COYOTE WATCH CANADA

Monday, September 12, 2022

Dear Mayor, Council, and City Officials,

I write regarding a report by Burlington & Oakville Coyote Management (BOCM). The February 2022 report was submitted to the City of Burlington with the intent of it being added to the Council's agenda or as an addendum to a public report.

While Coyote Watch Canada encourages citizens to become involved in local issues related to wildlife, several claims made within this document regarding Coyote Watch Canada, our reputation, and our work, are of significant concern. This does not reflect the numerous points in the BOCM report with which we agree, and which we have recommended in the past.

Concerns Regarding BOCM Report

In their "Summary of Recommendations", the BOCM makes statements regarding Coyote Watch Canada that are demonstrably false. Examples of these claims are included herein.

On page 8, they write, "BOCM maintains that organizations such as Coyote Watch have propagated several untruths that need to be de-bunked. The first is that coyotes are an endangered species."

Coyote Watch Canada has never claimed that coyotes are an endangered species. They write that "the existence of coy wolves is refuted by organizations such as Coyote Watch who maintain that coyotes are comparatively small and weigh less than forty pounds."

Coyote Watch Canada has never said that coywolves do not exist, instead that they are the same canid as the Eastern Coyote. Extensive field evidence collected by reputable university research teams, government researchers, and other naturalists indicate that 14-18kg is an approximate average weight for Eastern Coyotes.

"Coyote Watch is predominantly a Niagara Region based advocacy group whose real agenda is neither research nor safeguarding the public, but rather, environmental advocacy. Unlike BOCM which is comprised entirely of local taxpayers and residents whose predominant concern is public safety Coyote Watch is intent on perpetuating an outdated narrative that is both dangerous and jeopardizes the health of residents and their pets."

Coyote Watch Canada is based in Niagara and has conducted extensive fieldwork, research, community outreach, and educational programs across Ontario and Canada. Our organization is advised by top-level researchers and run entirely by volunteers. While environmental advocacy is a component of promoting coexistence and healthy ecosystems, the primary goals of Coyote Watch Canada are education, community outreach, field response, and research. Our work, accomplishments, and information disputing the claims made by the BOCM are available on our website.

Sincerely,

Lesley Sampson
Executive Director, Coyote Watch Canada

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Municipal Canid Response Strategy

Document Purpose:

This document is intended to provide information that can be used when creating a Canid Response Strategy and accompanying organizational Standard Operating Procedure (SOP).

Document Format:

The document is a written response strategy that includes 3 appendices as follows:

Appendix A – Canid Management Response Guideline

This is a table that includes common situations involving humans and wild canids with suggested response to each situation.

Appendix B – Aversion Conditioning

This appendix contains detailed information on how to apply “aversion conditioning”, a term that is referenced in the strategy.

Appendix C – Canid-Safe Neighbourhood Checklist

This is a checklist that can be used by organizational staff and residents when investigating situations involving humans and wild canids. The purpose of the checklist is to determine causes or reasons for canid behaviour.

A field response team should receive formal training and have an action plan in place so they can take immediate action, without a lot of planning at the onset of an emergent situation. Fee-based training is available from Coyote Watch Canada.

Notes in bracketed italics are prompts for the reader/user and not meant to be part of the final document.

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Strategy:

(name of organization) response strategy adopts best practices and focuses on a multi-pronged approach:

1. **General education**
   Information about wild canids, will be made available to the public on social media in regular intervals, press releases, website and signage. The information will include the benefits of wild canids in communities and how they fit into the landscape with an emphasis on how humans should respond to a sighting of a wild canid.

   The goal of the provided information is to encourage appreciation for wild canids and inform people on how to act or behave upon sighting a wild canid. Fear is a common response to situations that people are not accustomed to or don't have knowledge about. Educational information can help to prevent a fearful reaction to a canid sighting and equip people with the knowledge they need to respond appropriately.
   Conversely, some people find reward in feeding wild canids and if this occurs on a regular basis, can cause the animals to behave unnaturally and, in rare cases, cause people or pets to be bitten.

   Educational information on wild canids will help people to understand that canids are wild animals which are not a threat to humans and should be appreciated from afar for the role they play in our environments and for the connection they provide for humans to the natural world. Human interference with a canid's typical routine or behaviour is likely to cause harm to the animal and to the community at large. When humans understand how to live among canids, difficult problems are prevented.

2. **Field response**

   Field response should be considered for specific situations that indicate an escalation in negative encounters. Some or all of the following actions may be necessary:
   - Accurate and complete record-keeping - important to determine the extent of the potential human-wildlife challenge. If there are numerous concerns from different residents in the same geographical area, an on-site investigation may be necessary.
   - Early intervention - key to preventing escalation of specific situations.
   - Investigation – detailed discussion should take place with those who have expressed concerns. Discussion should include gathering facts and information as well as one-on-one education on aversion conditioning, specific to the situation.
   - Physical investigation of the neighbourhood for potential community hotspots, listed in the Canid-Safe Neighbourhood Checklist (appendix C).
   - Door to door information campaigns to distribute print materials about canids in general, how to deter canids, pet safety and Canid-Safe Neighbourhood

- Checklist. During the distribution of materials, discussions with neighbours can occur to determine if there are known food sources in the area.
- If it can be determined that a person in the area is feeding canids, actions must be taken to stop this activity. *(Authority will vary by jurisdiction. If no enforcement is possible, a discussion with the feeder is necessary and a written request from the municipality to stop the feeding in the interest of public safety can also be issued.)*
- It is strongly recommended that a bylaw be enacted to prohibit the feeding of wild canids.
- Organize and advertise a community meeting – experts should be invited to speak and educate attendees.
- Refer to:
  Appendix A - Canid Management Response Guideline
  Appendix B - Aversion Conditioning
  Appendix C - Canid-Safe Neighbourhood Checklist for detailed information on neighbourhood field response to concerns about wild canids.

3. **Lethal Measures**

   The strategy allows for removal of a wild canid *only* if a bona fide health and safety risk to the public has been determined or if euthanasia is necessary for humane reasons. Removal methods include capture using a leg-hold trap or dispatch by firearm. In these cases *(name of organization)* will seek assistance from a licensed wildlife trapper or police services. Lethal response is considered as a last resort.

4. **Partnerships**
   Partnerships are crucial to provide opportunity for non-lethal, problem solving and solution-focused action planning.
   (Include list of potential partners i.e. Coyote Watch Canada, relevant Provincial Ministry, local licensed wildlife rehabilitator. Briefly describe the expertise of each partner)

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Appendix A

Canid Management Response Guideline

*This is a guideline and does not account for variables that can occur in specific situations.

Description of Situation	Response
Canid heard or seen moving through an area OR Canid seen resting or lingering in parkland or ravine	• Conversation on telephone or in person to educate on typical canid behaviour and habitat
Canid following/approaching a person (this behaviour is commonly referred to as "shadowing" or "escorting" and is often seen when the person is accompanied by a dog, but may happen without a dog's presence) OR Canid biting unleashed dog	• If a dog is accompanying the person and is unleashed, educate dog caregiver about the importance of leashing dog and controlling dog's behaviour • Recommend aversion conditioning if appropriate (see appendix B) • Ask investigative questions and use observations to determine if feeding or food attractants may be in the area • If occurring in residential area, recommend use of Canid-Safe checklist
Canid biting leashed dog	• Recommend aversion conditioning if appropriate (see appendix B) • Ask investigative questions and use observations to determine if feeding or food attractants may be in the area • If occurring in residential area, refer to and recommend use of Canid-Safe checklist for on-site or in-field investigation purposes • Educate dog caregiver on walking dog in areas where there are other people and dogs • Assess area for possible canid den or young • If young canids are in the area, assess need for taping off the area, if practical
Canid seen resting or lingering in residential neighbourhood	• Conversation in-person to educate on typical canid behaviour and habitat. • Ask investigative questions and use observations to determine if feeding or food attractants may be in the area • Recommend use of Canid-Safe checklist • Recommend aversion conditioning if/when canid is resting or lingering on or near residential property • Track further concerns from same area for future reference.
Multiple sightings of canid resting or lingering in residential neighbourhood,	• Door to door distribution of education materials and Canid-Safe checklist • Recommend aversion conditioning

including canid entering yards with or without pets	• Discussion and investigative questions with residents to determine why the canid is entering yards and if there are potential feeding or food sources • Observe/educate neighbourhood businesses with improperly stored garbage • Check nearby parks, golf courses, cemeteries etc. for evidence of feeding • Organize community meeting for educational purposes • Continue to track concerns and complaints from area
Canid biting or injuring a person	• Confirm bite visually or by photograph • Identify and gather information on specific canid involved and circumstances around the bite • Provide all information resources, including Canid-Safe Checklist and aversion conditioning techniques • Report to local police authorities and consult with wildlife partners • Consider necessity and options for removal of canid • Contact 911 in case of immediate threat or danger

