how they live among humans (Carter, Shrestha, Karki, Pradhan & Liu, 2012). While the subject species of this study is not applicable to my analysis, parallels can be drawn from a theoretical point of view. Carter et al. (2012) found that tigers coexisted with humans by changing their behavioural patterns as the species became more active at night to compensate for human activity during the day, even though tiger density was high and overlapped with humans. This finding illustrates how some species can adapt to coexist with humans, with the authors attributing success to high availability of prey and low poaching levels. Ditchkoff et al. (2006) also add that while it is not uncommon for large predators to shift their behavioural patterns to compensate for human activity, there may be limitations to the availability of prey with the new modified schedules, further influencing species behaviour.

Overall, the above findings highlight behavioural and morphological differences in urban wildlife and can be used to further understand the subject species of my data, as well as highlighting consequences of urban development and species adaptation, which can also create an interesting parallel with the notion of zoöpolis.

2.5. Attitudes Towards Wildlife

2.5.1. Utilizing the Cognitive Hierarchy

Human attitudes towards wildlife is a topic that has been studied for several decades. Urban attitudes towards wildlife are particularly important to understand as they guide and shape legislation focused on wildlife management, since the political majority are urbanites (Hadidian, 1991). As previously mentioned, the cognitive hierarchy has been utilized to generally explain how behaviour is rooted in attitudes. For example, Tarrant, Bright & Ken Cordell utilized the cognitive hierarchy to assess attitudes towards wildlife species protection, finding that “attitudes toward wildlife species protection (...) are affected by general attitudes toward the environment and, to some extent, wildlife knowledge levels” (1997, p.14).

In terms of how the cognitive hierarchy manifests itself within wildlife protection issues, “such behavior may take an active form, as with appropriate hunting behavior on public lands, or a more passive form, such as support for specific management practices related to fish and wildlife issues” (Tarrant et al., 1997, p.16). It is valuable to make the distinction between possible outcomes, namely taking passive and active approaches as a result of attitude beliefs.

This shows that the cognitive hierarchy must not be used as a predictive tool but rather can be used to explain behaviour, which is the basis of my analysis (i.e. using the cognitive hierarchy to explain how behaviour is rooted in personal attitudes and values). Human attitudes are complex and it is often hard to predict resulting actions, especially regarding “human attitudes to liminal animals [of which] are often intense, but rarely simple or consistent thus making human-wildlife interactions complex as well” (Kymlicka & Donaldson, 2011, p.216). People can be motivated to interact with wildlife by their values and determining social factors (Dickman, 2010; Soulsbury & White, 2016) so people can take active, passive or even reluctant approaches (Soulsbury & White, 2016). Furthermore, attitudes towards wildlife are not only rooted in personal experiences, but also upon “wider societal experiences, cultural norms, expectations and beliefs” (Dickman, 2010, p.462). Therefore, it can be difficult to fully understand how or why people take certain actions, and while predictions cannot be made, it can be useful to deduce values based on these actions (e.g. concluding that someone who calls TWC to report a nuisance situation about a raccoon in their backyard can be assumed to have negative views on some wildlife species, as opposed to predicting this outcome based on the knowledge of their values).

2.5.2. Human Perceptions of Wildlife Depend on Many Factors and Change Over Time

Kellert investigated relationships between attitudes and age, race, gender, place of residence and level of education, also studying attitudes through time in North America. This pioneered research on human attitudes towards wildlife conservation including various species, countries and peoples having varying values and attitudes towards wildlife and animal practices. I am

using Kellert's work here to help frame the parameters best used in analysing and trending the data. Perceptions towards animals indeed differ depending on space, place and time and are case specific, with different people relating to different animals (Hovorka, 2017a). Moreover, attitudes may develop and change through time, as illustrated first by Kellert & Westervelt (1983) and Kellert (1985b) who studied changes in perceptions of animals, and later by George, Slagle, Wilson, Moeller & Bruskotter ((2016) who looked at changes in attitudes toward animals in the United States from 1978 to 2014 and found significant change between attitudes towards some species.

Kellert (1985b) argues that it is not changes in volume in terms of how many Americans changed their perceptions about and behaviour towards wildlife that occurred, but rather changes in the nature of these interactions (based on Kellert's [1985a] typology). Kellert (1985b) identifies three periods of increased concern for wildlife and nature, being the 1920s, 30s and 60s. Advances in technology have paved the way for conservation as well as eventually leading to increase human-wildlife conflict. In the 1920s, the invention of the car made it possible to easily access national parks and thus increased attention to nature and wildlife, consequently also increasing demand for outdoor activities (Kellert, 1985b; Kellert & Westervelt, 1983). However, unsustainable use of resources grew in the 1930s, and while the 1960s experienced increased public concern for the environment and environmental issues, the two world wars largely changed focus away from environmental concerns (Kellert, 1985b; Kellert & Westervelt, 1983). Particularly during World War 2, "very pronounced urban/rural differences were observed" (Kellert & Westervelt, 1983, p.139) for the utilitarian and humanistic attitude types, also indicating distinction of attitudes correlated with geographic location. Moreover, as Kellert &

Westervelt (1983) denote, “the greater frequency of the utilitarian attitude during the [20th] century indicates that a pragmatic relationship to animals remains a dominant perspective in American life” (p.145), keeping in line with the popular Western view that humans feel the right to control animals. However, Manfredo, Teel & Henry (2009) suggest that there has been a shift from “domination” towards “mutualism”, consistent with post-materialist thinking, though there is currently no direct assessment of this change (George et al., 2016). This can be considered as progress towards positive human-wildlife interactions and coexistence.

Kellert & Westervelt’s (1983) early research suggests that attitudes towards animals depended on many factors, including socio-economic context, location and education. Over time (between 1900 and 1976), the authors (1983) found that there was an increase in the described aesthetic and humanistic attitudes found in urban newspapers that could have led to a more “appreciative and emotional perspective toward animals among city residents” (p.145), as well as an increase in the described ecologicistic attitude which led to higher protectionist views towards animals from the urban residents. While Kellert & Westervelt (1983) have said that utilitarian views towards animals were prominent in North America in the 20th century, they also observed that, “on the other hand, the substantial declines in this [utilitarian] attitude, particularly in the urban areas, suggests a decrease in materialistic orientations to animals” (p.145). Moreover, “although the utilitarian attitude remained dominant in the rural areas, a marked decline in the negativistic and substantial increase in the neutralistic attitudes implies a more positive view toward animals among rural residents” (Kellert & Westervelt, 1983, p.145). This shows a divide in attitudes between urban and suburban thinking and a change between how people view animals based on location.

However, the authors also described that while positive changes in perspectives towards wildlife in American urban and rural areas were happening, that often emphasis was placed on local animals and native wildlife, disregarding larger wildlife issues such as endangered species. The authors (1983) also expressed many challenges with shaping people's attitudes towards wildlife, for example with the difficulty of visually expressing consequences of habitat loss or the collapse of visually unappealing species, or with the fall in interest with wildlife issues when in a period of economic decline. Therefore, during the period of 1900-1976, it can be said that in the United States, there were some advancements towards positive changes in attitudes towards wildlife and greater consideration for wildlife occurred, though some of these were minor and while potential for progress was observed, there were still many challenges expressed. It is also worth noting that in study by Kellert (1984) evaluating more recent (1980s) attitudes towards wildlife through interviews, it was found that

The humanistic perspective was by far the most frequently encountered attitude toward animals among urban residents. This strong emotional orientation to the natural environment and individual animals contrasts with the additionally frequent occurrence of the negativistic attitude, suggesting basic variations in affective and emotional feelings among urban residents toward nature and animals. (p.213)

This is an important finding to point out as it shows a positive change to attitudes towards wildlife and challenges the idea that urban residents have more utilitarian views, which was true for earlier periods. However, it was also found that while this rise in compassion for wildlife in urban areas occurred, rural residents were generally more comfortable with methods of wildlife exploitation that can now be perceived as cruel (Kellert, 1985a). It was also found that

educational levels towards wildlife differed greatly between urban and suburban areas (Kellert, 1984), suggesting proximity to green spaces and higher contact with wildlife led to higher knowledge of these animals. To compare with a Canadian setting also in the same period, a pilot study by Gilbert (1982) assessed attitudes towards urban wildlife in Guelph, Ontario. The results of the study indicated that those living in closer proximity to wildlife were more involved in feeding programs and were more aware of wildlife and conservation issues than those with less access to natural spaces (Gilbert, 1982). Though participants generally did not understand the ability of a habitat to sustain wildlife nor were able to name many specific wildlife species, they could overall recognize and were aware of their existence (Gilbert, 1982). Overall, this early research demonstrates key findings that can still be applied today, such as the idea that there are divides between urban and rural thinking and that living closer to green spaces leads to higher knowledge of and care for wildlife.

Also, to exemplify how many factors influence attitudes with a more recent study, Røskoft, Händel, Bjerke & Kaltenborn (2007) have researched attitudes towards large carnivores in Norway (wolverines, brown bears, lynx and wolves). The authors found that negative attitudes were correlated with age, education level and personal concern for safety, though have reported positive responses with the idea that these carnivores had a right to exist. This proposes that while people believe wildlife (in particular large carnivores) have a right to be and occupy space, that they would preferably be far away from humans and in small populations, as supported by the findings of the study (Røskoft, 2007).

2.5.3. Attitudes Vary by Species

To contrast, George et al.'s (2016) study, which can be seen as a continuation of Kellert & Westervelt's 1983 study, observed changes in attitudes towards wildlife between 1978 and 2014. The authors (2016) reported a positive change in attitudes towards specific species in the United States since Kellert & Westervelt's 1983 study, being possibly attributed to an increase in the concern for wild and domestic animals. While general attitudes towards wildlife were mostly unchanged since the previous study, attitudes towards six particular animals (the wolf, coyote, bat, rat, vulture and shark) were reported to be much more positive (George et al., 2016). This is an important finding as the species themselves were considered "historically stigmatized" (p.237), often seen as unwanted or threatening species, which demonstrates that change in dominant attitudes and stigmas is possible through time as well as helping to understand how this change is possible (for example through education). This relates back to my research as some of the species considered in the TWC data are viewed more negatively (see Figure 13) and may also be stigmatized due to various reasons (such as aesthetic value, disease transmission potential or general fear of species).

Several studies have been conducted to understand the relationship between animals and human attitudes, most within specific geographic locations and evaluating selected species. An earlier paper on wildlife attitudes by Hadidian (1991) explored attitudes of Americans towards wildlife in urbanizing landscapes. A notable section of the author's paper (1991) is the identification of "problem species" in North America. These included grey squirrels (though also well-liked by many), the striped skunk, raccoons, rabbits, pigeons and other nuisance birds, as

well as the white-tailed deer which is identified as a species causing growing concern in urban areas. This identification is interesting to note and compare with my findings of generally disliked species (see Figure 13).

Kellert (1985a) had also researched attitudes towards specific species. Though the findings are now dated, they emphasize a snapshot of views towards animals in North America for the 1980s, which can be paralleled with more recent findings as well as my own. Kellert's (1985a) findings demonstrate that out of 33 selected species, the top disliked animals were the cockroach, mosquito, wasp and rattlesnake, with urban species including the skunk, coyote, bat, rat and wolf also least liked. On the other hand, the dog, horse, robin, swan and butterfly were most liked respectively. Overall, the most to least preferred animals were domestic animals, attractive animals, game animals, birds, mammals, amphibians, reptiles and fish, predators, animals known to cause human property damage, invertebrates, animals known to inflict human injury, unattractive animals and biting and stings invertebrates respectively. Kellert (1985a) explained several factors that influence whether a specific animal was liked or disliked, namely:

size (usually, the larger the animal, the more preferred), aesthetics, intelligence (not only capacity for reason but also for feeling and emotion), dangerous to humans, likelihood of inflicting property damage, predatory tendencies, phylogenetic relatedness to humans, cultural and historical relationship, relationship to human society: pet, domestic farm, game, pest, native wildlife, exotic wildlife, texture (generally, the more unfamiliar to humans, the less preferred), mode of locomotion (generally, the more unfamiliar to humans, the less preferred) and economic value of the species. (p.191)

This demonstrates that many factors influence us to like or dislike certain species or particular animals, and will be interesting to compare with my own findings and assess whether these factors apply to my data.

2.5.4. More Case Studies

Many attitudinal studies on wildlife were conducted in remote areas in other countries; these are considered to contextualize my research with the understanding that findings will not necessarily correspond to my own. For example, Mohamad (2011) looked at different neighbourhoods' attitudes towards wildlife in Malaysia where urban parks are created to preserve species that have been affected by the conversion of lowland tropical forests to urban landscapes (i.e. due to urbanization). The research concluded that residents had mostly positive attitudes towards wildlife and naturalistic parts of their environments, varying by certain demographics, though that there was some bias against certain species that were considered harmful or a nuisance (Mohamad, 2011). This is interesting to parallel with my research as it shows that both attitudes towards wildlife vary by region and that they are based on the types of encounters people have with wildlife (with some species being favoured more than others). This favourability is anticipated to be geographically significant and thus varying by region, with favoured species in one region being different than another due to differences in the types of human-wildlife encounters, social context and regional values and biases. Tessema, Lilieholm, Ashenafi & Leader-Williams (2010) also researched community attitudes towards wildlife conservation in Ethiopia and found that residents held largely positive attitudes towards wildlife and protected areas, who described the benefits of wildlife and believed in human-wildlife coexistence, though

one community expressed negative views due to tensions with park authorities and regulations. Similarly, Mir, Noor, Habib & Veeraswami (2015) conducted a study in the Kashmir Valley, India on people's attitudes towards wildlife and believed that positive attitudes are correlated with success in conservation methods. Interestingly, their study was based on the extent of the people's loss due to wildlife, such as crop loss. These studies on other countries' remote populations can shed light on the differences in attitudes and struggles held by residents based on conservation and human-wildlife conflict, which can contrast my results on the case study of Toronto's urban wildlife.

Chapter 3. METHODS

3.1. TWC Hotline Procedures

Hotline staff at TWC are trained utilizing the same methods and reference material, such as the manual "Answering the call of the wild: A hot-line operator's guide to helping people and wildlife" (Luther, 2014) which addresses hotline topics such as conflict situations, methods of wildlife capture, and public health and safety, and includes an extensive guide on wild animal identification. When answering calls, TWC hotline staff use appearance descriptors, such as markings and relative size, as well as photos and videos to identify species from a call when in doubt. Staff don't assume the callers always correctly identify species, especially when the animal in question is more difficult to identify/differentiate, therefore ask questions to ensure all animals are identified appropriately.

3.2. Categorizing Attitudes

From the TWC call data, I analysed transcripts through the value-attitude-behaviour model (see section 2.1.1) to interpret attitudes from the callers towards urban wildlife in Toronto. This was done by interpreting the attitude based on behaviour (i.e. language used). The calls to TWC were made primarily for insight on certain animals (the subject) and not the caller themselves, therefore my methodology is based on indirect measurements of assessing attitudes. To categorize attitudes, I utilize attitude typologies based on Kellert (1985a), who described ten attitudes towards wildlife and nature. These have been and continue to be utilized (e.g., Boissonneault, 2011; George et al, 2016; Narli, Yorek, Sahin & Usak, 2010; Rauwald & Moore, 2002; Van Dyke, 2008) and include (among others) the following attitude descriptors:

- Naturalistic - Primary interest in and affection for wildlife and the outdoors.
- Negativistic - Primary orientation an active avoidance of animals due to dislike or fear.
- Neutralistic - Primary orientation a passive avoidance of animals due to indifference and lack of interest.

I utilize only the naturalistic, negativistic, and neutralistic attitude descriptors. However, the neutralistic descriptor is modified for callers demonstrating neither affection for nor dislike of wildlife, as it can be argued that the act of calling TWC in the first place could demonstrate an interest in (or fear of) wildlife. The other descriptors in Kellert (1985a) are omitted due to the difficulty in identifying these attitudes based on the context of the calls and the lack of in-depth information on the caller's values (which are typically deducible from interviews). The modified attitude typologies are as follows:

- Naturalistic - Primary interest in and affection for wildlife strongly demonstrated.

- Negativistic - Primary orientation an active avoidance of animals due to dislike or fear.
- Neutralistic - Neither affection for nor dislike of wildlife displayed, primary orientation unknown.

3.3. Data Analysis

3.3.1. Preliminary Filtering and Grouping of Data

I have filtered the data by 'reason' to include only the following: orphaned animal, sick/ injured animal, nuisance situation, (animal) cruelty, dead animal, animal sighting, how is animal, trapped animal, displaced animal, nesting animal/bird, animal(s) in distress, raised animal, rehabilitation, rescue needed, raised, transfer and kidnapped. For consistency purposes, I follow the terminology of TWC and of the excel spreadsheets throughout this paper, meaning I refer to calls as they are identified by TWC (i.e. "how is animal" calls indicating animal welfare with a caller inquiring about a specific animal's well-being, though are referred consistently as "how is animal" calls). When a caller leaves more than one message, the subsequent calls reference the original call using the unique hotline identification number. Thus, I have excluded repeat calls, follow ups and any other linked call by filtering calls that refer to another hotline identification number, as well as removed information offered, status of animal and rescue status calls as these do not reflect new situations and could lead to doubling of data (for example, two calls made about the same animal by the same person should be counted as one entry as to avoid skewing results and counting the same animal twice). I have, however, left any unlinked "how is animal" call, for reasons mentioned under the constraints section. I have also limited my data to include calls made only by members of the public, therefore excluding other caller types such as donor,

volunteer, police, business, veterinarian, humane society, ministry, wildlife service, media etc. to solidify my findings to the main research interest of this paper, which is in part to understand public attitudes towards wildlife. Other caller types may be affiliated with Toronto Wildlife Centre and do not represent an unbiased sample of the Toronto and GTA public.

All domestic animal calls have also been excluded, as they do not reflect wildlife, as well as calls with species labeled as 'not animal'. Finally, I filtered any hang ups of blank voicemails. After filtering my data, I was left with 86,102 data entries on excel. Some of the fields in the data base were blank. It was assumed that blanks under 'caller type' was a member of the public as this is the default category for TWC unless otherwise noted. Blanks under call transcripts were omitted (usually signaling hang ups). Where entries were left blank under species name, I have indicated the entry as unknown species. I have only filtered the intake data on the separate intake spreadsheet to exclude domestic animals.