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Appendix B

Keeping Canids Away: Aversion Conditioning

Aversion Conditioning is an effective tool for building healthy boundaries between humans and wild canids. It is important to note that using aversion conditioning close to a den site or with young pups is not appropriate. Canid seasonal milestones must be accommodated so the parents are able to raise their pups in a way that helps them disperse when they are old enough. **If situations arise where there is a den or a rendezvous site, it may become necessary to temporarily restrict dogs and/or humans from that area.**

- Aversion conditioning (commonly called “humane hazing”) is a method of negative association that **safely compels wildlife such as coyotes, foxes or wolves to move away from humans**, sometimes through the use of deterrents

- **Aversion conditioning has been used with great success around the world** with many species, including bears and tigers

- Aversion conditioning can restore a coyote’s natural avoidance of humans and minimize interactions. **Communities that employ these techniques experience measurable results** while educating and empowering citizens

- For communities experiencing regular canid sightings in identified hot spots, patience is required. **Intensive and consistent action may be required to encourage the canid to move on entirely.** Teams can be trained to respond to calls, communicate with residents, and utilize more intensive techniques if needed

- Remember that **each canid has a different “food education”: some canids have been taught that people (and their properties) will provide food** (e.g., direct feeding, compost bins, bird feeders, or cat and dog food left outside)

- Aversion conditioning can effectively **change canid behaviour and can help to ensure that future canids do not develop these behaviours**

Always Put Safety First

- Never run from any canid, including dogs, foxes, coyotes and wolves
- Never corner a wild animal; always provide an escape route
- Never approach a sick or injured canid
- Seasonal milestones dictate response in field (e.g., never approach den area or rendezvous site when doing aversion conditioning)

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Basic Aversion Conditioning Techniques

- **Stand tall, make yourself big, wave your arms and shout** (don't scream) while stepping in the direction of the canid until he or she runs away
- **Clap your hands** in front of you and above your head
- **Alternate gestures and be firm**
- **Use a noisemaker**, such as:
    - your voice
    - an air horn or whistle
    - pots and pans banged together
    - a shake can (such as a pop can filled with coins or pebbles)
    - snapping a large plastic garbage bag
    - jingling keys, or
    - an umbrella popping open and closed

- **Use a projectile (toward, not AT the canid)**, such as:
    - sticks
    - clumps of dirt
    - small rocks, or
    - a tennis ball

- **During warm months, use liquids**, such as:
    - a garden hose
    - a water gun, or
    - water balloons

Note: a canid that has never been exposed to aversion conditioning techniques before may not leave immediately. You may need to use more than one of the above-mentioned deterrents. If the canid runs a short distance, stops, and turns to look at you, continue your aversion conditioning actions until the canid has left the area.

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Appendix C

Canid-Safe Neighbourhood Checklist

Review and share information resources:

☐ Coyote Watch Canada website:
- Watch e-Learning module (created in partnership with City of Toronto) and include your family.
- Review all content on the Resources tab

☐ Discuss canids and canid safety with your children

☐ Share/circulate information with your neighbours, property manager or landlord

☐ Learn aversion techniques and be ready to use them
- keep a large garbage bag in your pocket

Property:

☐ Storage of garbage, green bin and blue bin materials
- To the curb on the morning of scheduled pick-up day
- Store indoors or in locked containers – ensure lids are secure
- Call your municipality if bins are damaged and need to be replaced

☐ Compost
- Don't compost meat, bones or dairy (these are green bin items)
- Secure compost bin into the ground and enclose top with metal mesh
- If rodents visit your compost, use green bin instead (rodents are prey for and attract canids)

☐ Barbeques
- Clean and cover barbeques after use
- Ensure drip-tray is cleaned

☐ Feeding animals
- Any/all food outside can attract canids
- Never feed wild mammals and don't feed pets outside
- Clean up daily under bird feeders – seed on the ground attracts rodents which attract canids
- If canids visit your yard or are seen daily in your neighbourhood, consider removing bird feeders and bird baths until there are less canid sightings

☐ Shelter and hiding spots

- Keep grass mowed – long grass provides cover for canids
- Clean up brush piles and debris on property
- Keep fencing, decks and sheds in good repair. Remove or replace structures that can't be repaired
- Trim bushes and lower branches from evergreen trees to reduce hiding places
- Check in and behind structures and bushes before letting pets outside

☐ Pets

- Closely supervise pets while they are outside in your yard, ground-floor balcony or patio. Keep cats inside or in enclosed areas. Do not leave pets unattended
- Canids can jump over or dig under fences. Check fences for holes dug under them and if found, fill them in and repair them
- Remove pet feces from your yard immediately
- Consider installing "coyote rollers" on the top of your fence. Information on coyote rollers can be found on the internet
- Ensure property is well lit at night and check darkened areas prior to letting pets outside.
- Ensure chicken coops are clean and predator-proof
- Keep dogs on leash in parks and other public property

☐ Garden and Fruit Trees

- Canids eat fruit – ensure fallen fruit from trees is picked up from the ground daily
- Vegetable gardens attract rabbits and squirrels which are prey for canids. Ensure vegetable gardens are wildlife-proofed as much as possible

Neighbourhood and Public Spaces:

☐ Feeding of Canids

- Contact your municipality to make a confidential report of deliberate or indirect feeding of canids and other mammals
- If you find food being left for wildlife in a park or other private property, consider disposing of the food in the garbage. If feeding seems significant, contact your municipality to report
- If food appears to contain a possibly toxic substance, call police immediately

☐ Improperly stored garbage – Commercial or Residential

- If you notice that canids are being attracted to improperly stored garbage at residential communal garbage areas or commercial buildings, contact your municipality to report

☐ Potential community hotspots – contact your municipality if you identify activity that could align with direct or indirect human feeding of wildlife:

- Cemetery
- Parklands – especially picnic areas and benches
- Construction sites
- Hydro corridors
- Conservation areas
- Bike paths and trails

- School yards
- Parking lots – can be in parks, industrial properties or shopping malls
- Golf courses
- Ravines
- Industrial sites – active and inactive
- Derelict or abandoned properties
- Waterfront or beaches
- Camping, picnic, or encampment sites
- Rural pastures with deadstock/animals

This checklist was modified from Toronto Animal Services' "Coyote-Safe Neighbourhood Checklist".

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Notes on Field Rescue and Outreach:

Wild canids may require assistance due to illness or injury, anytime throughout the year. The ability to intervene can be greatly impacted during the spring and summer months. In late winter, wild canids are preparing to have families. In January/February, females may be pregnant, by March/April, babies are arriving. (Refer to infographic on Seasonal Milestones)

Coyotes mate for life when left to thrive, and they co-parent their young. Babies depend on both parents for food, protection, and important life lessons about how to survive and thrive in a very dangerous world and survival readiness is a months-long process. We need to ensure that removing canids from their environment to receive intervention is absolutely necessary during the spring and summer months, thus collaborating with experts is a key factor.

There may very well be an entire family depending on the canid in question. There may be babies waiting for their mother to return so they can nurse, or a tired nursing mother waiting for her partner to bring food to nourish her while she nourishes their young. While it is difficult to see animals in trouble, it's important that we step back and ask how we can best serve each animal. Every case requires careful assessment and sometimes a challenging amount of patience.

It's important to work with a reputable wildlife rehabilitator and/or organizations, such as Coyote Watch Canada, to evaluate the urgency of each animal's condition. Some animals require urgent, life-saving medical care, but others may be best helped when humans step back, allow families to remain intact, and monitor from a distance. This is referred to as "mindful monitoring" and these cases should still be considered active. It's possible to rely on engaged members of the public to provide regular sighting reports so the animal's condition can be monitored, and the outreach approach modified if needed.