384 unique species were identified in the spreadsheets. However, some entries were identifying the same species but were written differently, and some were very specific (such as with birds) and for the purposes of this paper I did not require such precision. I have thus grouped these to avoid doubling the same species and to simplify my data, especially for visualization. Generally, all species of the same order were identified together (for example, the snapping turtle and Blanding's turtle both identified under 'turtle') and birds were grouped by order as guided by Strauss (2017) and The Cornell Lab of Ornithology (n.d.) (note that Accipitriformes have been included in the bird of prey category along with Falconiformes). I have, however, given more distinction between mammal species (for example, have avoided

grouping all carnivores together). Once all species were grouped, I was left with 55 species categories:

Table 1 – Categories for species identified in TWC data

Species Group		
Arachnid	Gamebird	Pigeon/Dove
Bat	Grebe	Rabbit
Bear	Heron/Stork	Raccoon (<i>Procyon lotor</i>)
Bird - Unknown	Hummingbird/Swift	Reptile/Amphibian - Unknown
Bird of Prey	Insect	Rodent - Other
Bobcat (<i>Lynx rufus</i>)	Kingfisher	Salamander
Canid - Unknown	Lizard	Shorebird
Chipmunk, Eastern (<i>Tamias striatus</i>)	Loon	Shrew/Mole/Hedgehog
Cougar (<i>Puma concolor</i>)	Mammal - Unknown	Skunk, Striped (<i>Mephitis mephitis</i>)
Coyote (<i>Canis latrans</i>)	Mink	Snake
Crane/Coot/Rail	Moose (<i>Alces alces</i>)	Squirrel
Crustacean	Mouse/Rat/Vole	Turtle
Cuckoo/Turaco	Multiple Species	Unknown
Deer, White-tailed (<i>Odocoileus virginianus</i>)	Nightjar/Frogmouth	Waterfowl
Egg(s)	Opossum, Virginia (<i>Didelphis virginiana</i>)	Weasel
Fish	Otter	Wolf
Fisher (<i>Pekania pennant</i>)	Owl	Woodpecker/Toucan
Fox, Red (<i>Vulpes vulpes</i>)	Pelican/Cormorant	

Frog/Toad	Perching Bird	
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Note that the above Latin names are provided for reference only, as the TWC use common names. Moreover, for the creation of pie charts, any pie section being 2% or less was grouped as “other” to simplify the charts visually. Excel functions utilized for quantitative analysis can be found in the appendix.

3.3.2. Qualitative Analysis

A qualitative analysis of the TWC data in terms of the species that were encountered and described was required to understand attitudes. Once the data was filtered, based on section 3.3.1, I randomly selected several calls to look into further detail, which was done utilizing a random number generator. I examined the transcripts as well as circumstance notes to gain an idea of what the calls were like, as a time constraints did not permit me to look at each call individually. I was thus able to identify the key words, phrases or concepts that surfaced the most to identify both common threats and attitude descriptors. Once key words and concepts were identified, I moved on to looking at the data from a wider angle and focused on retrieving information from the large dataset through groupings of calls.

3.3.3. Location Analysis

Location analysis was conducted using ArcGIS, based on anonymized street intersection data.

3.4. Correlation Analysis

Ultimately, I am looking for trending and correlations with other variables. I thus identify the species to see if there is a relationship with caller attitudes towards specific animals. I also identify the reason for the call or type of threat (e.g. nuisance animal vs injured animal), and where possible the geographic location, essentially looking for correlations between attitude and species, species and threat type, species and location and threat and location, as well as changes through time. For this, I produced maps using GIS detailing threat locations to find possible overlap with species, utilizing intake data.

Chapter 4. RESULTS: ATTITUDES AND THREATS TO WILDLIFE IN TORONTO

The filtered data includes 86,102 data entries with 55 designated species groups. Below are charts evaluating the entirety of the filtered data set, visualised by sorting the information in different categories. As seen by Figure 1, the number of calls received through time was quite consistent for the hotline data, while admittances were also consistent for the intake data though they could be said to have increased slightly over the years (this considering the time frame and missing months/years, a constraint detailed in the appendix).

4.1. Reasons for Calling TWC

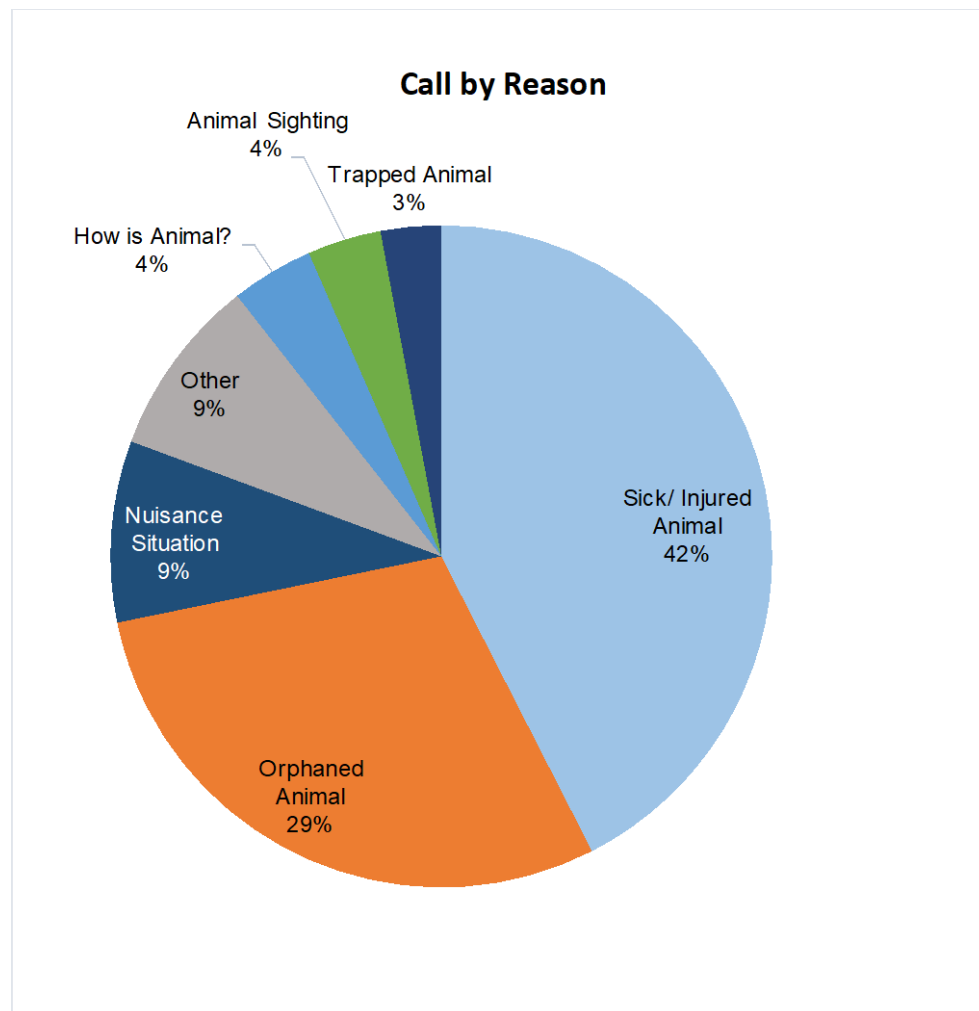


Figure 4 – Calls made to TWC between 2001-2013 displayed by the reason for the call

Figure 4 specifically indicates that the Toronto public are largely concerned with sick, injured and baby animals, totaling 71% of calls, and overall display a positive attitude towards wildlife as concern for the animal(s) is showed when a call is made to the centre regarding such a situation. However, with the third largest reason for calling TWC being nuisance at 9%, there is also a small but significant number of the Toronto public displaying negative attitudes towards wildlife. Since nuisance calls do not signify animals in danger, rather indicate members of the

public being annoyed/scared by wildlife, it can be said that these calls inherently demonstrate negative attitudes towards wildlife (also discussed in section 4.5.4). It can also be noted that while many are concerned with the safety and well-being of animals in Toronto, the fact that the “how is animal” category totals 4% means most are not concerned about such animals past the admittance stage (compared to a total of 23% of calls resulting in admittance, as seen in Figure 5).

4.2. Action Taken Following Calls

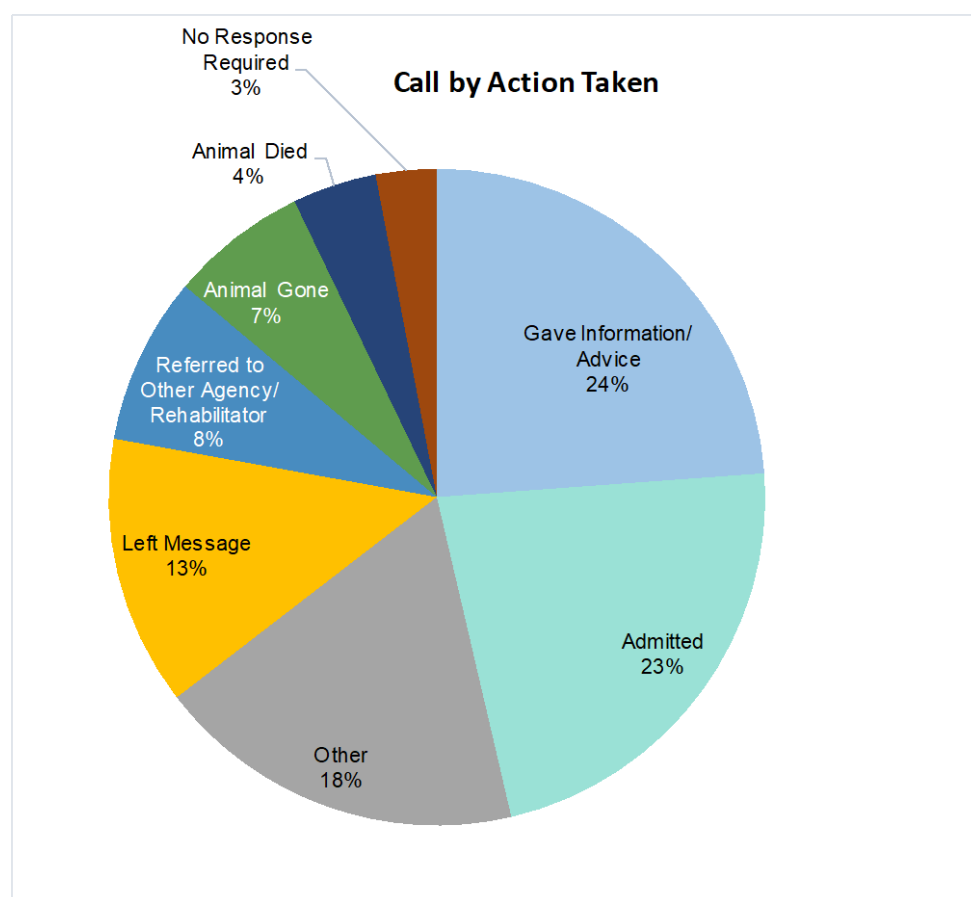


Figure 5 – Calls made to TWC between 2001-2013 displayed by the resulting action of the call

As seen from Figure 5, most calls ended with the hotline staff giving information or advice to the caller. This indicates that many calls were made from people who were unsure about an animal situation, though were not educated well enough to understand if the situation was normal or if external help was required. From experience in the hotline department, a common occurrence is when a person calls about a presumably orphaned animal, when in reality the animal is not orphaned and simply waiting for its mother to return (e.g. with fawns). This indirectly indicates that a large portion of people care about presumably sick, injured or orphaned wildlife when there was no need to admit the animal. However, nuisance situations also fall in this category, as many call TWC when an animal is inconveniencing them resulting in the hotline staff giving information to the caller and no admittance of the animal is required. Thus, the 'gave information/advice' section denotes a mix of situations reflecting a wide range of caller views. The following category however, which is admittance calls, follows closely behind and suggests callers did the correct thing by calling TWC hotline as the animal was admitted for rehabilitation, indicating it was either sick, injured, orphaned or in a similar predicament. It is presumed that the majority of these calls were made of worry for the animal, or a feeling of duty to intervene.

4.3. Admitted Species To TWC

Out of all filtered calls made to TWC, only 23% were admitted to the centre. Overall however, there was a total of 46,607 animals admitted to TWC between 2001-2013.

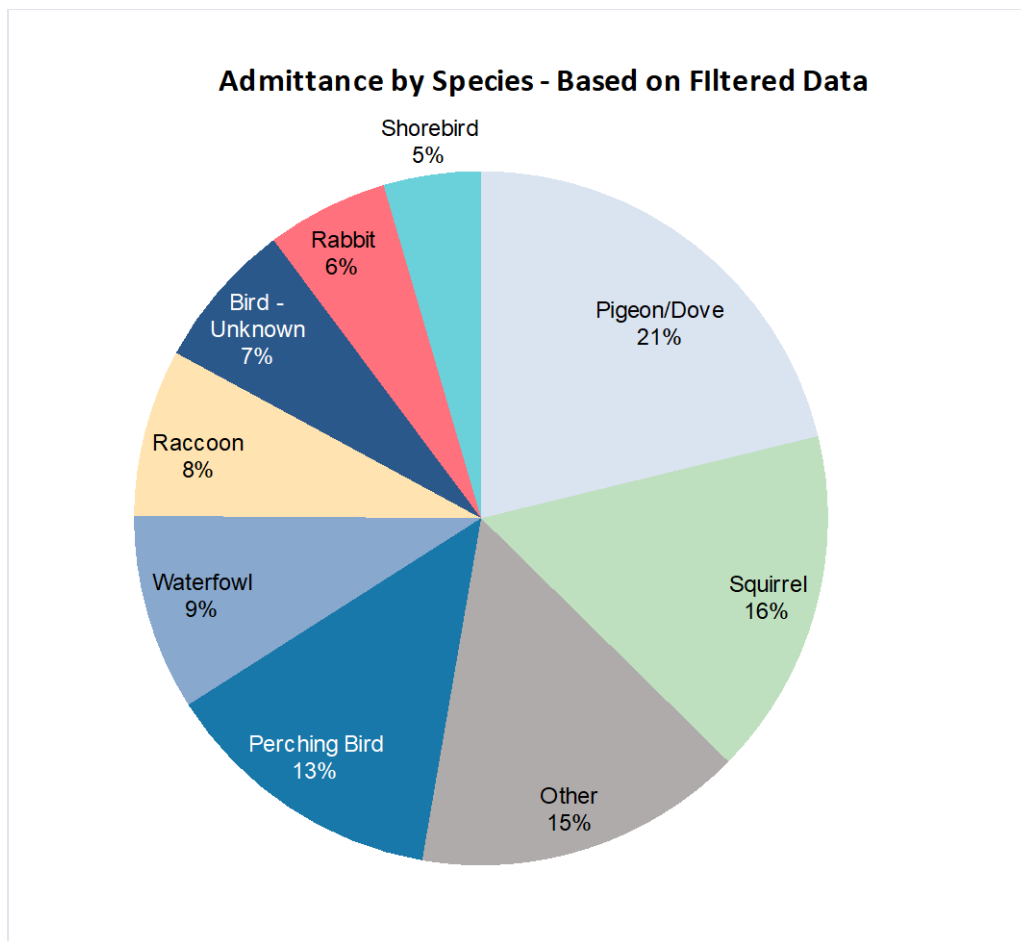


Figure 6 – Admittance of animals at TWC between 2001-2013 shown by species group, based on filtered hotline calls with result being ‘admitted’

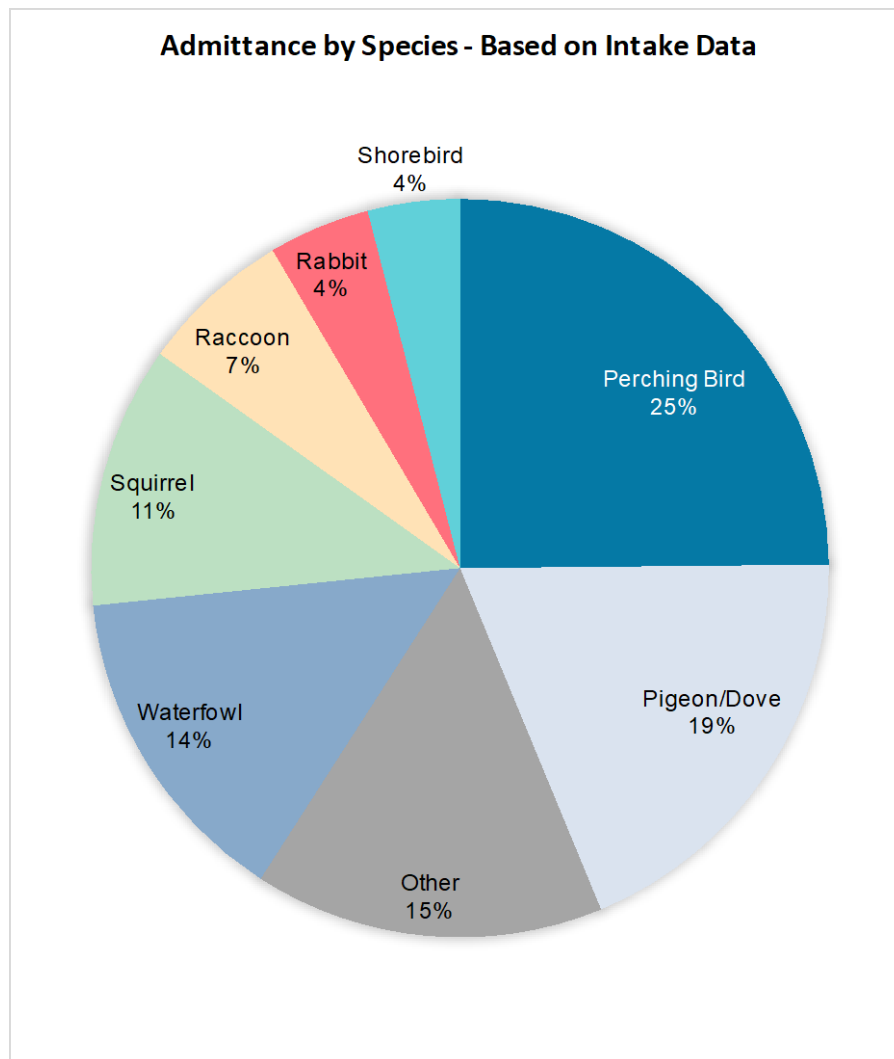


Figure 7 – Admittance of animals at TWC between 2001-2013 shown by species group, based on intake data

Admittance is based on a few criteria, including whether the animal is a candidate for rehabilitation at TWC (based on the nature of the situation and animal itself) as well as whether the centre can accept the species (based on capacity and resources).

4.4. Threats to Wildlife: Anthropogenically Derived

While Figure 4 demonstrates the reason for calls to TWC and gives an overall idea of the predicament of the animal in question (e.g. sick/injured, orphaned), it does not give much more detail to the specific situation, or how the situation arose. Indeed a variety of threats face the wildlife of Toronto, with TWC noting that:

Almost every animal brought in to Toronto Wildlife Centre has become sick, injured or orphaned due to some sort of human related activity. The most common reasons include: attacks by cats, hit by cars, collisions with windows, destruction of habitat, attacks by dogs, and becoming orphaned. (“FAQ”, n.d.)

The fact that most impacts on wildlife are anthropogenically derived is not surprising, based on the earlier discussion of urbanization and encroachment on wildlife habitats, as well as how humans impact wildlife in general. To understand the threats to TWC from analyzing TWC data between 2001-2013, I looked at admitted animals as more detail and accuracy is recorded for these. I also read the circumstantial notes on many entries, and most commonly, situations consisted of an animal found with injuries or looking ill with no obvious sign as to what caused it. Figure 8 below demonstrates the most common reason for all admitted animals between 2001-2013, based on all wildlife intake data.

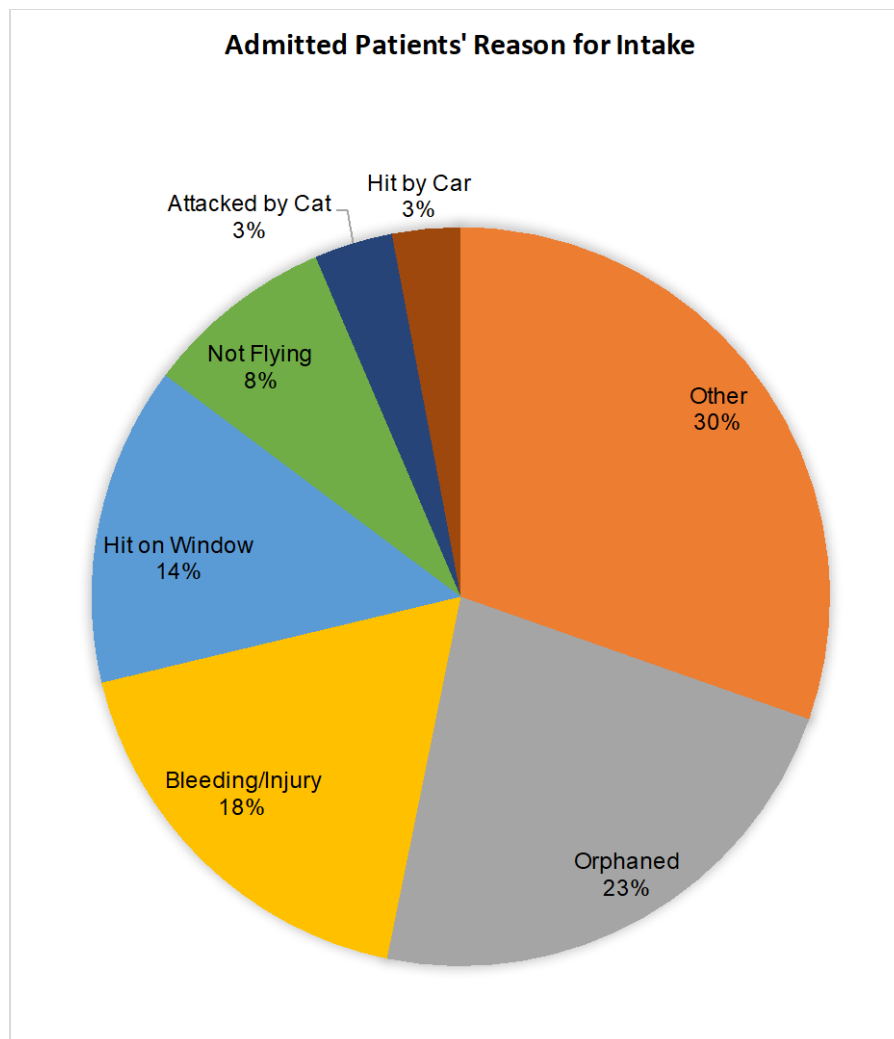


Figure 8 – Admitted patients' reason for intake, based on all wildlife intakes

4.5. Qualitative Analysis of Transcripts

4.5.1. Key Words

The following are analyses of data points under the most popular reasons for calling TWC as seen by Figure 4. Based on the qualitative analysis of several calls for these top reasons for calling TWC, I identify words and phrases that have occurred in the transcripts and signify

positive or negative attitudes. Table 2 indicates which words are positive, neutral and negative and Figure 9 shows the occurrences of these phrases among each category.

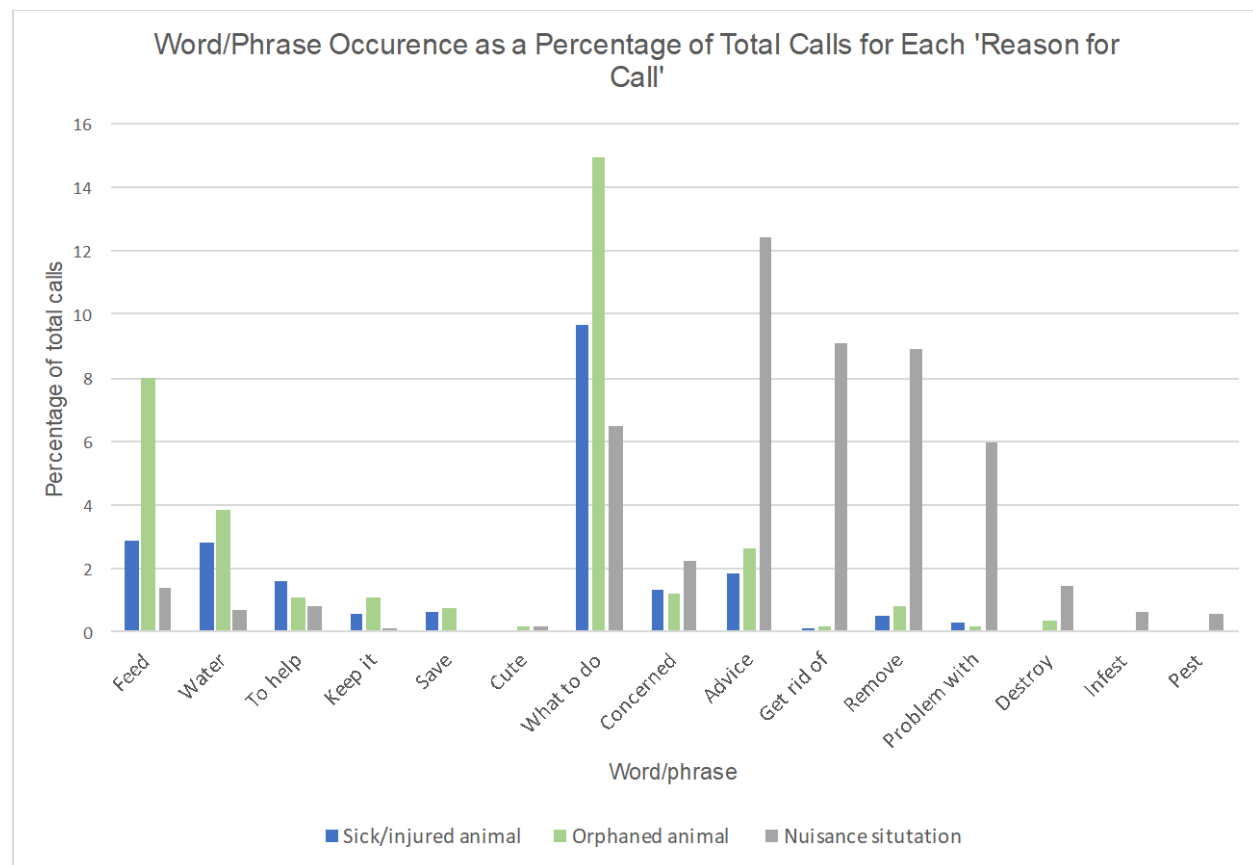


Figure 9 – Word/phrase occurrence as a percentage of total calls for each 'reason for call'

Table 2 – Identified key words/phrases and their corresponding category

	Word/Phrase
Positive	Feed Water To help Keep it Save Cute
Neutral	What to do Concerned Advice
Negative	Get rid of Remove Problem with Destroy Infest Pest

Some of the key words identified relate to an action a caller has taken, such as watering or feeding an animal, and thus demonstrate a positive or negative attitude towards that animal.

Figure 9 shows that positive words and actions are mainly associated with sick/injured and orphaned animals, negative words and actions are overwhelmingly associated with nuisance situations and neutral words/actions give a mix of results.

4.5.2. “Sick/Injured Animal” Calls as Neutralistic

Common phrases/themes encountered in the detailed analysis of “sick/injured animal” call transcripts include:

- Simple explanation of the situation (i.e. found an injured bird) (extremely common theme)

- Looking for help (“not sure what to do”, “need advice”) (very common)
- Callers seeming to have followed instructions from website/recording (common)
- Callers who have kept a wild animal trying to rehabilitate it on their own but can no longer (not very common)
- Anxious/willing to drop off animal (not very common)

From the above, it can be deduced that the “sick/injured animal” calls reflect a majorly neutralistic attitude. This is also due to the lack of overly emotional language (either positive or negative) and because most calls analysed were simply an explanation of the situation with no indication of the caller’s attitudes.

4.5.3. “Orphaned Animal” Calls as Neutralistic

Common phrases/themes encountered in the detailed analysis of “orphaned animal” call transcripts include:

- Simple explanation of the situation (i.e. found a baby bird) (extremely common theme)
- Looking for help (“I am concerned”, “what should I do to help?”) (extremely common)
- Willing to feed (i.e. “what to feed it?”/already tried to feed animal) (very common)
- Callers seeming to have followed instructions from website/recording (common)
- Caller wanting to keep animal as a pet (not very common)
- Callers who have kept a wild animal trying to rehabilitate it on their own but can no longer (not very common)

These calls were similar to “sick/injured animal” calls, though in many more instances the caller suggested a desire to feed the baby animal (or had already fed them). However, personal attitudes towards wildlife were not often shown, as most often the callers simply described the situation. For these reasons, the overall attitude descriptor for orphaned animal calls is categorized as neutralistic.

4.5.4. “Nuisance” Situation Calls as Negativistic

Common phrases/themes encountered in the detailed analysis of “nuisance” animal call transcripts include:

- “How can I remove/get rid of _?”, “how to get _ out?” (extremely common theme)
- “I have an issue/problem with”, (extremely common)
- “What to do”, “need advice” (common)
- Simple explanation of the situation (i.e. we have squirrels in our attic) (slightly common)
- Concerns for property (i.e. “_ is damaging property”) (slightly common)
- Upset about wild animal injuring pets (slightly common)
- Violent and descriptive language: “ready to kill”, “infested with” (not very common)
- Upset over cost of maintenance due to damage from wild animals (not very common)

The calls in this section were overall much more descriptive and indicated well the callers’ attitudes due to the language used and themes expressed. For example, most calls that were

inspected were referring to the idea of removal of wildlife and the caller expressed they had “issues”/ “problems” with certain animals, often using negative and even explicit language towards the wildlife/wildlife situation. This thus indicates “nuisance” calls represent largely negativistic attitudes from the callers, which is also intuitive of the category itself (“nuisance” calls being categorized as such and are thus inherently negative).

4.5.5. “How Is Animal” Calls as Naturalistic

Common phrases/themes encountered in the detailed analysis of “how is animal” call transcripts include:

- Caller asking about animal (“how is _ doing?”, “is _ okay?”) (extremely common theme, evidently)
- Caller wanting to know more information on animal admitted (what happened to it, nature of injuries etc.) (common)
- Descriptive language such as “cute” (slightly common)

This category of calls was different to assess as the transcript of many calls only consist of the ID number of the wild patient. “How is animal” calls also differ as the purpose of these calls is to inquire on the well-being of an animal. They all indicate follow-ups on the wild patients.

Moreover, the calls are categorized easily as “how is animal” either because the caller indicated this themselves and sorted the call into the appropriate mailbox, or by the fact that the caller is inquiring about an already-admitted animal. Thus, follow-up calls demonstrate overwhelmingly a naturalistic perspective.

4.6. Naturalistic and Negativistic Attitudes Towards Species in Toronto

Below, I show the four most popular ‘reason’ calls to identify species and visualize with charts. “Nuisance” calls are identified as holding negativistic attitudes towards wildlife, while “how is animal” calls are identified as holding naturalistic attitudes towards wildlife, which is also consistent with Kellert’s (1985a) typologies and associated behaviours. The specific attitude typologies associated with each reason for call below is also supported by the analysis in section 4.5. Overall, this information is interesting to consider when compared with the other pie graphs denoting reasons for calls, (see section 4.9).

4.6.1. All Calls Species

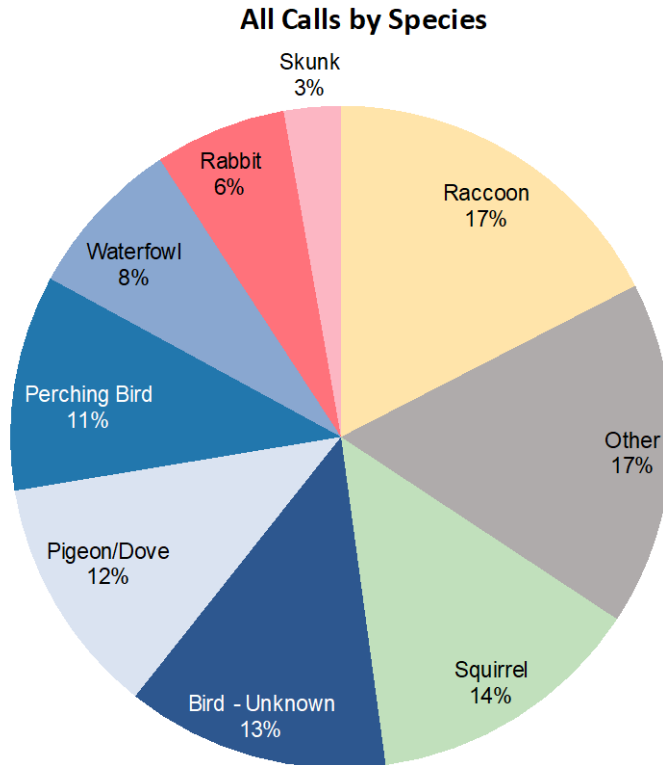


Figure 10 – All filtered calls made to TWC between 2001-2013 displayed by species group

Figure 10 shows that while the most popular species to be the subject of a call is the raccoon, followed by squirrels, overall, birds in general make up the majority of calls when grouped. This chart however does not reflect the reason for call, therefore deducing attitudes is not feasible. Rather, this chart gives a picture of the most popular species to be the subject of calls and can be useful to compare to the following charts, with the comparison analysis found in section 4.9.

4.6.2. “Sick/Injured Animal” Species (Naturalistic Attitude)

The most popular reason for calling TWC between 2001-2013 was to report sick or injured animals. These included 36,573 calls (around 42% of total filtered calls). These calls broadly portray a naturalistic attitude as many transcripts demonstrate a neutral stance towards wildlife (see section 4.5.3). Although the action of calling TWC can be interpreted as a sign of either empathy or duty to help and thus broadly indicating a naturalistic attitude, based on methods (section 3.2) this fact is omitted. Below is a pie chart visualizing the filtered “sick/injured animal” data, that correlates this type of call with the subject species (grouped based on section 3.3.1).

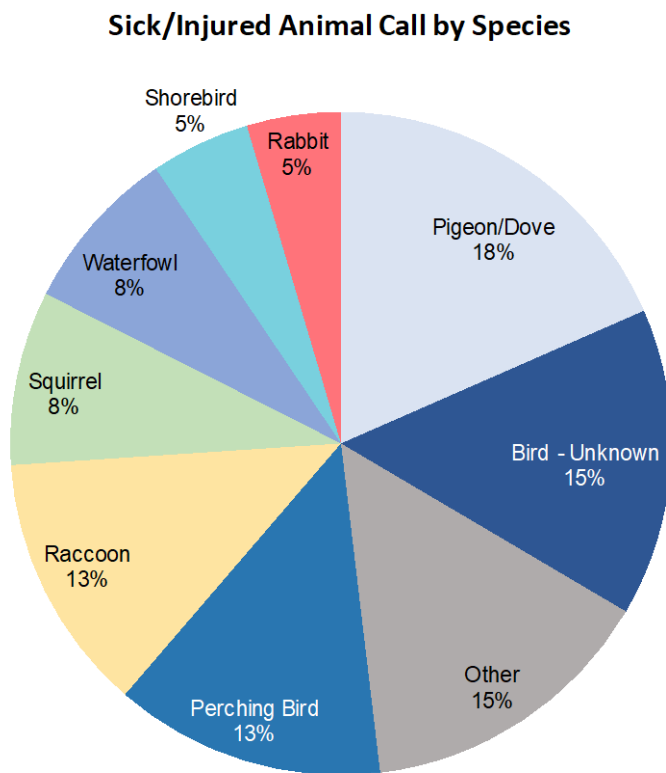


Figure 11 – “Sick/injured animal” calls made to TWC between 2001-2013 displayed by species group

This pie chart indicates that most species reported as sick/injured animals are birds, followed by raccoons and squirrels. Overall, birds being the most popular species for sick/injured animal could be explained by the fact that they are target for window strikes and cat attacks, often injuring themselves easily in a big city like Toronto where there are many tall buildings (and especially with migratory birds as they travel south) (“Hierarchy of Threats”, n.d.).

4.6.3. “Orphaned Animal” Species (Neutralistic Attitude)

All calls labeled as orphaned calls refer to animals that are babies and were either displaced from their parents or their parents were removed/killed. Below is a pie chart visualizing the filtered “orphaned animal” data, from a total of 25,236 data points (around 29% of total hotline calls), that correlates this type of call with the species in question.