Wildlife rescue requires front line responders to consider and respect the needs and wildness of the animals that potentially need help. This is not always an easy process. It is vital to have a "big picture" assessment to determine when to intervene versus when to provide mindful monitoring (e.g. using trail cameras to gain better insight). This process requires a great deal of patience, knowledge, and experience.

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Diagrams

These infographics are provided in PDF format for incorporation into your Canid Response Strategy as reference guides:

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Guideline for Report to Municipal Councils

Document Purpose:

This document covers points that can be included in a report to municipal councils when developing a formal Canid Response Strategy. A formal strategy will assist municipalities with developing an appropriate and effective wild canid (including foxes, coyotes, and wolves) response strategy that aligns with specific and common situations that can occur in large and small municipalities and jurisdictions. An effective response strategy is ecologically and socially complex and is specific to the context of each emergent situation. The document provides for the following:

- Accessible and inclusive collaboration with all demographics, including opportunities for engagement with Indigenous elders, leaders, and communities
- A living framework that allows for policy review and revision as needed
- A streamlined document that provides a foundation for policy that reflects current science and best practice field methodology, within a municipal framework
- Preparedness for human/canid interactions. The report guideline is applicable to all wild canids in Canada and can be modified to specify one, two or all canid species
- A goal that moves beyond the absence of human/wildlife conflict and towards a willingness to share spaces with wild canids appropriately and to appreciate the natural elements in the environment
- A general or broad view of the ecological role of wild canids in our communities, as well as addressing specific situations that are challenging at site-specific locations
- A strategy that is specific to context of each emergent situation

Document Format:

For the purposes of this document, the format contains headings which can be modified based on what is required for specific municipalities. The information under the headings is transferrable. The format is as follows:

Introduction – briefly describes the subject of the report and general situations or circumstances that sometimes occur.

Issue Background - describes the subject in more detail and includes what is happening in your community.

Comments – includes results of research into the subject and what actions are proposed to respond.

Notes in bracketed italics are prompts for the reader/user and not meant to be part of the sample report.

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Introduction

Municipal/Community Canid Response Strategy

Canids are a natural part of the urban landscape in every municipality in North America, including *(insert name of your municipality)*. Park-like valleys and natural areas make a very attractive habitat for canids. Food and shelter are also abundant and natural predators are limited. Canids perform an important role in maintaining the ecosystem, helping to control the populations of rabbits, rats and other rodents, and geese.

Canids are rarely a threat to people. As an example, research indicates that an average of 2.4 people per year are scratched or bitten by coyotes in Canada, compared to 460,000 dog bites that occur per year. (Statistics Canada, 2009). There was a recent situation in British Columbia's Stanley Park where a number of coyotes were removed because they had bitten people. This situation is considered unique and is not expected to become commonplace.

The International Union for Conservation of Nature, Species Survival Commission, describes human-wildlife conflict as *"struggles that emerge when the presence or behaviour of wildlife poses actual or perceived, direct and recurring threat to human interests or needs, leading to disagreements between groups of people and negative impacts on people and/or wildlife"*

When these situations occur and become escalated, they often require extensive human resources from city staff and partners to resolve. Conflict between neighbours can linger as a result. Therefore, the emphasis of this strategy is on prevention of heightened situations.

Research and experience have demonstrated that the most important actions that municipalities can take to reduce negative human interaction with canids are education and prevention. Other methods (such as removal) have proven ineffective and/or unsafe in urban environments.

Issue Background

(The following statement can be used if applicable or if a bite to a human took place, include the number of incidences.) In the last decade, there have been no reported instances of canids biting people in (*insert name of your municipality).* Canids are adaptable animals and thrive in rural and urban environments. Although they rarely pose a threat to humans, many people are scared or nervous when they see a fox, coyote or wolf *(specify the relevant species)*. Canids will usually develop a tolerance to closer proximity with humans when they are being fed by people. Deliberate and inadvertent feeding of canids has become a common human activity which must be addressed to resolve human/canid conflict.

When canids are encouraged to develop a tolerance of closer proximity to humans, there is an increased risk for negative encounters. Proximity tolerance makes some people very uneasy and can lead to conflicts with pets in or near residential neighbourhoods. Canids will sometimes prey on outdoor, roaming cats and can have negative encounters with dogs. Conflicts with domestic dogs can also occur outside of residential neighbourhoods and are usually caused by dogs that are off-leash and not appropriately supervised in an area where canids live, such as a park or a ravine. One study, done by Dr. Shelley Alexander, PhD, University of Calgary, found

that in Canadian print media, dogs were off leash in 92.3% of incidents between dogs and coyotes [link to abstract] *(Consider including statistics relevant to your municipality on the number of dog/canid conflicts, where they took place, how many dogs were off leash on public property etc.)*

Comments

Best Practices

(Include results of jurisdictional scan. If applicable, consider using the following information)

The scan demonstrated that the most effective methods for reducing human-canid interactions include public education and the removal of canid attractants, such as food. The feeding of canids can be deliberate or inadvertent. Overflowing or carelessly stored garbage can attract smaller rodents such as mice and rats, which in turn attract canids. As a result, most public education campaigns on canids aim to raise awareness about food attractants, include instructions on how to canid-proof properties and what to do during a canid encounter. (*Include information on any bylaws that would prohibit feeding of canids or wildlife in general, if any)*

Beyond the removal of canid attractants such as food, and public education, other methods applied for managing canids have proven ineffective in urban environments. These methods include relocation, trapping and hunting. (*Include any information on provincial statutes governing these activities)*

The relocation of canids from urban areas is impractical and will not offer a permanent solution. Canids are mobile and territorial animals. They can travel great distances to return to their original home. Relocation could also inflict the canid's problem behaviour on another community. Relocation of a canid requires that it be caught first. Canids are extremely intelligent animals that generally will not enter a box trap (this is the type of trap that is baited with food, which when eaten, trips a door to close, trapping the animal inside). Other capture methods include use of firearms or leg-hold traps. These methods can be dangerous to people and domestic pets in urban areas. Furthermore, when large numbers of wild animals are removed from an area, the animals quickly repopulate by producing larger litters and expanding their range if there is suitable habitat. For these reasons, efforts to remove canids from some urban areas in the U.S. have been futile.

Proposed Canid Response Strategy

The four cornerstones of an effective wildlife response strategy are: prevention, education, investigation, and enforcement. The following strategy includes actions that align with the four cornerstones.

- Residents can report canid and related human activities to the municipality
- Reports will be tracked by geographical area to determine if there is a specific canid or a group of canids that seems to have developed proximity tolerance to humans

- Municipality will respond appropriately based on the available information and the degree of potential impact the canid behaviour has on the community
- *Emphasis is on early response* to resolve issues before they become heightened or are mischaracterized on social media or other publications
- Municipality will respond with one or more of the following actions, depending on the situation:
    - Community meeting – can be done in person or remotely
    - Door-door information provided in neighbourhood
    - Mail-outs of educational material to residents in neighbourhood
    - Information on website and social media platforms
    - Investigation of potential feeding sites and identification of potential feeder(s) – this will include information gathering during discussion with neighbourhood residents and physical observations
    - Enforcement of by-law infractions
      (OR if no by-law exists)
    - Issue a written request to the person feeding canids to reinforce the importance of why their behaviour must stop, including public and pet safety as well as welfare of the canid.

Partnerships

Working with local wildlife experts, such as Coyote Watch Canada and licensed wildlife rehabilitators offers important added value to any Canid Response Strategy. Consulting with experts will help municipal staff to navigate the nuances of wild canid behaviour. Canids are very adaptable and quickly learn how to respond to what is in their environment. Consultation with experts is necessary to determine how to respond to an escalated situation.

Engagement with Indigenous communities in the early stages of planning wildlife strategies provides for opportunities to share information and ideas, note any concerns and explore cultural connections. *(Include specific results of the engagement, if any)*

(*insert name of your municipality*) Canid Response Strategy aligns with best practices in urban canid management. Providing long-term solutions and factual information to residents usually alleviates conflict, fear and misperceptions regarding canids. These policies are reinforced by expert partnerships and increased coordination with emergency responders to reduce negative interactions between residents and canids.

Collaboration with neighbouring municipalities is crucial where canids are living on or near a geographical border. Actions taken to address a situation must occur in both municipalities to be effective.

Lethal Measures

While the strategy includes possible removal of a canid, this should only occur if there is a bona fide health and safety risk to the public and/or for humane reasons. Removal methods include

capture using current equipment, or dispatch by firearm. In these cases, municipalities can seek assistance from wildlife experts, such as a licensed trapper or rehabilitator, and police services if removal requires use of a firearm. (*Including police in the strategy requires consultation and agreement)*

Although there are no feasible alternatives to capture a canid without including the option to use firearms when necessary, the lethal response is considered as a last resort. Municipal Animal Services are not armed, and their efforts are focused on educating the public on how to minimize negative interactions with canids.

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Advancing best practices for aversion conditioning (humane hazing) to mitigate human–coyote conflicts in urban areas

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Abstract: Coyotes (*Canis latrans*) are now recognized as a permanent feature in urban environments across much of North America. Behavioral aversion conditioning, or humane hazing, is increasingly advocated as an effective and compassionate alternative to wildlife management strategies, such as trap and removal. Given a growing public interest in humane hazing, there is a need to synthesize the science regarding methods, outcomes, efficacy, and other relevant considerations to better manage human–coyote conflicts in urban areas. This paper was prepared as an outcome of a workshop held in July 2019 by Coyote Watch Canada (CWC) to synthesize the literature on aversion conditioning. The paper also includes the deployment experiences of members of the CWC Canid Response Team. Herein, we propose best practices to enhance the efficacy of aversion conditioning for the management of urban wildlife, particularly coyotes. We detail recommendations concerning: the importance of consistency, adaptability, humaneness, and clear goals; training and proactive implementation; and the need for a comprehensive wildlife coexistence program. We further detail additional considerations surrounding domestic dogs (*C. lupus familiaris*), public perceptions, and defining behavior and conflict. We hope this synthesis will assist wildlife managers and local governments in identifying and deploying nonlethal human–coyote conflict mitigation strategies that are effective, humane, and community supported.

Key words: aversion conditioning, canid, *Canis latrans*, coyote, human–wildlife conflict, humane hazing, nonlethal, urban wildlife management

Coyotes (*Canis latrans*; Figure 1) are increasingly recognized as a permanent feature of urban environments across much of North America (Hody and Kays 2018). As highly adaptable generalist omnivores, they are proficient foragers who make use of a range of natural and anthropogenic foods within cities (Gehrt et al. 2011, Murray et al. 2015, Poessel et al. 2017). Heightened public awareness of their presence and concern over the potential for negative interactions, especially with domestic pets, have increased community interest and the dialogue surrounding human–coyote conflict (Alexander and Quinn 2011, Elliot et al. 2016, Draheim et al. 2019). At the same time, the public may be increasingly concerned with the use of lethal control options, which have been the status quo for managing predators and other "nuisance" wildlife (Messmer et al. 1997*a*, Wittmann et al. 1998, Messmer et al. 1999, Martínez-Espiñeira 2006, Jackman and Rutberg 2015). In addition to public perceptions, there are ethical, scientific, and legal considerations affecting the use of lethal control options in urban environments (e.g., Sterling et al. 1983, Messmer et al. 1997*b*, Treves and Karanth 2003, Treves et al. 2016, Bergstrom 2017).

Concomitantly, behavioral aversion conditioning, also termed humane hazing, is increasingly advocated as an effective and compassionate alternative to wildlife management strategies such as trap and removal (involving translocation or lethal interventions; Shivik 2004, Bonnell and Breck 2017, Breck et al. 2017). Bonnell and Breck (2017, 147) defined aversion conditioning as "deliberate negative conditioning. A training method that employs immediate use of deterrents or negative stimulus to move an animal out of an area, away from a person or discourage an undesirable behavior or activity. Hazing is conducted to sensitize coyotes to the presence of humans or human spaces such as backyards and play spaces. Hazing does not harm animals, humans, or property."

Among the approaches commonly termed hazing, there are a number of competing definitions. Project Coyote (n.d.) differentiates between passive hazing, or making an area

Figure 1. A mother eastern coyote (*Canis latrans*) feeds her pups in a residential backyard in the city of London, Ontario, Canada (*photo by J. Merner for Coyote Watch Canada*).

unsuitable for coyotes (i.e., habitat modification, attractant removal, deterrents), and active hazing, or responding to coyote activity to reshape their behaviors and create avoidance. Breck et al. (2017) stated that nonlethal (as well as lethal) approaches also may be either proactive or reactive. In proactive hazing, all coyotes in an area are conditioned to avoid interactions with humans prior to any specific concerns. Conversely, reactive hazing targets specific individuals who have already started to demonstrate behaviors that are viewed as undesirable by the community. The coyote management and coexistence plan in Chicago, Illinois, USA (Chicago Animal Care and Control n.d.) differentiates between basic hazing, in which residents routinely appear "big and loud" to scare coyotes away, versus high-intensity hazing, in which trained professionals respond to particular incidents using a variety of tools such as projectiles or pepper spray. A number of additional deterrent strategies are employed in rural settings, including flandry, conditioned taste aversion, and guard animals, but are either less implementable or have yet to be explored in urban settings (Shivik and Martin 2000, Shivik 2004, Parr et al. 2017).

Despite increased public interest in the use of hazing to manage human–coyote conflicts, the evidence available regarding the methods, outcomes, efficacy, and relevant considerations is conflicting and poorly supported (Shivik 2004, Grant et al. 2011, Bonnell and Breck 2017, Breck et al. 2017). The lack of published data on the efficacy of aversion conditioning and the factors that influence its success have been used to argue against the widespread implementation of nonlethal conflict-mitigation strategies (e.g., Brady 2016). However, studies that report mixed results of hazing efficacy have acknowledged limitations, including: (1) difficulty in quantifying coyote behavioral responses to hazing; (2) no standard approach for assuring and assessing the competency of those administering the treatment, especially if conducted by members of the lay public; (3) difficulty in relating short-term behavioral responses of coyotes to long-term changes in behavioral patterns; and (4) pronounced differences between treatment and control sites that likely confound study results (Bonnell and Breck 2017, Breck et al. 2017).

As local governments and wildlife managers attempt to develop human–wildlife conflict mitigation strategies that are effective, humane, and community supported, there is a need for guidance regarding if and how aversion conditioning can be successfully implemented as a nonlethal response strategy (Young et al. 2019).

To respond to this need, in July 2019 Coyote Watch Canada (CWC) convened an Aversion Conditioning Best Practices Workshop to discuss existing evidence and recommendations on aversion conditioning. Coyote Watch Canada is a community-based and volunteer-driven federal not-for-profit wildlife organization that collaborates with a broad range of stakeholders to develop and implement nonlethal human–wildlife conflict solutions. We have demonstrated success in facilitating the development and implementation of sustainable, effective, and compassionate wildlife coexistence programs, with a focus on canids (coyotes and foxes). We provide: multilevel educational programming; private, municipal, and provincial level consultation; on-site and in-office training; and support for municipal wildlife conflict mitigation policy development. Our methods are field tested and have evolved through decades of implementation and experimentation. Our longest-running program is in the Niagara Region of Ontario, Canada, which after over a decade of collaboration now represents a flagship model for our Wildlife Strategy Framework (City of Niagara Falls n.d.; Coyote Watch Canada n.d., 2013).

Workshop participants included research-

Table 1. Terms used and the results of a Google Scholar search to compile literature on aversion conditioning for coyote (*Canis latrans*) management published between 2000 and 2019, Coyote Watch Canada, St. Davids, Ontario, Canada.

Search term	Date range	Results yielded	Results pages scanned	Papers included
Coyote "aversion conditioning"	Since 2000	283	10	2
Coyote "aversive conditioning"	Since 2000	556	10	12
Coyote hazing	Since 2000	903	10	4
Coyote deterrent	Since 2000	3,460	10	1
Coyote repellant	Since 2000	2,170	10	1
Coyote haze	Since 2000	4,290	10	0
Coyote harass	Since 2000	2,340	10	3
Coyote harassment	Since 2000	3,900	10	2
Coyote nonlethal	Since 2000	3,030	10	1
Mined from reference lists	Since 2000	N/A	N/A	2

ers and members of the CWC Canid Response Teams (CRTs). The CRTs consist of volunteers trained in CWC's field-tested methodology who consult and collaborate to implement on-the-ground response such as investigation, rescue, and conflict resolution. Team members have a combined total of >35 years of experience in implementing humane wildlife strategies. The CRTs provide on-site investigation, wildlife rescue and release assistance, and assessment and mitigation directives, including deployment of aversion conditioning.