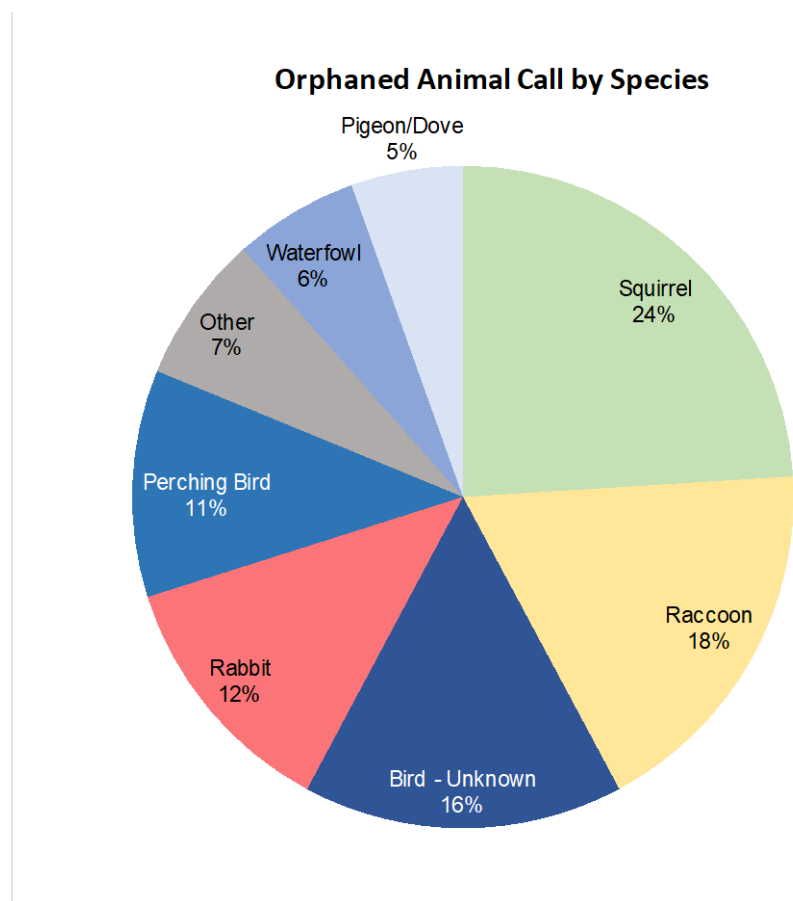


Figure 12 – “Orphaned animal” calls made to TWC between 2001-2013 displayed by species group

As seen by Figure 12, the most popular orphaned species include squirrels followed by raccoons, unknown birds, rabbits, other bird groups and others. While it can be argued that squirrels, raccoons, birds and rabbits are species that the public care about (as they make up most calls), which may be partly true, they may also indicate the number of situations that arise in the GTA. It can be assumed that instances of people passing by orphaned squirrels are much more common than orphaned opossums, which can be explained by either a higher population of squirrels in the GTA than opossums but also by the fact that opossums are nocturnal therefore less likely to be encountered during the day.

4.6.4. “Nuisance” Species (Negativistic Attitude)

To understand which species are largely disliked by the public, I filtered the data to the “nuisance” only calls and calculated which species are involved. When a member of the public calls TWC about an animal who is not injured, orphaned or sick, but rather the motivation for calling is due to an animal proving to be an inconvenience, staff categorize this call as a “nuisance” call. Moreover, when negative language is used it helps to differentiate between a person calling to report an animal sighting and a “nuisance” call. This signifies a negativistic attitude on the part of the caller, as identified in section 4.5.4. Below is a pie chart visualizing the filtered “nuisance” data, from a total of 7,623 data points (around 9% of total hotline calls), that correlates this type of call with the species in question.

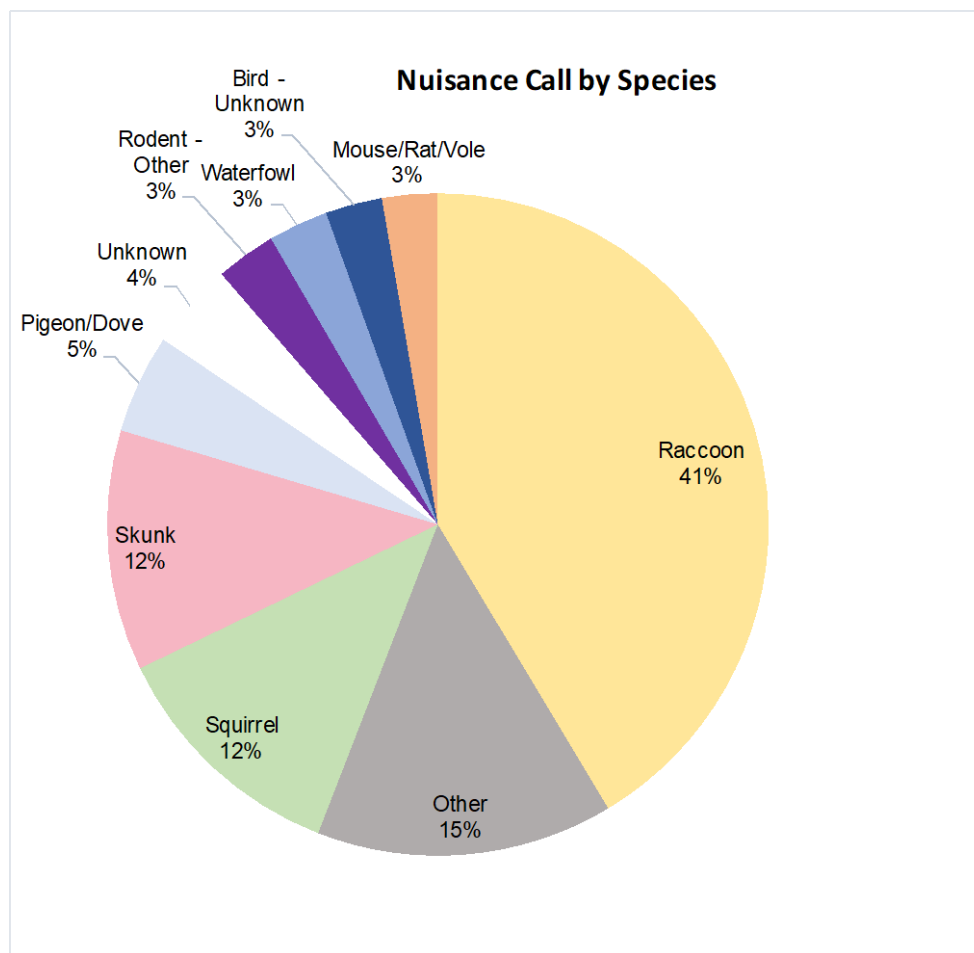


Figure 13 – “Nuisance” calls made to TWC between 2001-2013 displayed by species group

Figure 13 indicates a very high number of raccoon calls, followed by a significant number of squirrel and skunk calls, and further pigeon/dove calls. This is not surprising, as these species can be considered pests or unwanted from the public eye due to reasons discussed in the literature review.

4.6.5. “How Is Animal” Species (Naturalistic Attitude)

“How is animal” calls are labeled when a call is referring to a patient of TWC and the purpose of the call is to inquire about its health/release/general status. This signifies a naturalistic attitude on the part of the caller as previously noted (section 4.5.5). Below is a pie chart visualizing the filtered “how is animal” data, from a total of 3,470 data points (around 4% of total calls), that correlates this type of call with the species in question.

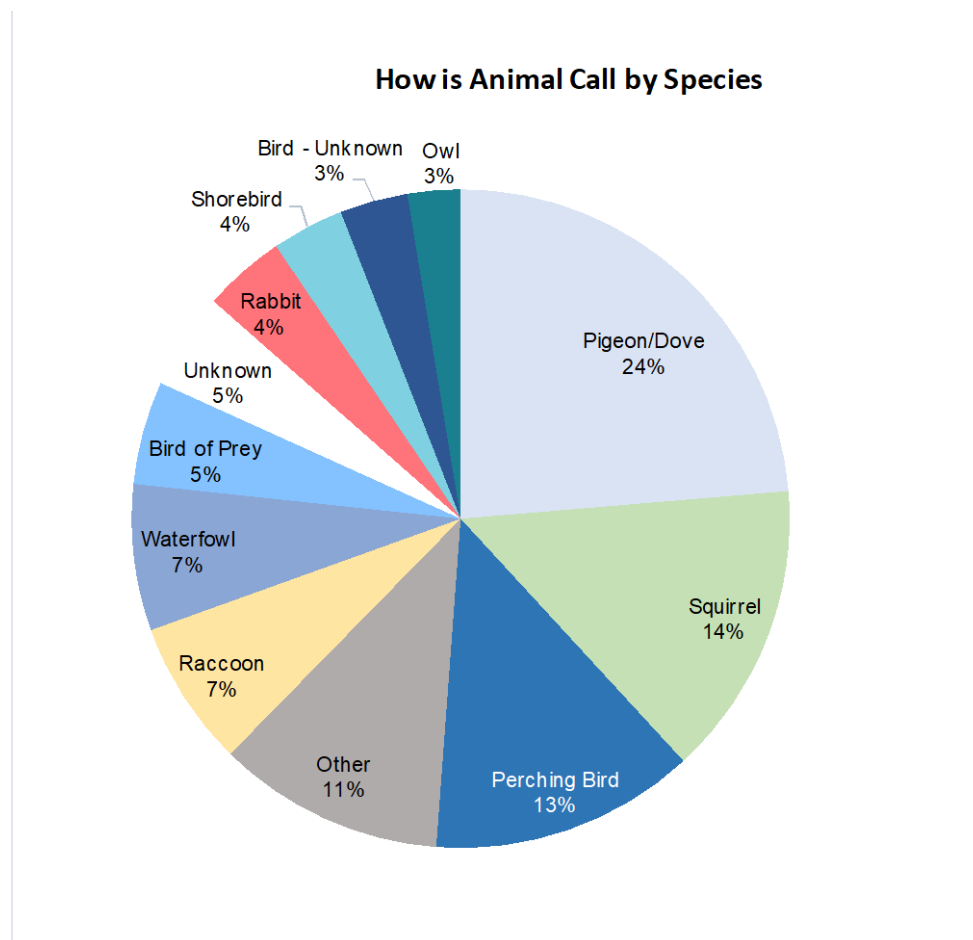


Figure 14 – “How is animal” calls made to TWC between 2001-2013 displayed by species group

Follow ups on certain animals demonstrate a very high naturalistic attitude towards wildlife. These species demonstrate both what species the public are concerned about, while also

and more predominantly reflecting what animals are in care (for example, many more pigeons are admitted to TWC than bats and turtles).

4.7. Most Popular Species and Reason for Call

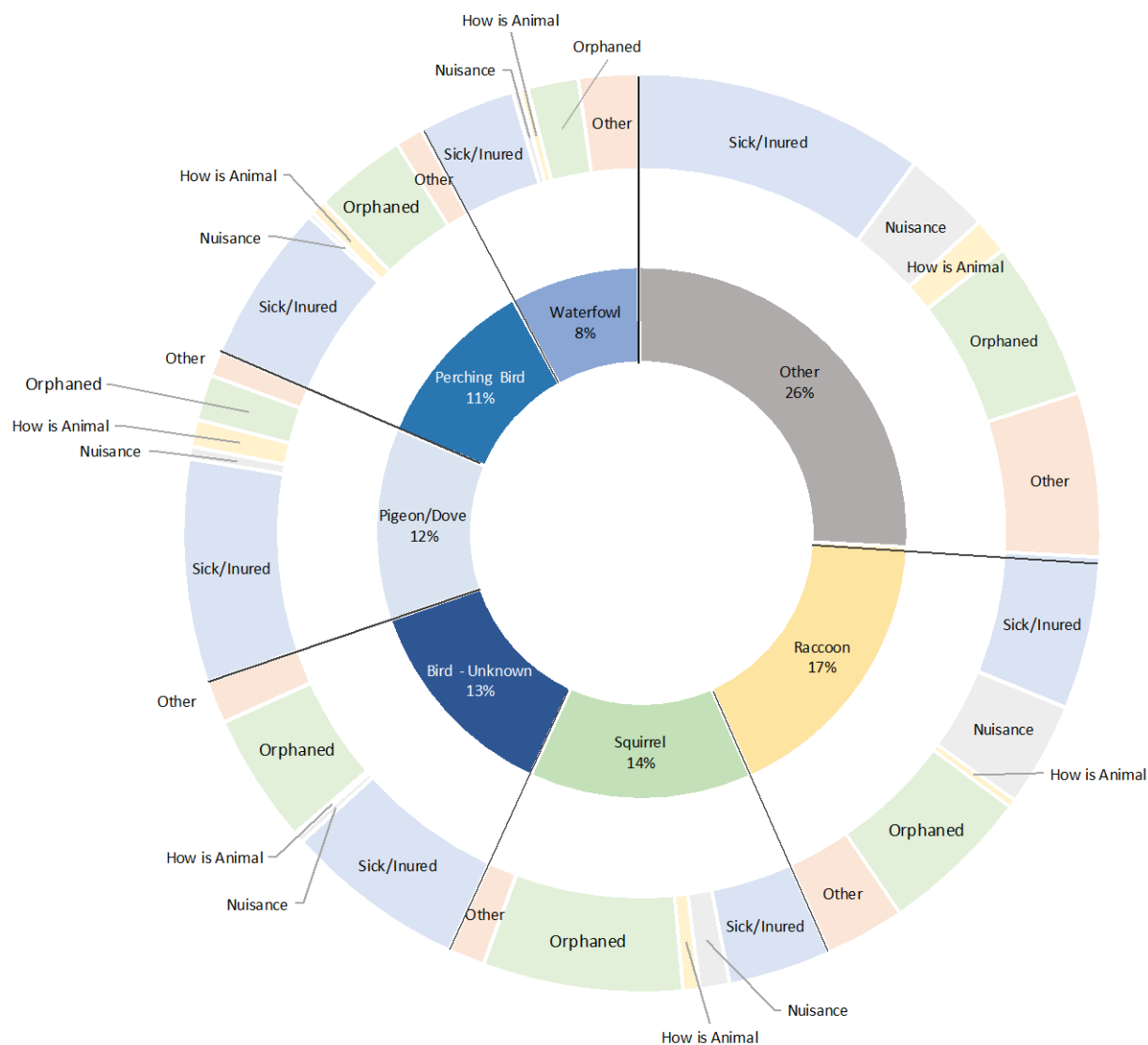


Figure 15 – All filtered calls made to TWC between 2001-2013 displayed by species group with each showing portion of reason for call

Figure 15 is a visualization of all calls by species along with the reason for call for each species. As seen by Figure 15, “sick/injured animal” calls are the most common for almost each category followed by orphaned animal calls, along with skunks showing overwhelming portion of “nuisance” calls (as well as raccoons), squirrels having a large percentage of “orphaned” calls and pigeons/doves interestingly having a large portion of “how is animal” calls.

4.8. Majority of Calls are Urban Exploiter Species

After categorizing species of the filtered 2001-2013 calls into categories, being urban exploiter, adapter, avoider, or unknown, 60% of species were urban exploiters, followed by unknown (due to lack of information) and urban adapter species. The fact that the large majority of species were urban exploiters is not surprising, given the location and nature of TWC. These species are species that are well adapted to city environments, benefit from humans and are also thus prone to being in humans’ way. The top species for each category of calls (the reason for call) were also all urban exploiter species.

4.9. Comparison Analysis

Below, I compare pie charts from section 4.6. This is to further understand which species correlate to a naturalistic perspective versus a negativistic one.

4.9.1. “Sick/Injured Animal” Calls Comparison with All Calls

The comparison between Figure 10 and Figure 11 shows quite a difference between the species that are being called about in terms of being sick/injured compared with all the calls. In particular, pigeons/doves are the most popular species for “sick/injured animal” calls (at 18%), while being the fourth most popular overall (at 12%). On the other hand, raccoons are the opposite, being the most popular species of all the calls (at 17%) though only the fourth most popular for “sick/injured animal” calls (at 13%). Squirrels similarly rank much lower (14% for all calls though only 8% of “sick/injured animal” calls).

4.9.2. “Orphaned Animal” Calls Comparison with All Calls

The comparison between Figure 10 and Figure 12 shows that the most popular species for “orphaned animal” calls and all calls are quite similar. Raccoons are most popular species in general (at 17%) and make up a similar percentage of orphaned baby calls (at 18%). Squirrels on the other hand, while being the second most popular species overall (at 14%), are overwhelmingly the most orphaned animal subject (at 24%). Following this, birds make up much of the “orphaned animal” and all calls. It is interesting to note however that while many pigeons/doves are the subject of calls overall (at 12%), they make up less “orphaned animal” calls (at only 5%). On the other hand, it can be seen by the comparison that rabbits are the subject of many more orphaned animal calls (at 12%) when compared to how they scale in terms of all the calls (at 6%). This could be because baby cottontail rabbits are visually appealing, and thus people are more likely to be worried and call TWC, and also perhaps as they are very abundant.

4.9.3. “Nuisance” Calls Comparison with All Calls

The majority of “nuisance” calls are raccoons (as seen in Figure 13), and while this species is the most popular in general in general, the percentage of raccoon “nuisance” calls far outweigh any other species with raccoons being over 3 times more called about than squirrels (the second most popular “nuisance” animal species). What is most striking about the comparison between Figure 10 and Figure 13 is the absence (or rather, much more minor abundance) of birds and rabbits as the subject of “nuisance” calls in general. For example, perching birds make up 11% of total calls but only 2% of nuisance calls, and rabbits comprise 6% of total calls but only 2% of nuisance calls. The only bird that seems to be significantly the subject of “nuisance” calls are pigeons/doves (at 5% of “nuisance” calls), which correlates with the idea that pigeons can viewed as pest species. This is because they can be carriers of diseases and can dirty common spaces as they are abundant in city streets, with such traits deeming a species undesirable (Bateman & Fleming, 2012; Hadidian, 1991; Kimlicka & Donaldson, 2011). Although, pigeons/doves are interestingly also the top follow-up species (see Figure 14). Rabbits on the other hand can be considered visually appealing, and evidently as seen from the figure comparison, are much less considered a nuisance by the public of Toronto. Perching birds are also well-liked by the public, further discussed in section 5.5.

4.9.4. Admittances (Filtered Hotline Data) Comparison with Admittances (Filtered Intake Data)

Comparing between Figure 6 and 7, the top species that are admitted to TWC are the same. However, the percentages differ, with intake data showing perching birds as the most admitted species (at 25%), followed by pigeons/doves (at 19%), other species, waterfowl (at 14%), squirrels (at 11%), raccoons (at 7%), rabbits (at 4%) and shorebirds (at 4%) respectively. The filtered hotline data on the other hand shows the top species being admitted as pigeons/doves (at 21%), squirrels (at 16%), perching birds (at 13%), other species, waterfowl (at 9%), raccoons (at 8%), unknown birds, rabbits (at 6%) and shorebirds (at 5%) respectively. This discrepancy could be since entities other than members of the public have brought in more of certain species than others, as well as the fact that the unknown birds from the hotline data have been identified in the intake data.

4.9.5. “How Is Animal” Calls Comparison with Admitted Species (Filtered Hotline Data)

A comparison between Figure 6 and Figure 14 shows a quite consistent follow up pattern between the species admitted and the species followed-up on. For example, 21% of species admitted between 2001 and 2013 were pigeons/doves and 24% of follow up calls were regarding pigeon/doves. This is consistent with almost every species with this comparison.