In this paper, we synthesize the results of the 2019 workshop with contemporary literature to advance a set of recommendations and considerations (i.e., best practices) for using aversion conditioning as a nonlethal management tool for mitigating human–coyote conflicts in urban areas. We briefly describe the methods employed to generate coyote aversive hazing best practices, relay the key recommendations in terms of the what, when, who, and how of implementing aversion conditioning for urban canid management, and conclude by describing additional relevant considerations concerning domestic dogs (*C. lupus familiaris*), public perceptions, and defining behavior and conflict.

Table 2. Coding nodes (themes) employed in NVivo 12 coding of 2019 peer-reviewed and gray literature search results on aversion conditioning for coyotes (*Canis latrans*). Emergent codes in italics. Coyote Watch Canada, St. Davids, Ontario, Canada.

Primary nodes	Secondary nodes
Considerations	Humane Geography Public safety Pups/den Other
Definition	
Dogs	
Failure	
Food attractants	
Gaps	
Limitations	
Noise	
Projectiles	
Recommendations	
Visual	
Other	

Methods

To conduct the literature review, we compiled peer-reviewed sources using the Google Scholar search engine. We included only sources published since the year 2000, as we aimed to synthesize recent literature reflective of the current state of knowledge on aversion conditioning. We detailed search parameters and results (Table 1). We reviewed reference lists of included articles to identify further sources that aligned with the search. Combined methods yielded 27 unique articles.

Table 3. Summary of best practices for aversion conditioning (humane hazing) to mitigate human–coyote (*Canis latrans*) conflicts in urban areas.

Aversion conditioning methods should be adaptable, humane, and applied consistently. We recommend the garbage bag method and do not support the use of dogs (*Canis familiaris*) or projectiles in hazing.
All members of the public should be encouraged to implement basic hazing techniques where appropriate, but high-intensity hazing involving targeted responses to hotspots should only be conducted by personnel who have been trained by someone with firsthand experience deploying the methodology.
Mitigation measures should be implemented proactively, rather than reacting to escalating conflict scenarios, and after investigating the circumstances and planning the most effective response.
Aversion conditioning should not be implemented in isolation, but rather as part of a comprehensive wildlife coexistence program that attends to the 4 cornerstones of investigation, education, enforcement, and prevention.
Coyote management goals should be clearly defined, approaches consistently deployed, and effects monitored to measure efficacy based on an agreed upon definition of success.
Interactions between coyotes and domestic dogs should not be classified as "conflict," and efforts should be made to educate and enforce responsible pet practices, including not allowing dogs to roam freely in wildlife areas. It should be acknowledged that hazing may be less effective when domestic dogs are present, and the priority should be to remove the dog from areas where coyotes may be denning.
When implementing aversion conditioning, public outreach and education should prioritize ensuring that residents understand the purpose of hazing as a humane wildlife response tool and that it not inadvertently validate unnecessary and inappropriately high levels of wildlife harassment.
"Proximity tolerance" should replace "habituation" in wildlife research, management, and policy vocabularies.
Nonlethal interventions such as aversion conditioning should be seen as an appropriate response and mitigation tool for coyotes engaging in any behavior that is deemed undesirable by the community.

Secondly, we identified relevant gray literature by first searching for "coyote humane hazing" and "coyote aversion conditioning" in the Google search engine. This search identified possibly useful organizations and locales with relevant recommendations or other documents on aversion conditioning. This search resulted in the following secondary searches: "project coyote," "Stanley park coyote," "city of Calgary coyote," "San Francisco coyote," "Chicago coyote management and coexistence plan," and "humane society coyote hazing guidelines." Searches resulted in 5 unique documents for coding.

We analyzed the documents generated by our searches by qualitative coding in QSR International's NVivo (QSR International Pty Ltd., Version 12, 2018). We established nodes (themes) *a priori* and others emerged as the data were analyzed. Nodes included: considerations, definitions, failures, gaps, limitations, and recommendations as well as specific approaches (dogs, noise, projectiles, visual; Table 2).

We synthesized literature review findings into a workshop package, which was distributed to participants in advance of the workshop. The 1-day workshop consisted of 2 parts, each with distinct goals: (1) to draft a set of best practices; and (2) to discuss the tensions, gaps, and responses to existing literature and recommendations. There were 7 workshop participants with >35 combined years of experience in deploying response protocols to reshape interactions with canids, including aversion conditioning techniques. We present key best practice recommendations and additional considerations (Table 3).

Results

What: rigorous methods that are consistent, adaptable, and humane

In terms of what constitutes effective aversion conditioning, methods should be consistent, humane, deliver clear messaging, and be flexible in adapting to novel scenarios. Many

Figure 2. A member of Coyote Watch Canada demonstrates the garbage bag method (*photo by Coyote Watch Canada*).

sources note that hazing must be applied consistently and persistently to be effective (Timm et al. 2004, Grant et al. 2011), and our experience supports this. If it is only performed by 1 or 2 individuals in a neighborhood while other residents continue to make their property or company comfortable and appealing to coyotes, this mixed messaging risks eliciting poor results. Targeted education campaigns within community hotspots are therefore critical in terms of ensuring residents work together to apply mitigation measures consistently. There is evidence that domestic dogs can differentiate humans both by scent (Schoon and De Bruin 1994) and visually (Huber et al. 2013). Anecdotal observations from our CRTs and in the literature (Grant et al. 2011) similarly suggest that coyotes can recognize individual humans, and therefore if there are only the same few individuals hazing, coyotes may learn to avoid only them. Where aversion conditioning is being conducted by individuals in a professional role who wear a uniform (e.g., animal control, humane society, police), we will at times recommend that officers practice aversion conditioning without the uniform if the coyote has adapted to responding to those in uniform but does not act in a consistent manner with members of the public.

Aversion conditioning is not a specific method, but rather a collection of interventions designed for a certain aim: to communicate to coyotes to move and/or stay away; it is a toolkit of actions and gestures designed to maintain healthy boundaries between wildlife and humans. A wide variety of stimuli have been employed and can be successful (e.g., shaker cans, umbrellas, garbage bags). Generally, deployment involves using one's body along with additional visual or auditory stimuli or tools to send a clear message. The key to success lies not in the specific tool used, but rather the intention of the deployer, effective communication, and persistence. Clear messaging is integral to communicating effectively with canids. In domestic dog training, body language and gestural communication are key and are more effective than visual or auditory communication alone (D'Aniello et al. 2016, Scandurra et al. 2017). Thus, yelling at a coyote from a window may not always be effective, and physically advancing toward the coyote with purpose is often required. What works in 1 situation may not be effective in another (Grant et al. 2011), so some degree of persistence and adaptability may be required. Because each coyote will have a different history and there may be inherent differences in behavior, not all coyotes will respond similarly to the same stimuli. Efficacy requires creativity, flexibility, and innovation, along with skills to analyze the context and respond accordingly, which is why we emphasize the importance of experience and training in the following section.

One technique CWC frequently recommends is the garbage bag method (Figure 2). Quite simply, it involves unfurling and rapidly snapping a large, air-filled garbage bag loudly. It can be accompanied by walking toward the coyote and using a firm, loud voice to encourage the coyote to move away. Benefits of this method include: coyotes are often averse to loud and unfamiliar noises (Darrow and Shivik 2009), and this, if done properly, can be quite dramatic; and unlike whistles or airhorns, this method has the added benefit of providing a visual stimulus, which is why we recommend a black or green garbage bag rather than clear. It creates a visual barrier, and shiny billowing plastic can be an alarming sight to an animal. Finally, it is accessible and simple to carry and use. While other methods might have a similar effect, such as popping open an umbrella, garbage bags can fit easily into your pocket, are inexpensive, and are available anywhere. This method can be easily used by any member of

the public regardless of age or ability. It has been used extensively in the communities in which we work, both by members of our team, first responders (animal control or services, bylaw, humane society, law enforcement, etc.), and the public, achieving the desired outcome (e.g., immediate: the coyote is redirected out of the area in an encounter; long-term: coyote behavior is reshaped to avoidance, leading to a reduction in coyote complaints in an area).

Concerns have been raised that coyotes may become tolerant to a single tool; for instance, over time they may learn that snapping a garbage bag does not present a threat and stop responding to it. We have not encountered this in our experiences and feel it is important to reiterate that effective mobilization of aversion conditioning is less about any 1 specific tool and more about intention and persistence. Our high degree of success in this method is because if an individual coyote does not respond to a given stimulus, we immediately employ another tactic and follow through until the desired response is elicited. If insufficient response is generated through snapping the garbage bag, then one should walk quickly and with purpose toward the coyote while snapping it and/or vocalize loudly and firmly. Clear and confident body language and assertive voice is more important than sophisticated tools or body size in obtaining desired results. Thus, evolving public perceptions from fear and misinformation to understanding and empowerment is key to human–coyote coexistence.

Finally, although recommendations for aversion conditioning generally specify that methods should not harm coyotes, a discussion of what constitutes "harm" and how to avoid it is often lacking. Hazing, by definition, induces fear, which could constitute psychological harm, but which is preferable to the lethal control measures that are often implemented if conflicts remain unresolved. Generally, the aim of hazing is not to cause physical harm to coyotes. This means, for instance, throwing objects near, not at, them. It means being mindful of the circumstances and possible risks to coyotes (e.g., not hazing them onto a road). Humane practices also mean not forcing a family to relocate their den, unless the situation is dire. Most sources recommend that hazing not be conducted near pups or an active den site (Project Coyote n.d., Bonnell and Breck 2017). In addition to welfare considerations, there is a risk that new den sites that result from forced relocation may be even more problematic than the original site (Colorado Parks and Wildlife n.d.). Finally, it is commonly advocated that sick or injured coyotes should not be hazed (Project Coyote n.d., Bonnell and Breck 2017). We agree with the former, because of the possible harm associated with additional stress, but would add that appropriately responding to sick or injured coyotes should entail efforts to rescue and rehabilitate where such opportunities and resources are available.

We advocate against the use of dogs or projectiles such as clay bullets in hazing because these methods are inhumane, and we challenge their efficacy. In terms of dogs, intentionally creating conflict between 2 canids puts both at risk and is unethical. Furthermore, given that domestic canines are key drivers of human–coyote conflict in urban areas (Bombieri et al. 2018), enabling an augmentation of this conflict by intentionally creating antagonistic situations is irresponsible. We suggest that in any situation where dogs are currently used to haze coyotes, a person could deploy the aversion conditioning methodologies described here with less risk to all involved, and likely with greater efficacy. In terms of projectiles such as clay bullets or paintball guns, the risk of injuring the animal is an important welfare concern. We also question the intention of hazing done at such a distance, as it is misaligned with the goal of preventing proximate encounters, making it difficult for the coyote in question to link stimulus to response (Shivik 2004).

Best practice: Aversion conditioning methods should be adaptable, humane, and applied consistently. We recommend the garbage bag method and do not support the use of dogs or projectiles in hazing.

Who: training

One of the more challenging questions related to aversion conditioning is who should be deploying it. Hazing is often undertaken by those in professional roles or official capacities, such as individuals working in animal control, parks staff, police, etc. Some recom-

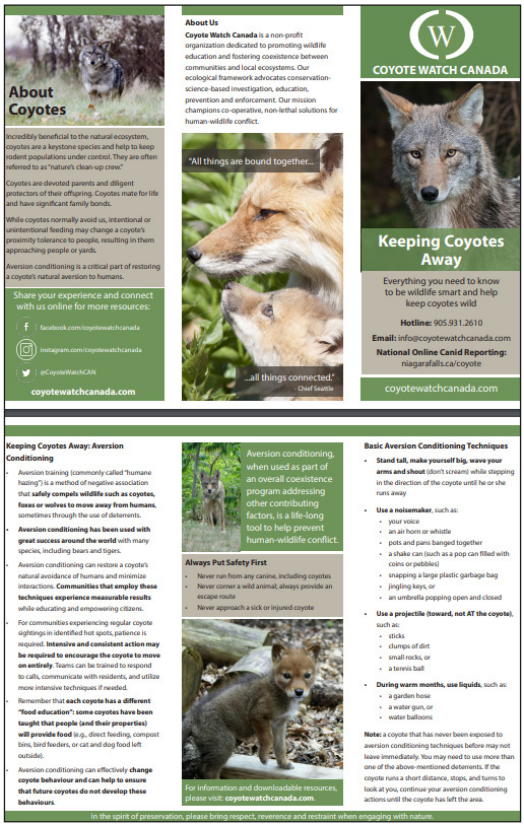

Figure 3. Coyote Watch Canada's "Keeping Coyotes Away" brochure (*available from https://www.coyotewatchcanada.com/files/CWCKEEPING-COYOTES-AWAY-BROCH0920.pdf*).

mendations target broad audiences, suggesting that all members of the public haze coyotes. There is increasing discussion of "hazing crews" who can respond to hotspots and apply aversion conditioning (e.g., see Brennan 2017). Bonnell and Breck (2017) recruited 207 volunteer community scientists around the Denver Metropolitan Area, Colorado, USA, who were then trained in hazing and asked to record any coyote encounters or instances of deployment. But questions of who should be trained and how, as well as who should do the training, remain unaddressed.

The approach advocated by our organization aligns with the city of Chicago coyote management and coexistence plan's (Chicago Animal Care and Control n.d.) differentiation of basic versus high-intensity hazing. All members of the public should be encouraged to practice basic hazing techniques, such as the garbage bag method, where appropriate. Our organization's educational literature includes a brochure on keeping coyotes away, which details basic hazing techniques (Figure 3). Some jurisdictions have incorporated instructional videos on hazing within their educational materials, such as the Town of Oakville (2016), Ontario. However, in situations of hotspots where concerns have escalated, effective aversion conditioning to mitigate the situation may require high-intensity hazing (in conjunction with thorough investigation). High-intensity hazing should be deployed only by trained personnel, such as animal control, humane society, parks staff, or wildlife organization employees or volunteers. Those deploying high-intensity hazing should have received comprehensive training on assessing conflict scenarios and effective use of the appropriate mitigation techniques. As noted by Bonnell and Breck (2017, 154), "hazing is a complex concept and is difficult to teach using non-personal media such as on-site signs," and therefore, in-person training is recommended. We recommend that training on aversion conditioning only be conducted by those who have firsthand experience deploying the methodology. For instance, CWC regularly holds training sessions for municipal employees in animal management or first response roles. We do not support the formation of hazing crews by members of the lay public. Any targeted or high-intensity hazing response should only be undertaken by skilled professionals or volunteers capable of assessing and responding to the potential complexity of each situation and who are trained and supported by those with expertise and firsthand experience.

Best practice: All members of the public should be encouraged to implement basic hazing techniques where appropriate, but high-intensity hazing involving targeted responses to hotspots should only be conducted by personnel who have been trained by someone with firsthand experience deploying the methodology.

When: monitoring and timely response

Often there has already been an escalation of concerns over a period of weeks or months by the time interventions are deployed (Carillo