4.9.6. Admitted Patients Comparison with All Calls (Filtered Hotline Data)

The comparison between Figures 6/7 and Figure 10 indicates that while raccoons were the subject of the most calls between 2001-2013 for the filtered data, that they were not the most

admitted patient by far (being only the 5th most admitted patient). This could be for a number of reasons though presumably due to the nature of the call (it was shown in the figure comparison that they were the subject of the majority of “nuisance” calls). Although, it could also be because of the capacity levels of TWC, or because of the nature of the species (some species have high requirements for admittance, such as size and can only be admitted in a group, for example). On the other hand, pigeons/doves were highly admitted while not being the most called about (only 12% of total calls). Another comparison to note is the absence of unknown species in the admittance pie chart, which is simply because once an unknown animal is admitted to TWC, it is identified as best as possible immediately. Otherwise, the pie charts are quite similar in terms of species percentages.

4.10. Location Analysis

Out of 46,607 wildlife intake entries, about 29,927 had location information attached. These are displayed below.

4.10.1. Species Analysis by Location

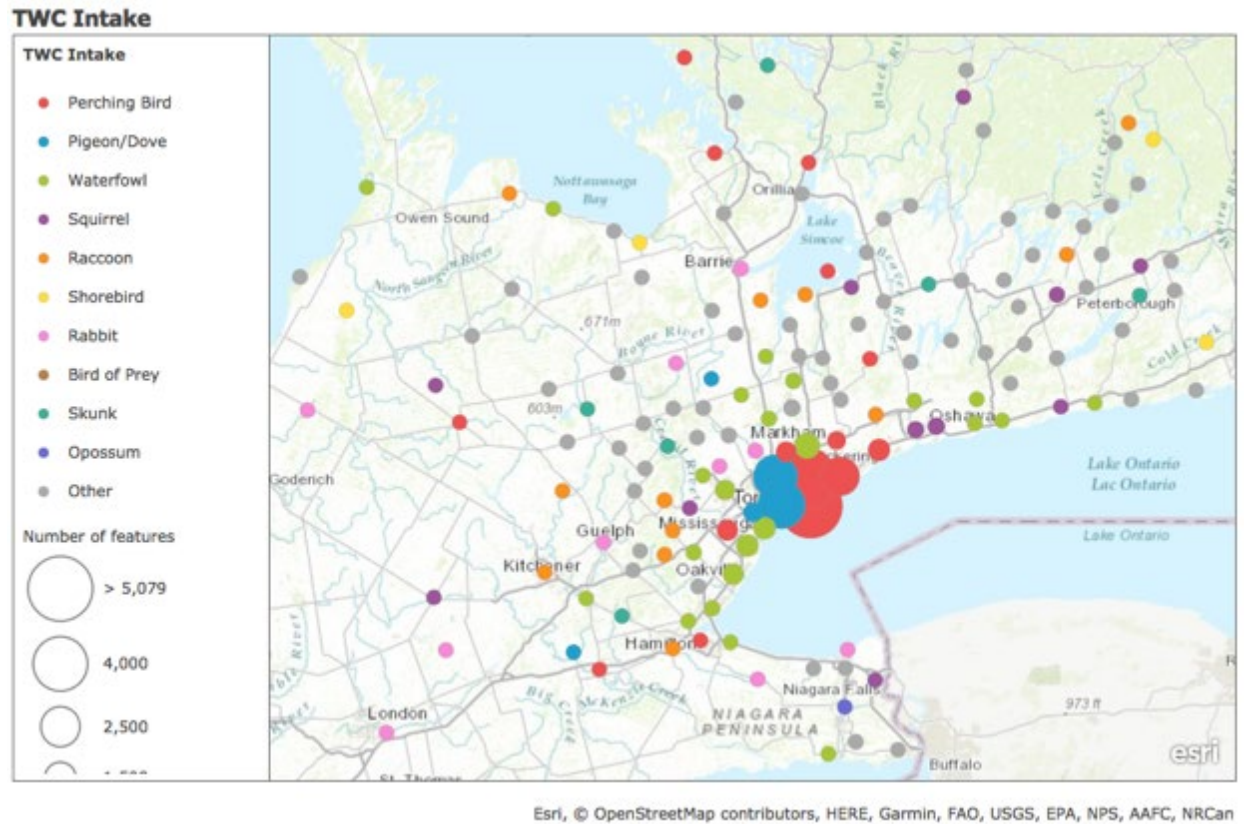


Figure 16 – Wildlife species admitted to TWC between 2001-2013 shown by location as clusters, Ontario view

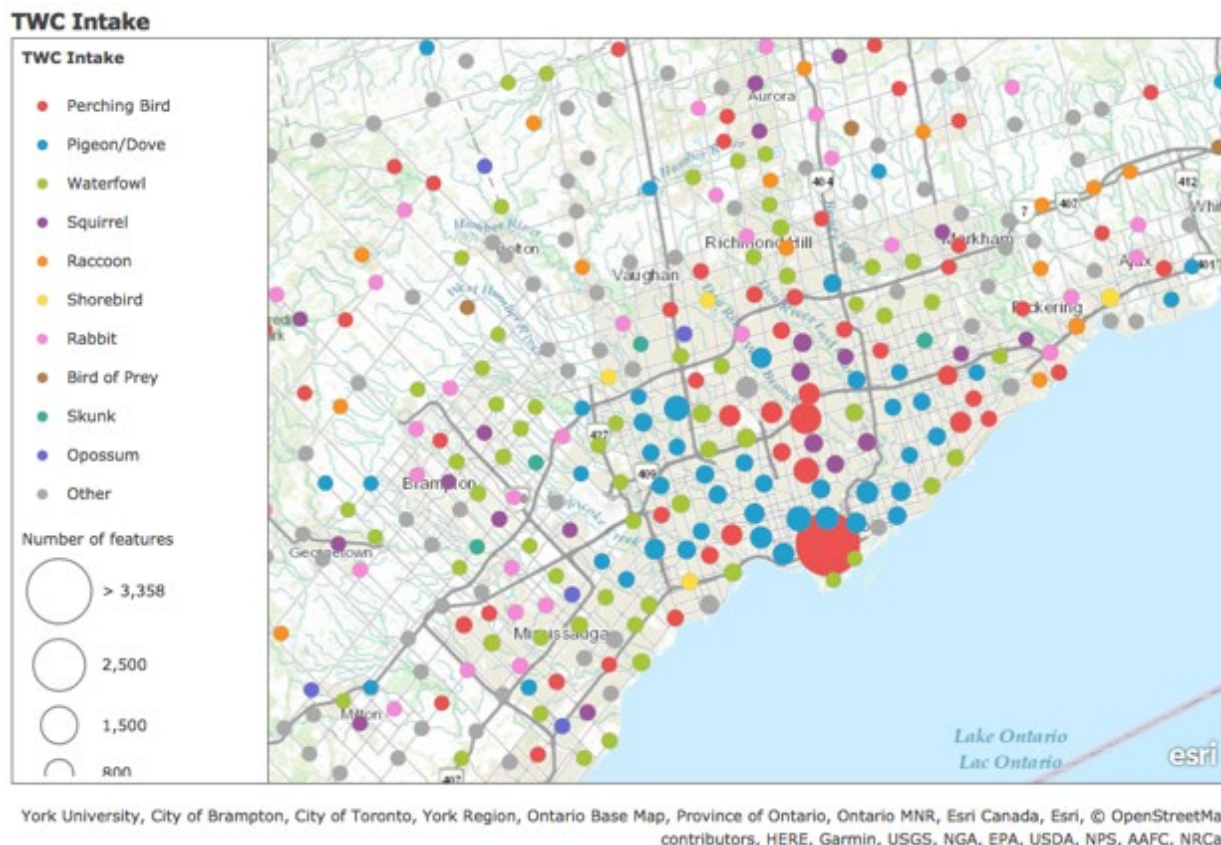


Figure 17 – Wildlife species admitted to TWC between 2001-2013 shown by original location as clusters, GTA view

As seen by Figures 16 and 17, most species that became injured, sick or orphaned in downtown Toronto were birds, especially perching birds. More concentrated to the downtown core were perching birds, followed by pigeons/doves and finally waterfowl who were seen more spread out in the outskirts of the GTA. Raccoons admitted originated especially from outside of the GTA. Notably, seen from Figure 16, waterfowl also originated from areas near waterbodies such as along Lake Ontario. As well, it is interesting to see from Figure 17 that there is a slight increase in perching birds affected directly north of the downtown core near the 401 highway.

4.10.2. Threats Analysis by Location

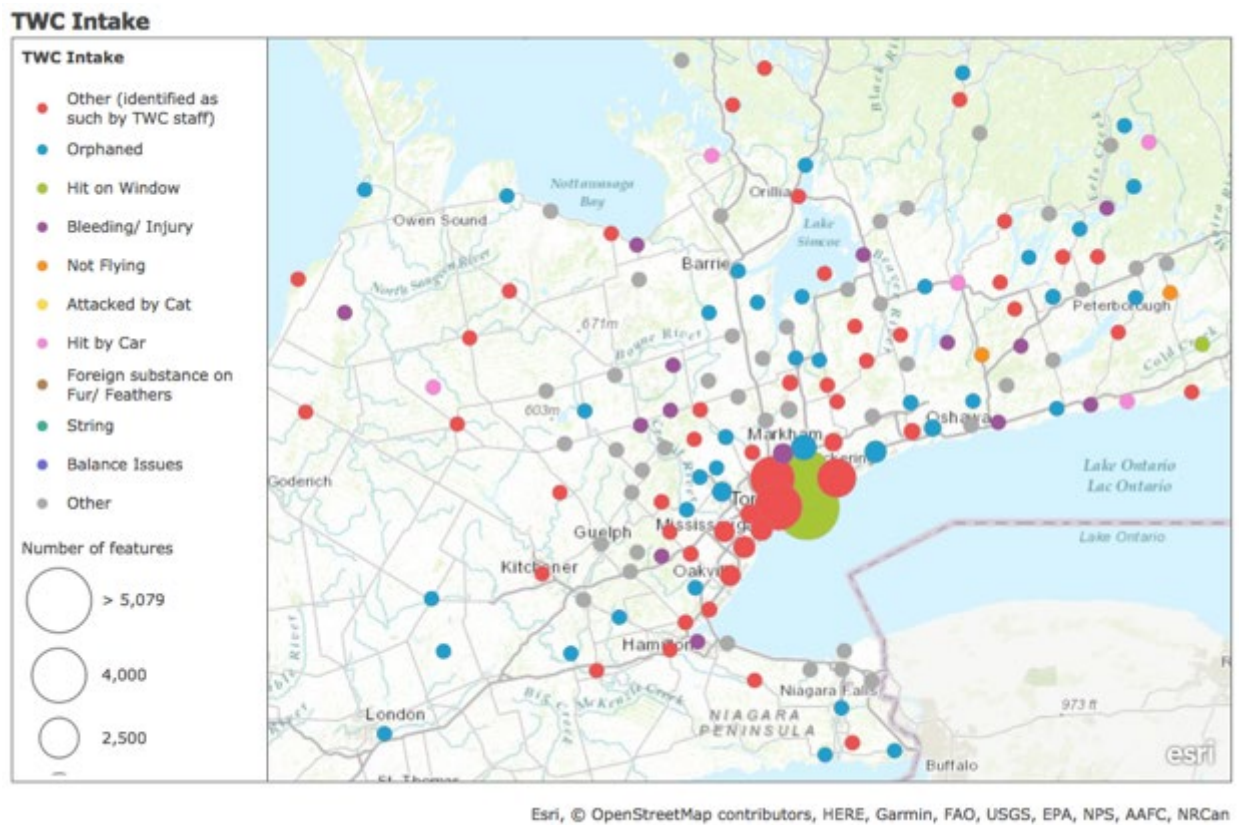


Figure 18 – Reason for intake of wildlife species admitted to TWC between 2001-2013 shown by original location as clusters, Ontario view

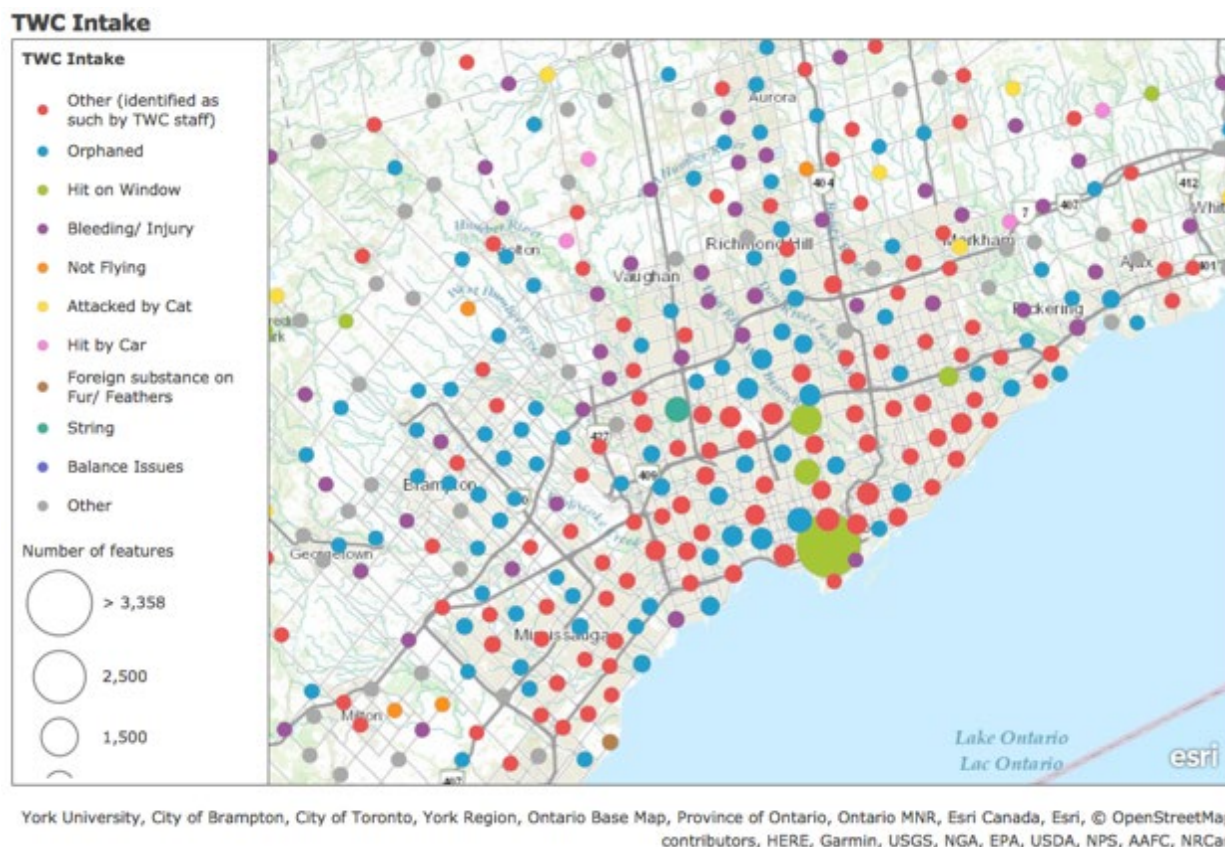


Figure 19 – Reason for intake of wildlife species admitted to TWC between 2001-2013 shown by location as clusters, GTA view

From Figures 18 and 19 it is evident that birds' main obstacle in the city are buildings, seeing as perching birds being injured and hit on window incidences correlate geographically. Interestingly, there is a high number of perching birds admitted due to window strikes originating not only from downtown Toronto (where a high number of buildings pose a greater challenge for migratory birds) but also north along the 401, indicating a possible continuous threat. Upon further research, this intersection has proven to be notorious for causing bird strikes due to a particularly reflective building, and is part of a routine search intersection for an organization called Fatal Light Awareness Program (FLAP), who has volunteers on the lookout

for injured birds. Orphaned animals' situations appear to occur unsystematically all over the GTA. To note is also a surge in stringfoot incidences (a threat to pigeons and doves especially as they find urban materials such as string and wire to build their nests and end up getting tangled in the materials) west of the 400 highway and in between the 401 and 407 highways with a correlated high number of pigeons/doves being admitted from this location. Upon further investigation, this increase in pigeon and dove admittances is not necessarily a result of higher threat potential, but rather is due to a keen member of public who regularly patrols this area and consequently brings many injured pigeons and doves to TWC.

4.10.3. Admitted Species' Origin Locations Analysis Through Time

Figures 20 to 30 in the Appendix demonstrate wildlife admittances displayed by location through the years (2001-2013, excluding 2005-2006). Worth noting is: the dramatic increase of perching birds in 2002, consistent perching bird density downtown Toronto for 2003 onwards, consistent perching bird location along the 401 highway directly north of the city centre, consistent pigeon/dove location along the 400 highway just south of the 407 highway, as well as the general increase in species location range in 2003 and subsequent decrease 2009 onwards.

Chapter 5. DISCUSSION: IMPLICATIONS, RECOMMENDATIONS AND CONCLUSION

5.1. Comparing Results to Literature: Mixed Outcomes

Kellert (1985a) had found that the most disliked urban species were the skunk, coyote, bat, rat and wolf with the raccoon and turtle making an appearance as the most liked animals. While my findings suggest that the skunk is a notable subject of “nuisance” calls, and a small percentage includes rats, the most disliked species based on my data differ greatly (possibly showing a change in views through time). However, George et al., 2016 had noted that coyotes were a species that had gained positive outlooks since the 1985 study, and my findings appear to correlate with this as only 15% of all coyote calls are categorized as “nuisance” calls. Overall, coyotes appear to create polarizing opinions, as coyotes were historically seen as a nuisance, with recently positive attitudes rising due to wildlife affection and appreciation, though appearing to be more aggressive since adapting to human environments (Wine et al., 2015). Comparing my results with Hadidian’s (1991) “problem species” in North America on the other hand, which included grey squirrels, the striped skunk, raccoons, rabbits, pigeons and other nuisance birds, as well as the white-tailed deer, more accurately reflect my findings as all these species (except the white-tailed deer) are among the most popular “nuisance” call species. However, a direct comparison between findings cannot be accurately made as my results indicate views based on animals seen in Toronto and their abundance in the city (the more animals viewed and called about the more data available), and results (discussed below) are not an accurate snapshot of every Torontonians’ views but rather of those who called TWC.

5.2. Raccoons: Disliked by the Public

According to my data analysis, raccoons are the species viewed most negatively in Toronto as they make up almost half of “nuisance” calls while only being the subject of around one sixth of

total calls. In fact, a recent Forum Research poll found that over half of Torontonians would be in favour of a city raccoon cull, and only a quarter would oppose (Connor, 2017). Raccoons can be perceived as pests as they possess many qualities described by Kellert (1985a) that make an animal undesirable (such likelihood of inflicting property damage, low economic value of the species, relationship to human society as a pest as opposed to pet/game/farm animal) as well as being perceived as disease carriers (including rabies and distemper). Moreover, raccoons being exploiter species mean they utilize human resources (such as utilizing garbage dumps as communal sites) and reside within cities therefore they are more prone to appear on private property and in the public eye. This makes them less publicly liked according to Kymlicka & Donaldson's (2011) view that we see urban wildlife in terms of their problem attributes, which is also true for other nuisance and exploiter species such as the skunk. The OMNR also states that "you don't need a permit to scare away, capture or kill most wild animals, if the animal is causing damage to your property" ("Harass, Capture or Kill a Wild Animal Damaging Private Property", n.d.) (with some species exceptions) therefore it may be socially acceptable to consider some animals as nuisances and thus take serious action to deter these from private spaces, which further perpetuates the concept that animals don't 'belong' in some places (Philo & Wilbert, 2000).