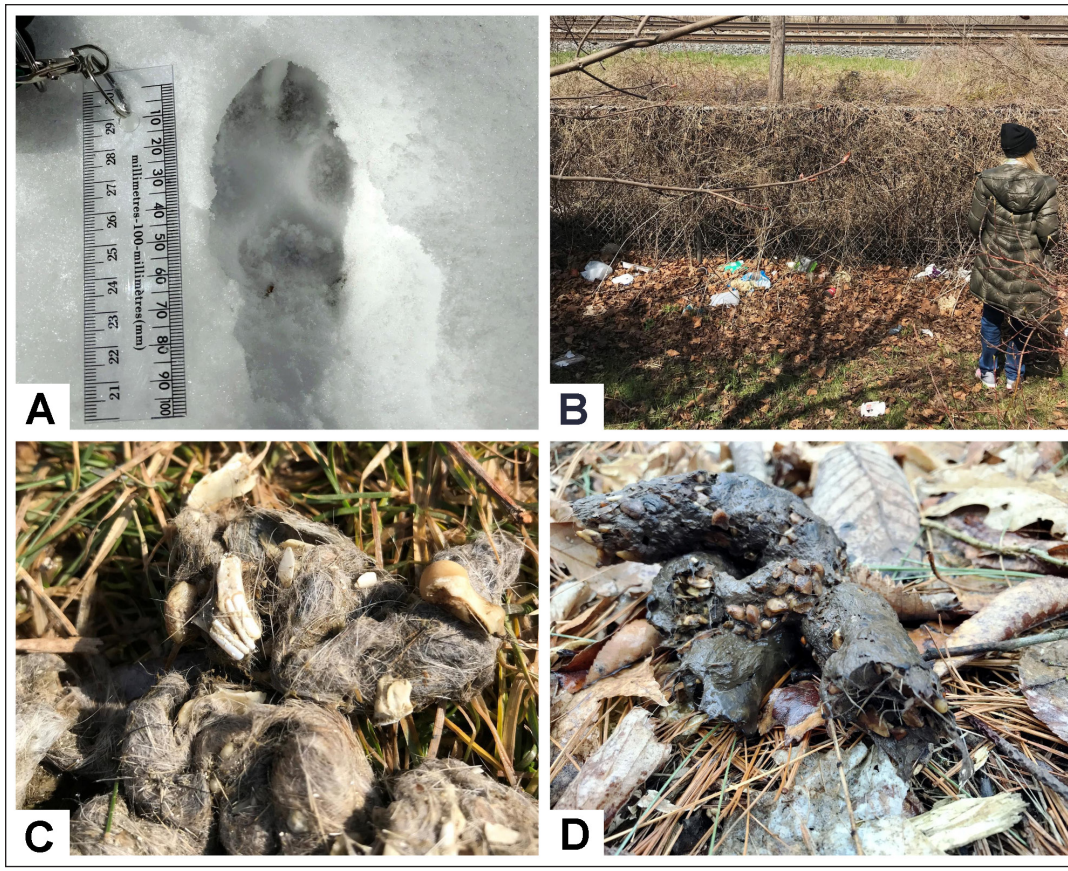

Figure 4. Investigation entails learning about the behaviors of coyotes (*Canis latrans*), human residents, and the context of interactions. This could involve: tracking coyotes (A); identifying any food attractants, such as garbage (B); and characterizing coyote diet, for instance looking for natural foods like fur and small mammal bones (C), or anthropogenic foods such as birdseed (D; *photos by L. Van Patter*).

et al. 2007). This is not ideal, but rather mitigation measures should be implemented proactively (Fox 2006, Breck et al. 2017). A system for reporting and monitoring encounters or concerns is invaluable in identifying and responding to possible emerging hotspots before conflicts can escalate. Ideally, hazing should be implemented after an investigation of contextual factors so that an understanding of drivers of conflict, goals of intervention, and effective mitigation techniques can be assessed and strategized (see next section).

Best practice: Mitigation measures should be implemented proactively rather than reacting to escalating conflict scenarios and after investigating the circumstances and planning the most effective response.

How: as part of comprehensive coexistence framework

In terms of how aversion conditioning should be implemented, our central recommendation is that it should not be used in isolation, but rather as part of a comprehensive wildlife coexistence framework. Aversion conditioning is often presented and assessed as a lone measure (e.g., Brady 2016, Bonnell and Breck 2017, Breck et al. 2017), despite the acknowledged imperative to address additional concerns, such as anthropogenic food provisioning (Timm et al. 2004, Baker 2007, Elliot et al. 2016, Baker and Timm 2017). Rather than advocating for the implementation of aversion conditioning as a solitary measure, CWC's 4-cornerstone approach to coexisting with wildlife entails prevention, investigation, education, and enforcement, each of which is briefly detailed below.

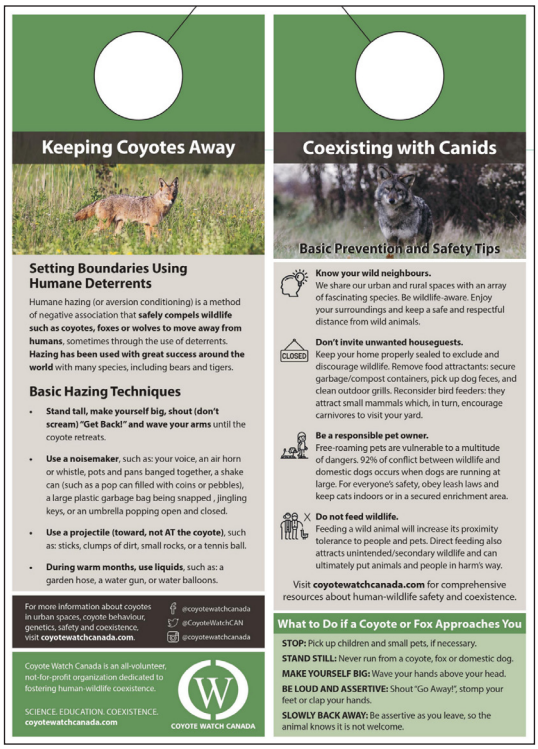

Figure 5. Coyote Watch Canada's "Coexisting with Canids" doorhanger (*available from https://www.coyotewatchcanada.com/files/CWCDoorHangerMay122018.pdf*).

Investigation. Investigation is key, as implementing appropriate responses requires an assessment of contextual factors relevant to each situation. Without understanding the root cause of conflicts, interventions may be inappropriate or ineffective, responding to symptoms rather than causes. Usually when there is a problem situation, conflict, or hotspot, feeding is the root issue (though other considerations may be relevant, such as off-leash dogs or infrastructure changes that disrupt foraging opportunities or travel routes and corridors; Alexander and Quinn 2012). Investigation might entail ground truthing, tracking, interviewing residents, and identifying food attractants (Figure 4). The aim is to establish the relevant factors contributing to instances of concern or conflict to help inform the most appropriate course of action. Aversion conditioning is an important tool in responding to many situations. However, implementing additional concurrent strategies such as community outreach and education or enforcement of wildlife feeding bylaws, may be equally important to ensuring a successful outcome. Without some investigation, it is impossible to understand the context, source of the issue, goal of the intervention, and how to best ensure its outcome.

Education. Education is integral to coexisting with wildlife in cities. It is particularly important to raise awareness of the consequences of intentional or unintentional food provisioning, including pet food, bird feeders, compost piles, accessible urban food gardens, and fallen fruit from trees. The urban coyote conflict literature emphasizes the importance of education about the consequences of feeding as well as wildlife-proofing property (Timm et al. 2004, Baker 2007, Carillo et al. 2007, Baker and Timm 2017). Education campaigns should be targeted and strategic. In a recent survey undertaken in Chicago, Illinois and in Los Angeles, California, USA, knowledge of and attitudes toward coyotes were highly variable, highlighting the challenges involved in reaching a consensus for appropriate management interventions (Elliot et al. 2016). Most respondents reported that when encountering a coyote, they were more likely to stand still or walk away than to try to scare the coyote away. The authors concluded that nature lovers may equally contribute to coyote conflict, as they are less likely to engage in hazing and more likely to participate in activities that attract wildlife (gardening, composting, bird feeding, etc.).

Thus, education efforts should target specific behaviors (i.e., what to do and not do), as opposed to attempting to shift broader attitudes concerning coyotes or other wildlife (Elliot et al. 2016). Along with conducting an investigation, one of the first responses undertaken by CWC when we are called into a community or made aware of an emerging hotspot is to schedule outreach meetings and/or circulate educational materials to the surrounding community, such as our doorhanger about coexisting with canids (Figure 5).

Enforcement. Enforcement of wildlife-related bylaws and ordinances, such as those that prohibit feeding, should be consistent to prevent coyotes from becoming used to frequenting anthropogenic resources or spaces (Fox 2006). Although education is often effective, a key question is "how many 'cheaters' does it take to change a coyote's behavior?" (Schmidt and Timm 2007, 299). Despite education, some

individuals may still be inclined to provide food, and therefore the creation and enforcement of bylaws and ordinances to prevent such behaviors and ensuing conflict scenarios is key. Partnerships and coordination between agencies are central to the success of human–wildlife conflict responses (Fox 2006). Relationship building across agencies and within communities ensures that information transfer and response occurs in a timely and effective manner. Within partner communities, CWC forges relationships with law enforcement, animal control, environmental and parks staff, neighborhood associations, and other relevant bodies to ensure alignment of expectations, efficient division of responsibilities, and clear communication and response pathways.