5.3. Mixed Feelings on Squirrels

Squirrels, on the other hand, while being the second most popular "nuisance" call subject, are also the most popular orphaned animal call subject and second most popular follow-up call subject. This shows people have mixed feelings on squirrels, as they care to bring orphaned

squirrels to the centre and check up on the in-care patients, but also often report them as a nuisance. This is consistent with Hadidian's (1991) findings who presented grey squirrels as "problem species" though noted that they were simultaneously well-liked by many people.

5.4. Mixed Feelings Pigeons and Doves

An interesting finding from my results is with pigeons and doves, urban exploiter species, which are the only significant bird species considered in the "nuisance" category. While this may not be surprising, given pigeons can be seen as pests, they are also the top species to be followed-up on. This, similarly to squirrels, indicates that while they may be viewed as a nuisance in Toronto they are also well appreciated and cared about, evidently as many bring them to the centre to be rehabilitated. Also to note is that not only personal experiences and values affect attitudes towards specific species, but other factors such as emotional connection and visual aesthetic (Kellert, 1985a). This could be used to further understand why some species are like or disliked, though how these aspects interrelate is complex.

5.5. Perching Birds: Liked by the Public

A comparison between the "nuisance" and follow up ("how is animal") data, as well as considering overall admittance, suggests (birds in general but specifically) perching birds are well liked by the Toronto public. This is due to the absence of perching birds from "nuisance" data (portraying a negativistic attitude), yet being 13% of followed up species (portraying a naturalistic attitude). This could be explained by Kellert's (1985a) factors that determine whether a species is likeable, as perching birds generally: are usually aesthetically pleasing (with lots of bright colours and

sounds), have low danger potential to humans, have a small likelihood of inflicting property damage, lack predatory tendencies, have a cultural relationship to humans (many birds are/have been used as symbols), and have a historic relationship to human society as native wildlife and even pet (as opposed to being a pest/game/farm species for example). However, it is also worth considering that there are exceptions and public views may be species-dependent, for example demonstrated by Belaire, Westphal, Whelan & Minor's (2015) findings that while overall the public held positive views towards birds' aesthetics and place in the environment, there were a few consistent negative views on the House Sparrow, European Starling and Blue Jay (all perching birds).

5.6. Skunks: Disliked by the Public

While not as disliked as raccoons, results suggest skunks are also largely disliked by the Toronto public. This is seen by an absence of the skunk as a significant species in Figure 14 ("how is animal") as well as in Figure 11 ("sick/injured animal") and 12 ("orphaned animal"), while simultaneously comprising 12% of "nuisance" calls. This negative view could be explained by the skunk's well known ability to spray, which causes an unpleasant smell. Thus, the skunk is viewed through its "problem" attribute (though a defense mechanism, is viewed as such by humans) (Kymlicka & Donaldson, 2011).

5.7. Rabbits: Public Seems Indifferent

The Toronto public seems indifferent towards rabbits, as results demonstrate the species is present in the city (as shown by being a large percentage of "orphaned animal" calls at 12% as well as

“sick/injured animal” calls at 6%), though is not considered a large nuisance (at only 2%). While rabbits are not a particularly popular species that is followed-up on (at only 4%), this is consistent with admittance data (at 6% of filtered hotline admittances). The abundance of rabbits in Toronto and low “nuisance” calls shows the rabbit is not particularly disliked. While some find rabbits to be disturbing due to their burrowing and grazing habits, others may find them more likeable with their visual appeal and association as household pets. Overall however, they seem to be accepted within the community as wildlife.

5.8. Orphaned Animals Generate Empathetic Reactions

For the detailed examination of transcripts, it is surprising how the public demonstrate much higher desire to feed orphaned animals, as well as a few instances proving to have a desire to either rehabilitate the animal themselves or keep an animal as a pet, when compared with sick/injured animals. While this may seem like the correct thing to do, and demonstrate a naturalistic attitude towards the baby animals, it is worth noting that regularly feeding and especially self-rehabilitating orphaned animals can result in more damage than good (as animals become habituated to humans and are improperly cared for). This is also true for members of the public who call TWC about orphaned animals, who are not actually orphaned. In this case, bringing such an animal to TWC would cause more harm as the animal becomes separated from its mother and natural habitat. Indeed, Hadidian (1991) noted that acts of perceived kindness towards animals may in fact be damaging to their population. Thus, while people may have the right intentions, their actions could be damaging to not only individuals but also at the population level.

5.9. Infrastructural Threats: Window Strikes for Birds Prove Major Challenge

Location analyses demonstrate that the downtown core of Toronto pose challenges to birds especially, as window strikes correlate with a large number of admitted perching birds (the most admitted species originating from downtown). Indeed, windows prove to be the most challenging threat for migratory birds especially (“Hierarchy of Threats”, n.d.). FLAP in Toronto (a partner of TWC) works to prevent migrating birds from hitting building, especially at night, and indicate that glass is fatal to birds as they cannot see it, instead seeing either a reflection of or through to the surrounding environment (“Glass and Daytime Collisions”, n.d.). Moreover, at night, birds can be misled by artificial light from inside buildings and consequently hit windows (“Lights and Nighttime Collisions”, n.d.)

5.10. Recommendations

Even though TWC is not an animal/pest control centre, many members of the public call the wildlife hospital to complain of urban animals. This indicates that the Toronto public still consider many species as pests either as they infringe on people’s lives and property, or as they are viewed as disease carriers/generally dirty, or simply because they are perceived as not belonging. This may be due to lack of education, lack of proximity to natural spaces and therefore appreciation for wildlife, or lack of personal values, experiences or connections with wildlife (Gilbert, 1982; Kellert 1984). The recommendations below tackle these pitfalls. Coexistence between many animals and humans in a large Canadian city is possible, as shown

for example by Lukasik & Alexander's 2011 study results on coyotes successfully living alongside humans in Calgary.

5.10.1. Creating Green Spaces and Revitalizing Cities

An early study by Kellert (1984) found that suburban residents (of urban areas) held highest knowledge of and appreciation for wildlife and nature, hypothesized to be due to proximity of nature and open spaces, whereas those who were remote from the countryside lacked appreciation for certain species. This, along with common urban attitudes defining animals as either pets or pests (Wolch, 1996), could be utilized as grounds for revitalization of cities with the incorporation of zoöpolis principles into city-planning helping to tackle this divide. My findings suggest that life for many species is increasingly difficult as they travel closer to the city centre, with many more anthropogenic obstacles to overcome. Creating green spaces in the city could mitigate these impacts as green spaces have shown to benefit all urban species types, as Kark et al. (2007) suggest; "in order to maintain high biodiversity in urban environments, it is crucial that we maintain more sub-natural areas within the city in which both adapters and avoiders can persist, in addition to the exploiters" (p.647). Thus, creating green spaces may improve urban residents' attitudes towards certain wildlife species, may further integrate wildlife into cities to bridge the gap between animal and human spaces (zoöpolis) as well as may promote ecological conservation of natural habitats and reduce anthropogenic stresses on wildlife. However, there is still the issue of many species becoming less fearful of people or more aggressive as they are adapting to the city. Therefore, education is needed to minimize human-wildlife conflicts and habituation.

5.10.2. Supporting Education Programs

Educating the public of wildlife issues may prove to be challenging (Hadidian, 1991), though critical to progress in regard to urban wildlife issues and acceptance, especially in highly urbanized areas (McKinney, 2002). Fortunately, there are some management techniques, programs and facilities that aim to educate the public about wildlife and improve human-wildlife relationship and interactions. For example, the Toronto Wildlife Centre has resources, presentations and events aimed at educating the public on wildlife in cities, keeping animals safe and urban ecosystems. Indeed, “Toronto Wildlife Centre’s education program promotes peaceful co-existence with wildlife and humane response to wildlife situations by providing education and expert advice about wildlife situations” (“Education and Outreach”, n.d., para 1). Moreover, other facilities like the TWC are in a unique position to educate the public on certain species, conservation themes and environmental awareness (Patrick, Matthews, Ayers & Tunnicliffe, 2007) and many environmental education programs show students having more positive attitudes towards wildlife through the completion of such programs (Dettmann-Easler & Pease, 1999). An informed public is also more likely to promote conservation of native species (McKinney, 2002) and be aware of wildlife’s presence in the city as well as understand when an animal is truly in need of assistance as opposed to simply being present. Kellert (1895a) indeed suggests that there is public interest in animals and that this should be considered to increase awareness and understanding of environmental issues.

5.10.3. Implementing Mitigations Strategies for Urban Animal Threats and Supporting Wildlife Rehabilitation

While many animals are injured randomly throughout the city, there are some patterns that indicate systematic species admittance, for example with birds hitting windows in the same places each year, also supported by FLAP who regularly patrol the same high-risk areas. The recurrence of the same species being admitted due to the same threats in the same locations year to year could demonstrate fixed obstacles for wildlife that affect their well-being. Without mitigation measures for such threats, this will likely continue to affect the same species for years to come. Overall, we must make the best of an inevitable situation; we must understand that wildlife will encounter human environments and thus we must mitigate impacts (Bateman & Fleming, 2012). As seen from the TWC data, with over 36,000 initial “sick/injured animal” calls and over 25,000 initial “orphaned animal” calls (from members of the public only) over 12 years, there are indeed a large number of threats affecting urban wildlife in Toronto every day, many of which are anthropogenically derived. Birds especially continue to hit windows and consequently injure themselves, thus a mitigation strategy could include supporting ‘Lights Out Toronto!’ which aims to reduce nighttime light pollution (“Lights and Nighttime Collisions”, n.d.) as well as implementing glass density patterns on existing and exempt buildings (new buildings in Toronto must follow bird-friendly guidelines) (“Bird Friendly Guidelines”, n.d.). As cities continue to be designed without wildlife in mind (Hadidian, 1991), the need for rehabilitation facilities such as TWC continues. Rehabilitation centres are effective, as shown by Tribe, Hanger, Nottidge & Kawakami’s 2005 study, indicating that rehabilitated and released animals had high survival rates, were in good health and were also able to create new home ranges.

Ideally, the best solution would be to remove the source causes of animal injury and sickness in the city, however this is unrealistic as urban development continues to grow. What can be done is to include wildlife in management decisions and urban planning. As Hadidian, (1991) notes that “cooperation between different stakeholders is crucial to reach agreements on management course of action” (p.10) (based on a review of problems with squirrel populations in Lafayette Park in the United States), it is important to do so “without compromising natural resources” (p.10). Indeed, preserving species’ natural habitats (as well as restoring habitats) promotes species conservation which consequently reduces the impacts of urbanization (McKinney, 2002), therefore efforts should be placed on such practices. Another aspect to consider is how people’s opinions and attitudes can influence decision-making. Findings from Mir et al.’s (2015) study revealed that while only a small number of residents held negative views towards wildlife, this was significant as their activities and opposition had the potential to affect conservation practices. This is an important observation as it shows that not all opinions are weighed the same with some having the potential to have major impact, giving more incentive for encouraging peaceful coexistence between wildlife and humans. It is also worth noting that while current solutions to mitigation of wildlife damage (a driver of human-wildlife conflict) is mostly focused on technical rather than social aspects (Dickman, 2010), social factors are worth considering as they affect people’s perception of wildlife and human-wildlife conflict. This finding can be used to promote positive attitudes towards wildlife.

5.10.4. Recommendations For TWC

Based on an extensive evaluation of data, recommendations for TWC are as follows. Firstly, it is recommended for hotline staff to correctly input species and location data to ensure there are no discrepancies (no doubles or misspellings, no missing fields) so location information can be analyzed correctly and for efficiency in species analysis (primarily useful for future data analysis). Moreover, putting emphasis on continual use of social media and curation of events for educational purposes, especially aimed at the Toronto public, is recommended for reasons mentioned above. A final suggestion is to create a direct message input on the TWC website where a potential ‘caller’ could effectively provide all information on the situation in the correct fields (see Figure 2) for efficiency purposes. This would reduce labour time of transcription of each voicemail as well as improve the time gap between a ‘call’ made and the return of the call. This could also be in the form of an app with citizen-science potential, where the app could provide general information on what to do in certain situations as well as answer questions on what is normal/abnormal behaviour for common urban species. Participants could also fill in sightings with geolocation information that would in turn be advantageous for TWC.

5.10.5. Recommendations for Further Research

Further research on change through time and cyclical analyses could be beneficial to understand how views towards urban wildlife progress with time as well as how species adapt to urban development. Research could also be done to understand specific recurring threats to species in the GTA to ultimately implement mitigation measures accordingly, with potential to also

consider other data sources such as FLAP bird collision data. Further, more research should be done on species activity patterns, ecology and biology as the world becomes increasingly crowded (Carter et al., 2012; Ditchkoff et al., 2006; Hadidian, 1991).

5.11. Conclusion

Based on 12 years of TWC data, this study found that the Toronto public generally view perching birds positively, raccoons and skunks negatively, and have mixed feelings on squirrels and pigeons/doves, with calls made to TWC being predominantly about urban exploiter species. How the public perceives wildlife, and the actions people take based on these values, can create both positive and negative consequences on wildlife, which may either perpetuate certain misleading beliefs or promote positive messages of acceptance, coexistence and conservation.

Most threats identified from species' admittances are anthropogenically derived and located throughout the GTA, with increased hazards downtown Toronto. These include animals becoming sick/injured/orphaned due to human activity, and specifically with window strikes, collisions with cars, getting stuck in lids and jars, and becoming trapped in human structures. This indicates a need for mitigation strategies and integration of wildlife in urban planning. Educating the public on wildlife issues can challenge misconceptions and incorporating wildlife needs and dangers in policy decisions, such as implementing bird-safe windows to tackle bird collisions, can lead to positive human-wildlife coexistence.

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APPENDIX

Excel Functions

In order to count instances of a species for particular reasons for call, as well as threat or word/phrase from the main data set, I utilized the excel function “count if” i.e. `=COUNTIF(A:A, "*" & B1 & "*")`, with A:A as an example denoting the list and B1 as an example denoting the particular word. To count the number of species for each reason for call, further calculations were required once exact species were grouped based on Table 1. For figures 9 and 10, following a qualitative analysis of notes, key words were identified. These were then counted using the same ‘count if’ function, though it is important to note that for these two analysis specifically, flaws can arise when using this function therefore a margin of error exists.

To merge information between two excel spreadsheets (from hotline calls and intake forms), I utilized the “vlookup” function, i.e. `=VLOOKUP(lookup_value, table_array, column_index_number, range_lookup)`, with lookup value being the intake ID.

Data Constraints

The dialogue portion of the calls (exact transcript) is cut off after around 50 words. Although this is enough to get a general idea of the message, it is sometimes more difficult to assess caller attitudes.

The data was missing a few months in 2001 and 2011 for the hotline spreadsheets and missing the years 2005 and 2006 for the intake spreadsheets. I was limited to the available data.

The process of linking calls (many calls made about the same situation by the same caller) was out of scope for my analysis, therefore repeat and linked calls were simply omitted (to avoid counting one situation twice). For a small number of cases where the action suggested to ‘see previous call’, were also removed. Linked calls however suggest a person is calling more than once and thus could suggest the caller is attached to an animal or situation, and could be used to identify caller attitude as naturalistic. Thus, to minimize these consequences, I have included all original ‘how is animal’ calls (suggesting caller is interested in knowing the status of a particular animal in care), therefore effects should be minimal.

For animals not admitted, location is sometimes recorded by listing the major intersection of the animal’s location. However, this means that for many cases, there is no spatial information, though it is assumed that the location is within the GTA. Also to note is the location inaccuracy of a very small number of entries due to incorrect spelling or inconsistent location description, though these are not significant enough to affect cluster diagrams. Although information on the type of property is recorded (house, apartment etc.) the size of the property is unknown.

For some calls, fields were missing. All unknown fields were marked as ‘unknown’ in graphs and charts. Moreover, some fields were wrongly inputted. For example, the reason for

call or species was wrong. These errors were ignored, as time constraints did not allow for double checking of every single call. While some of the calls were thus not filtered through, the effects are presumed to be minor and have no significant effect on data analyses and findings.

Time Constraints

Ideally, I would have interpreted each call individually and read each transcript to understand the call in full detail before allocating an attitude type. However, this would have been much more time consuming, therefore other methods were utilized as I was under the time constraints of the MES program. As well, complete analyses through time (e.g. a complete analysis of species occurrences as a percentage of each 'reason for call' for each year of data) were not possible due to program time constraints, therefore a streamlined version of a time analysis was performed.

While correlations between location and attitude also ideally would have been explored, this was not possible due to the inability to correlate each individual call with an attitude descriptor (due to lack of time). Further, as location information is recorded by the closest major intersection, there is a lack of preciseness for some data points needed for such an analysis.

Biases

As Soulsbury & White (2016) point out, there is inherent bias in urban wildlife ecology literature in terms of how the focus is put on human-wildlife conflict, since it is easily quantifiable (in terms of "disease transmission, physical attack and property damage" p.541). However, the

authors (2016) suggest that on the other hand, benefits from human-wildlife encounters while not as easily measured, but may be just as important. This relates to my paper as I also focus heavily on human-wildlife conflict and part of this is directly because of the availability of data in literature. Moreover, another bias that relates to my research is one pointed out by Bateman & Fleming (2012), who note that literature emphasis is put on ‘western’ societies as there is more quantitative data (and also non-anecdotal data is less common outside of these areas). While for the purposes of this paper, non-‘western’ data was not the primary focus due to the spatial scope of my study, it is nevertheless an important distinction to note when reading literature reviewed from outside Canada.

Species Location Analysis Through Time

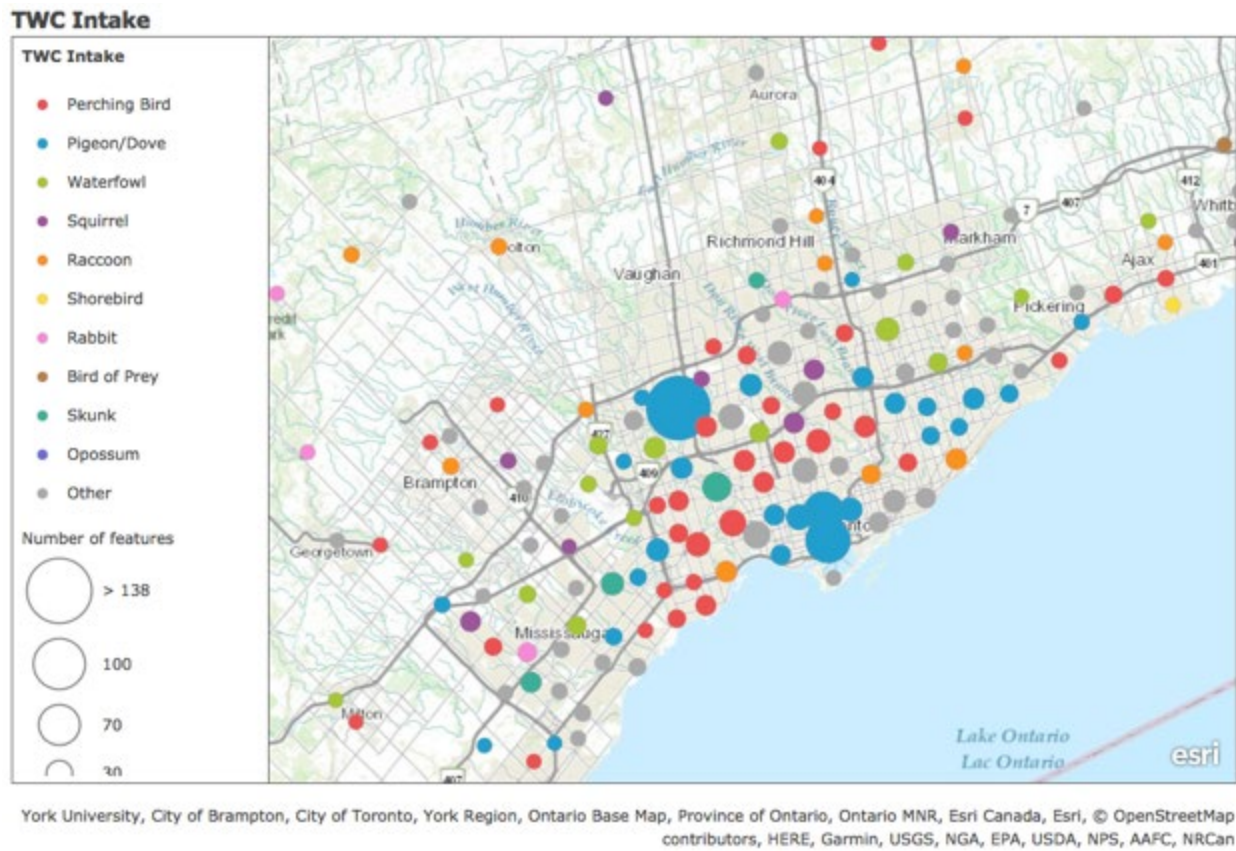


Figure 20 – Wildlife species admitted to TWC in 2001 shown by original location as clusters, GTA view

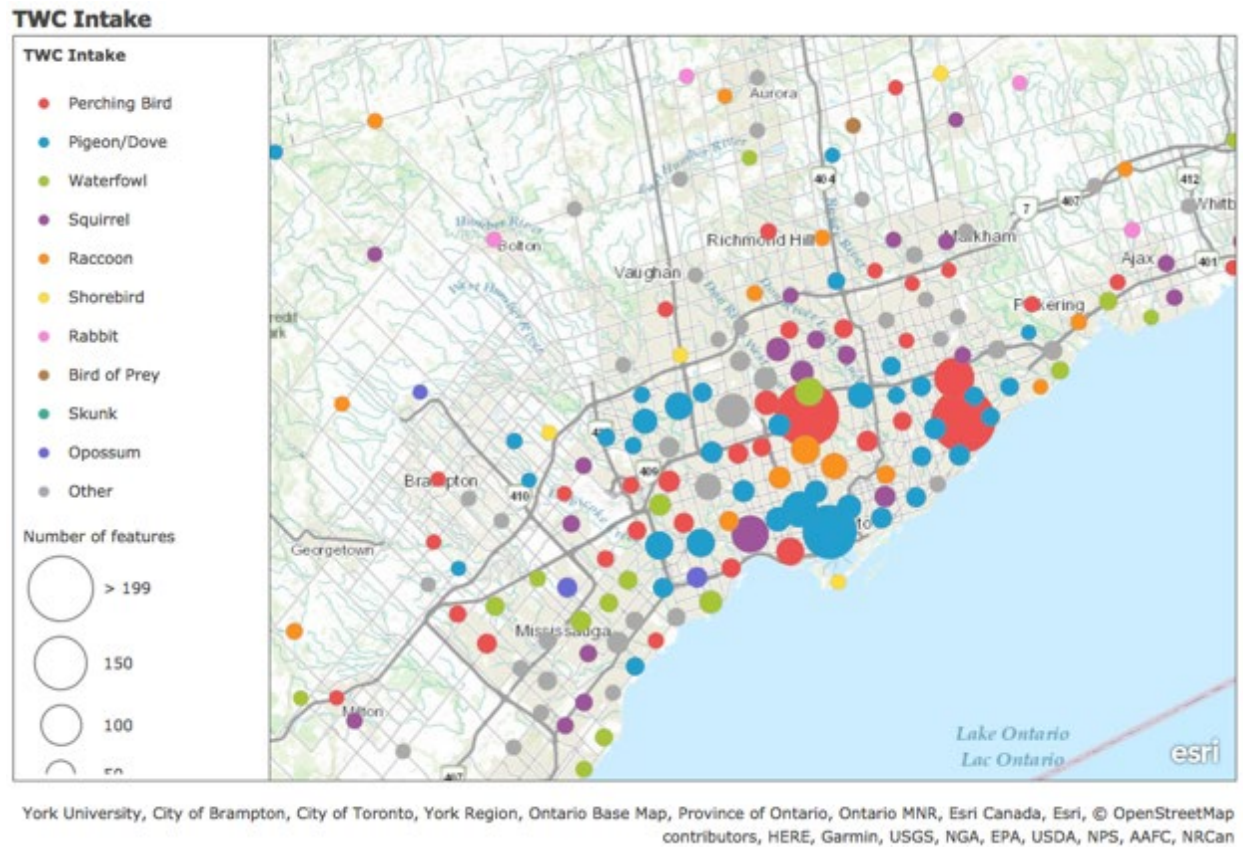


Figure 21 – Wildlife species admitted to TWC in 2002 shown by original location as clusters, GTA view

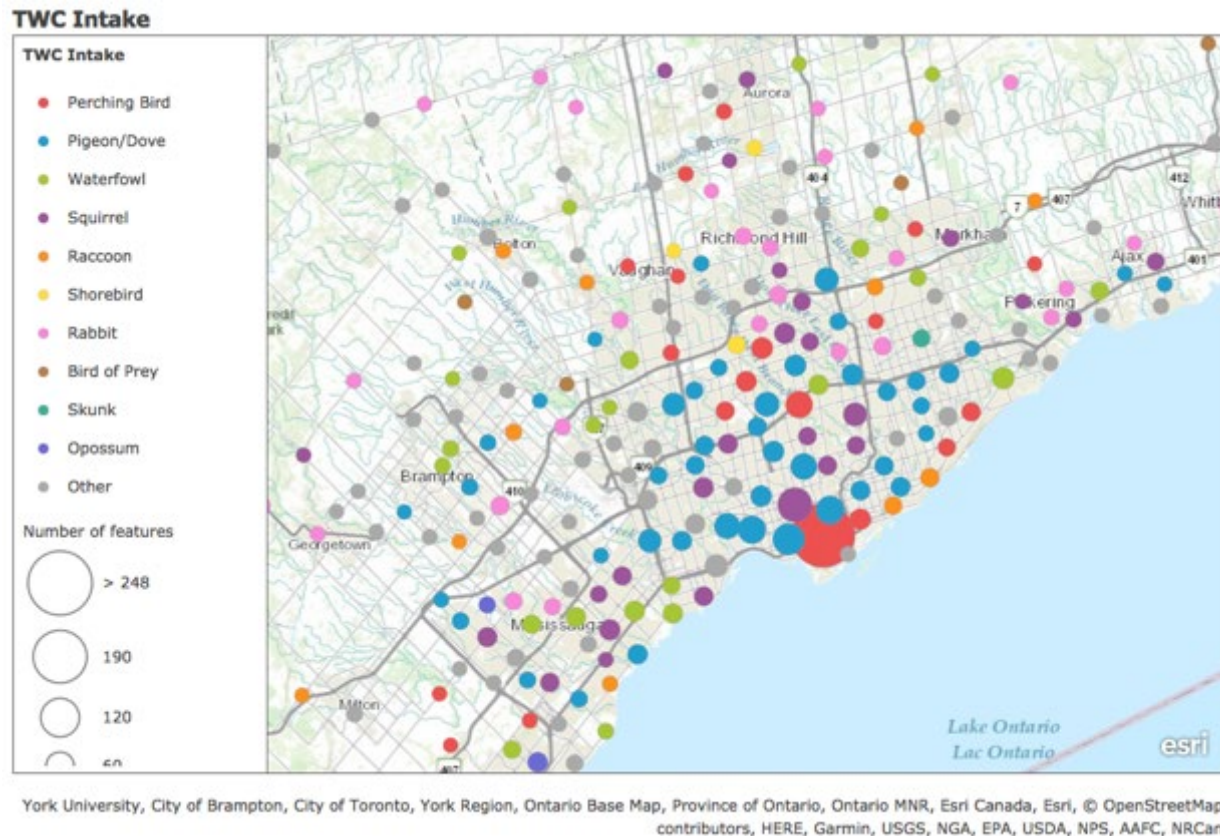


Figure 22 – Wildlife species admitted to TWC in 2003 shown by original location as clusters, GTA view

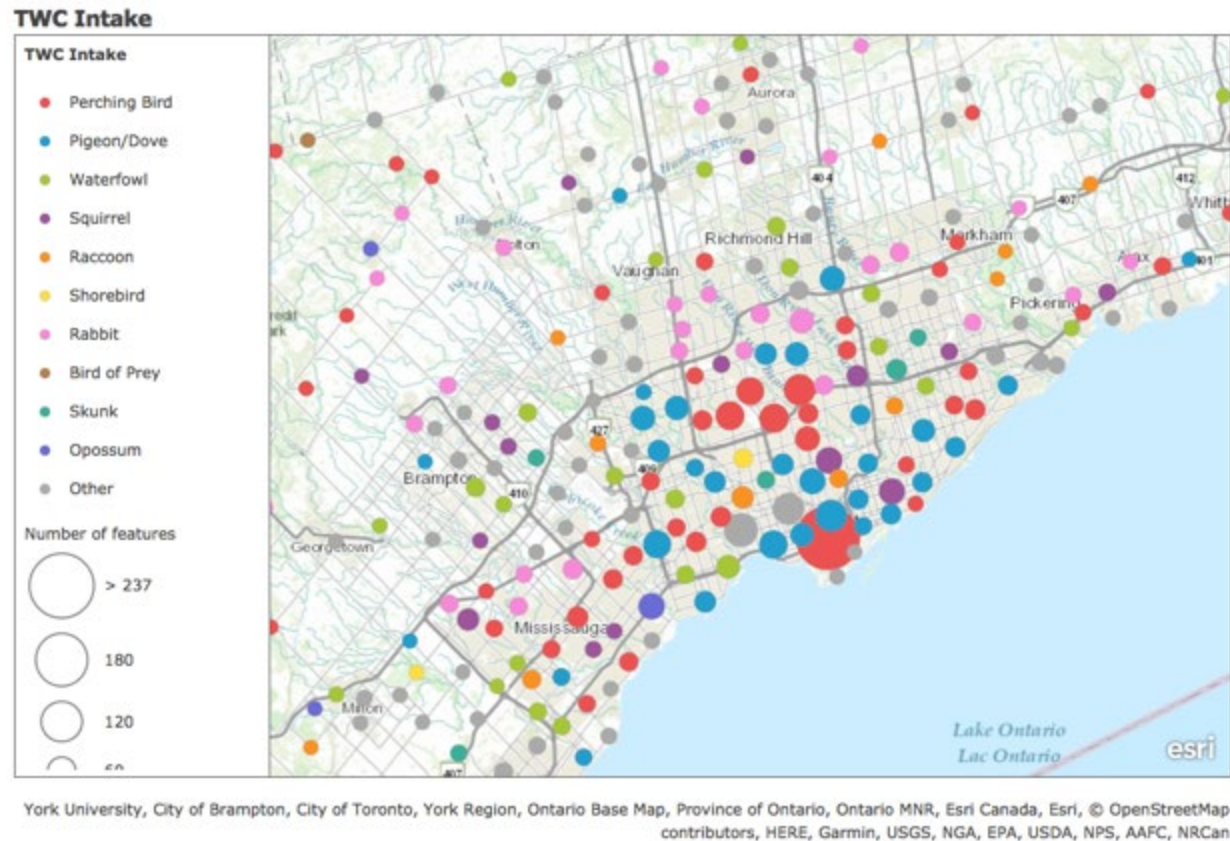


Figure 23 – Wildlife species admitted to TWC in 2004 shown by original location as clusters, GTA view

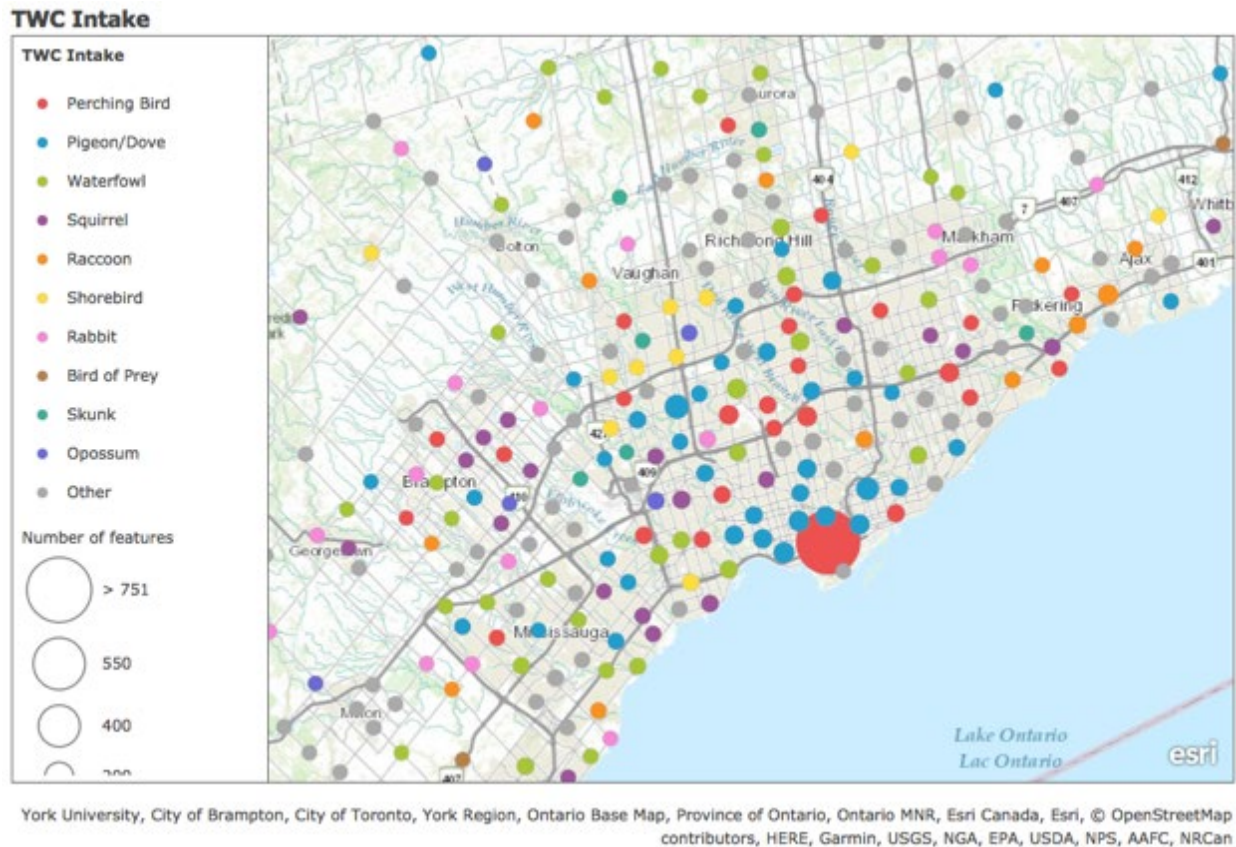


Figure 24 – Wildlife species admitted to TWC in 2007 shown by original location as clusters, GTA view

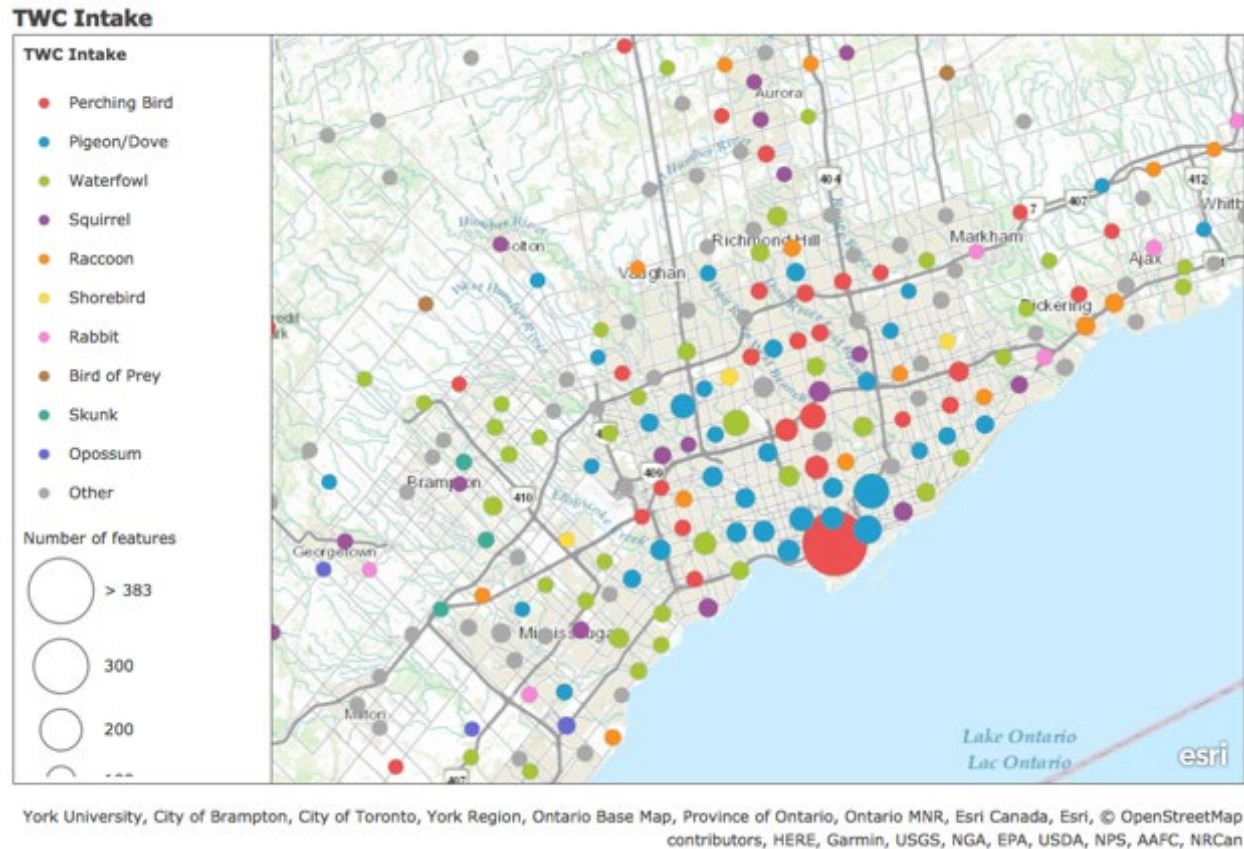


Figure 25 – Wildlife species admitted to TWC in 2008 shown by original location as clusters, GTA view

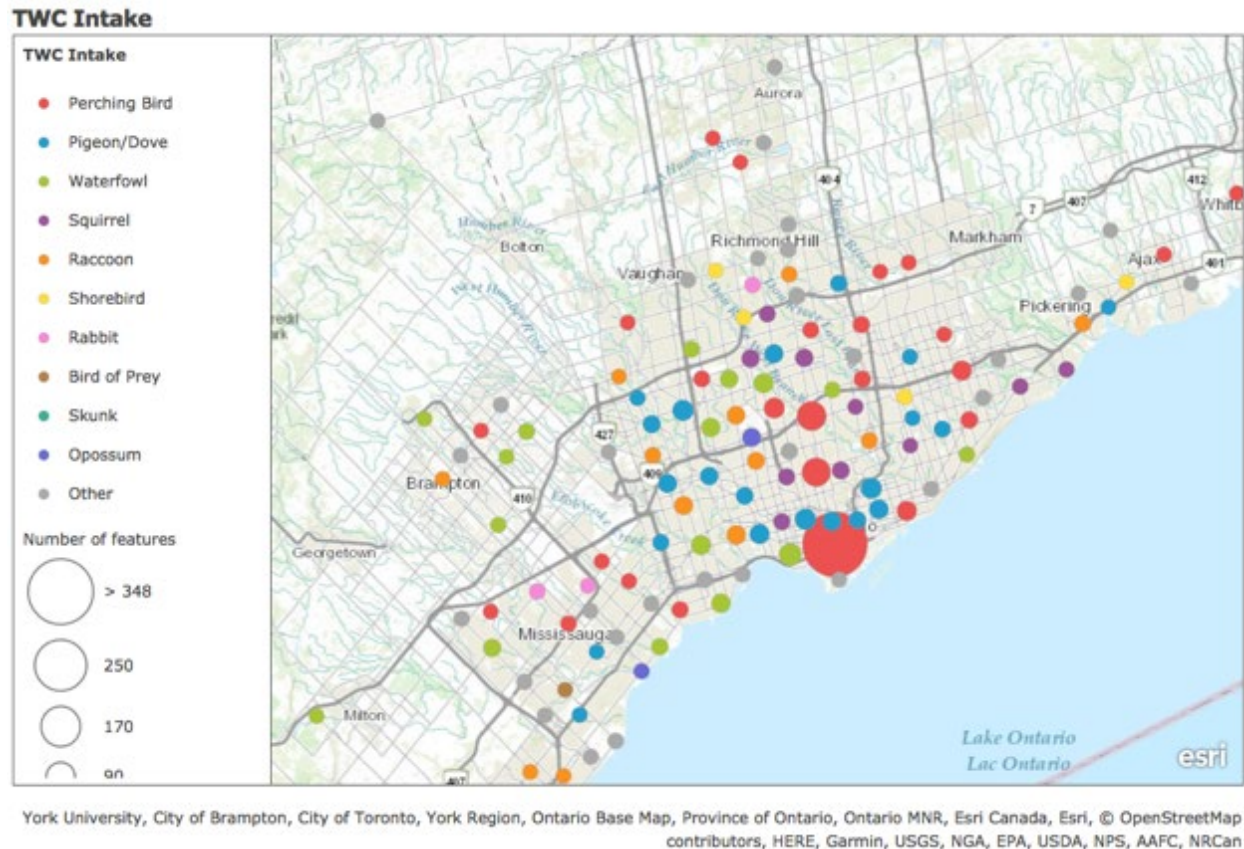


Figure 26 – Wildlife species admitted to TWC in 2009 shown by original location as clusters, GTA view

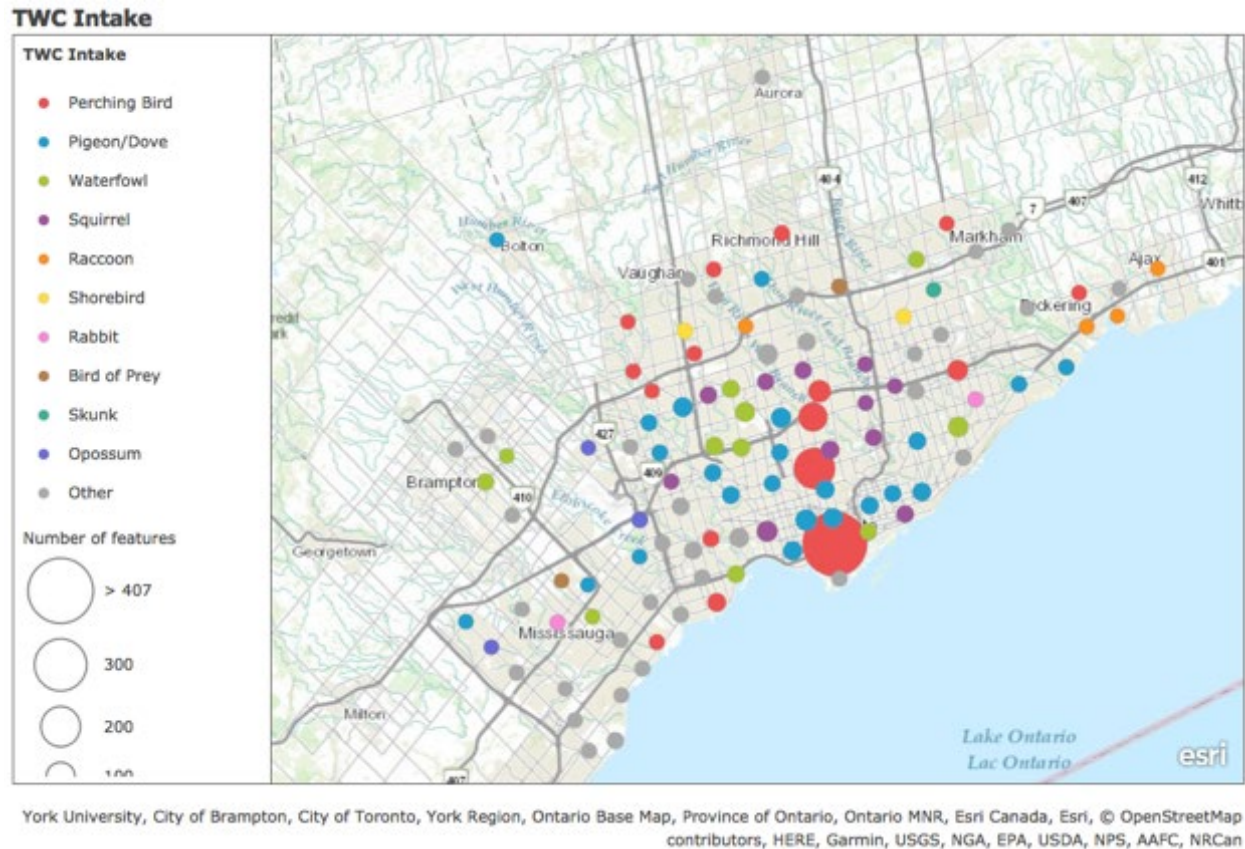


Figure 27 – Wildlife species admitted to TWC in 2010 shown by original location as clusters, GTA view

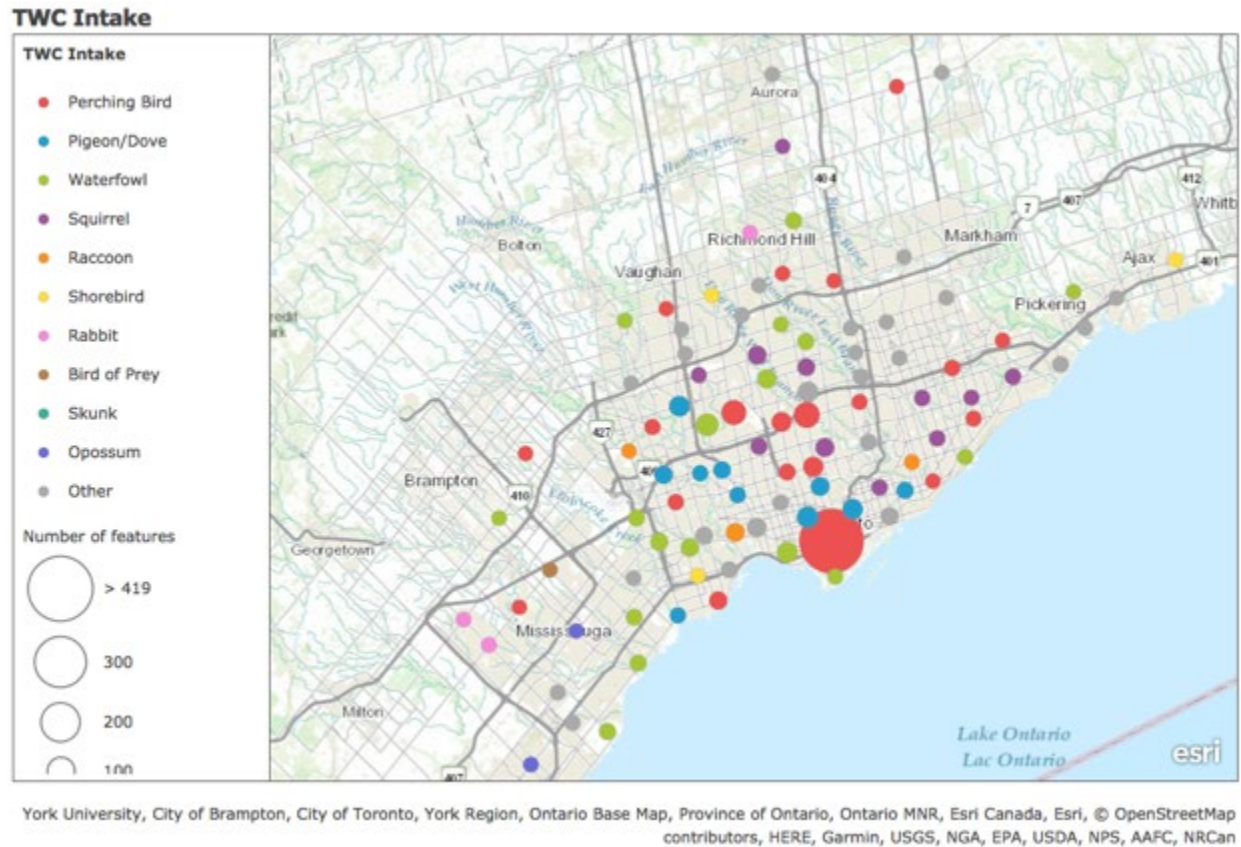


Figure 28 – Wildlife species admitted to TWC in 2011 shown by original location as clusters, GTA view

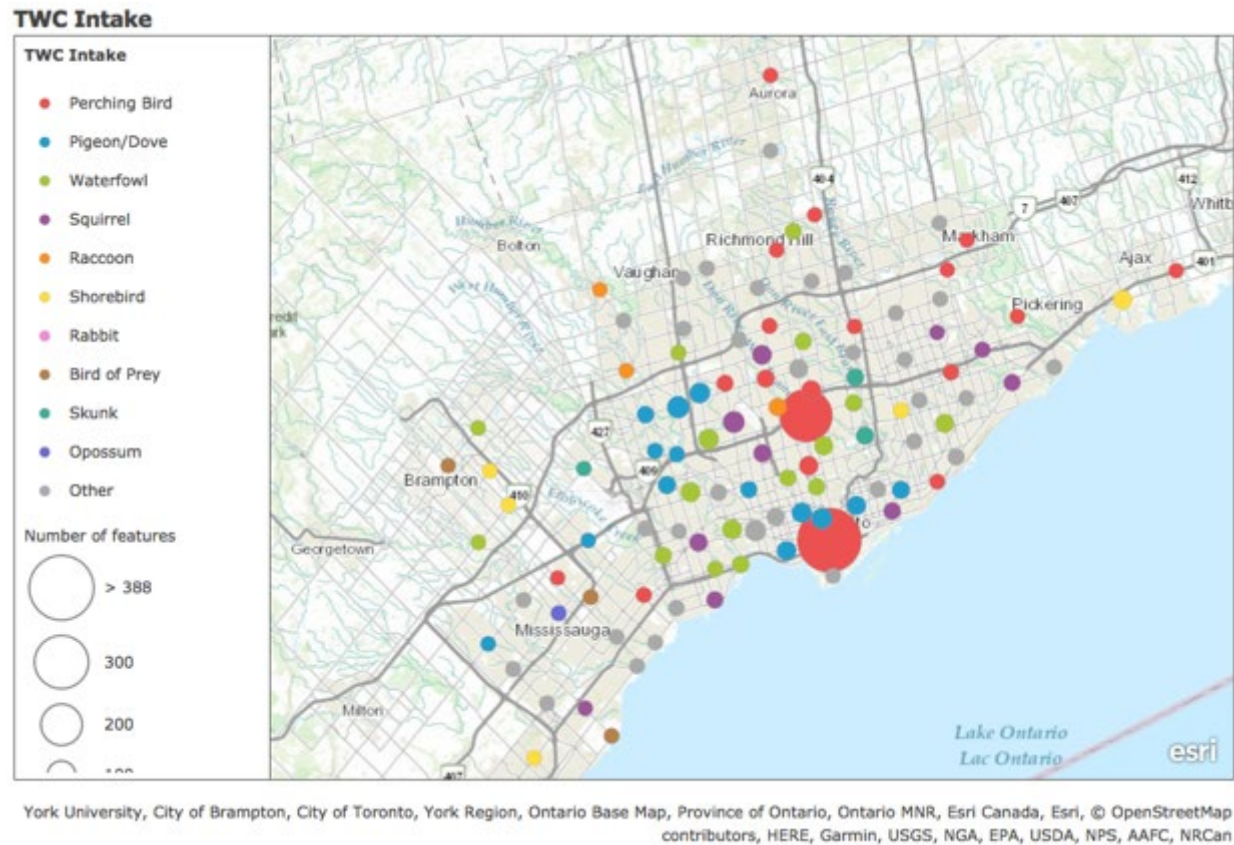
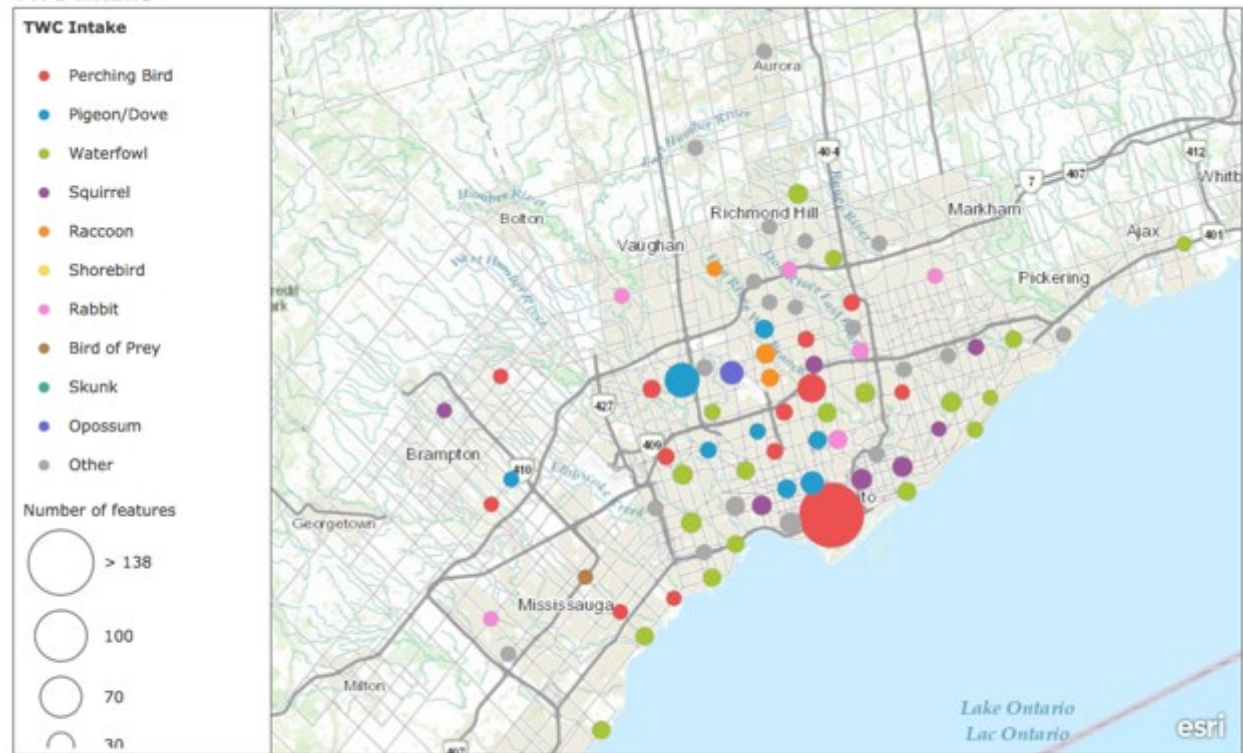


Figure 29 – Wildlife species admitted to TWC in 2012 shown by original location as clusters, GTA view

TWC Intake

York University, City of Brampton, City of Toronto, York Region, Ontario Base Map, Province of Ontario, Ontario MNR, Esri Canada, Esri, © OpenStreetMap contributors, HERE, Garmin, USGS, NGA, EPA, USDA, NPS, AAFC, NRCan

Figure 30 – Wildlife species admitted to TWC in 2013 shown by original location as clusters, GTA view