Prevention. Ultimately, strategies should prioritize prevention, as opposed to response. Proactive nonlethal strategies entail "altering the behavior of coyotes prior to the onset of conflict" (Breck et al. 2017, 134). Proactive interventions are preferable to reactive, wherein one responds to a situation after significant conflict has emerged. Proactive preventative strategies include education and enforcement, but there are also ways in which aversion conditioning can be used proactively. Generally, this involves practicing wider-scale basic hazing to maintain healthy boundaries between coyotes and humans sharing space in an urban environment.

Best practice: Aversion conditioning should not be implemented in isolation but rather as part of a comprehensive wildlife coexistence program that attends to the 4 cornerstones of investigation, education, enforcement, and prevention.

A final best practice in terms of how aversion conditioning is implemented pertains to defining and measuring success. It is imperative to clearly define the goals of response efforts from the outset. Grant et al. (2011, 21) noted that a common mistake is that "hazing is employed regardless of the specific behaviors or actions of the coyote…hazing should only be used if a coyote is behaving in a way that is unacceptable to the public or is using an area that residents deem unacceptable." Therefore, communities need to define which spaces are and are not acceptable for coyotes to occupy and determine levels of tolerance for specific behaviors. Ideal scenarios will involve community consensus and consistent application of techniques to discourage the presence of coyotes where they are deemed unacceptable and intervention in response to behaviors that are viewed as problematic. Coyotes need to live somewhere, and they need to make a living. If a coyote is walking across a field into a treed area, there is no need to haze it. If it is resting next to a sidewalk during a busy time of day, there will likely be community interest in discouraging this behavior. What is acceptable or not is subjective and will vary by community. The ultimate goals of management will vary accordingly, as will the strategies employed to attain these goals.

Finally, measuring success of aversion conditioning efforts is also a challenge. In our organization's experience, deployment of basic or high-intensity hazing along with other relevant mitigation efforts (i.e., education and enforcement to remove food attractants) will result in a decrease of incidents reported and frequency of encounters or conflicts. However, it is important to note that individual coyote response to hazing may vary, and a lack of immediate decrease in sightings does not indicate failure, but rather that persistent action may be required. We caution against oversimplification of anticipated outcomes, such as Bonnell and Breck's (2017, 150) "response coding of coyotes…being hazed by citizen scientists to rank individual coyote response to hazing from -4 (most averse) to 1 (coyote approaches)." Although some manner of typology may be useful, individual coyote responses to hazing techniques will depend greatly on contextual factors such as the presence of dogs, food resource being accessed, age of individual, proximity of den site, and the coyote's history of interactions with humans. If a coyote fails to move away, this may not indicate that hazing is ineffective, but rather that the coyote is reluctant to leave a nearby den site or pups. If a coyote "moves <10 feet away after input, stops and looks back in the direction of stimulus <10 feet from the original starting point" (rank -1 on Bonnell and Breck's [2017, 150] responses), they may be confused about the intentions of the deployer or reluctant to leave a valuable food resource. If a coyote approaches, is the deployer with a dog that is perceived as a threat to the coyote's territory

or family? Individual responses will depend greatly on the coyote's history and food conditioning, as well as the efficacy of the specific treatment being employed. Individuals who are not confident and committed and who do not sufficiently follow through are not communicating effectively to the animal, and a lack of response should not be seen as problematic coyote behavior nor a failure of the methodology itself. This highlights the importance of training to response success.

Best practice: Coyote management goals should be clearly defined, approaches consistently deployed, and effects monitored to measure efficacy based on an agreed upon definition of success.

Additional considerations

Along with the best practices discussed above, there are several additional factors that are important to consider when implementing aversion conditioning: presence of domestic dogs, public perceptions, and consistent definition of behavior and conflict. We detail each of these briefly below and advance several further best practices that incorporate considerations of the complexities surrounding these factors.

Domestic dogs

A key consideration both from the literature and our experience involves the presence of domestic dogs, which can exacerbate human–wildlife conflict (Lukasik and Alexander 2011, Alexander and Quinn 2012, Bowes et al. 2015). In the case of coyotes, an analysis of Canadian print media between 1995 and 2010 found that 23.8% of articles reporting on conflicts with coyotes specifically pertained to coyote–dog interactions and were characteristic of territorial conflicts (Alexander and Quinn 2011). In our experiences, territorial conflicts with off-leash dogs is one of the primary drivers of human–coyote conflicts in urban areas. In terms of mitigating conflict, education pertaining to the risks to dogs, wildlife, and humans of allowing dogs to roam is important, along with the creation and enforcement of leash laws. This is important for protecting not only dogs and coyotes, but the many other wildlife species that are at risk from roaming dogs, which are an increasingly recognized conservation threat (Lenth et al. 2008, Young et al. 2011, Hughes and Macdonald 2013, Doherty et al. 2017).

In terms of aversion conditioning, the presence of domestic dogs can present complications for deployment. Where a coyote is behaving defensively toward a roaming dog, the coyote may be less responsive to human hazing attempts, as the primary focus is on protecting its territory, resources, or family from encroaching canines. In this context, the priority is to maintain or create space between the dog and coyote. This can be done by calling the dog near, putting the dog on a leash, and slowly backing out of the area while deploying basic hazing techniques, such as the bag method described above. Bonnell and Breck (2017) reported that outcomes of hazing were negatively impacted by the presence of domestic dogs. In their research, "coyotes moved ≥10 feet away from the person hazing 49% of the time when no dog was present, but only 23% of the time when a domestic dog was present… dogs were present during 4 of 5 occasions when coyotes approached the person attempting to haze it" (Bonnell and Breck 2017, 153). The authors conclude, and we concur, that hazing can still be performed if an individual with a dog encounters a coyote, but that expectations of reduced efficacy in the presence of dogs should be clearly communicated to residents being educated about aversion conditioning. The response of individual coyotes to hazing in the presence of dogs will depend greatly on contextual factors, including proximity to a den, presence of pups, presence of food resource, and history of interactions with the individual dog or other domestic dogs.

Overall, education and enforcement concerning responsible pet practices are priorities for mitigating one of the largest sources of human–coyote conflict in urban areas. Where roaming dogs threaten coyote territories, resources, or families, we can expect coyotes to respond defensively. In instances where residents report behavior such as coyotes approaching or shadowing them while domestic dogs are present, the best practice is not necessarily to haze coyotes, but rather to ensure dogs are on leashes, or to keep dogs out of an area with known dens during pup rearing season. For instance, the Presidio Trust (2020) in California will tempo-

rarily close sections of trails to humans and/or domestic dogs when there are known active den sites.

Finally, we contend that interactions between domestic dogs and coyotes should not automatically be defined as conflicts or result in a coyote being designated as a problem individual. Contexts surrounding interactions need to be assessed on a case-by-case basis. As noted above, territorial interactions between animals is a natural process. If a dog is injured by a goose (Anatidae) protecting their young, the goose is not a problem animal, but rather the problem is inappropriate human behavior in allowing domestic pets to harass wildlife. The same should hold true in instances of altercations between coyotes and domestic dogs. This is common practice in many of the communities in which we work, including Toronto, Ontario, where the coyote response strategy stipulates that "a bite to another animal is not grounds for removal – it is normal coyote behaviour" (City of Toronto 2017).

Best practice: Interactions between coyotes and domestic dogs should not be classified as conflict, and efforts should be made to educate and enforce responsible pet practices, including not allowing dogs to roam freely in wildlife areas. It should be acknowledged that hazing may be less effective when domestic dogs are present, and the priority should be to remove the dog from areas where coyotes may be denning.

Public perceptions

One consideration that has received scant attention in the peer-reviewed and gray literatures is public perception. How the public perceives aversion conditioning will influence both uptake and willingness to conduct such practices at the community level and has the potential to present a risk to animal welfare. If members of the public do not understand the aims of hazing, they may be concerned about what they interpret as harassment or harm to wildlife. These concerns may be valid if best practices are not followed. Bonnell and Breck (2017) noted a reluctance to haze by some participants as a result of this perception, and Elliot et al. (2016) similarly reported that individuals who do not see coyotes as a problem are unlikely to haze them. There is a need to educate the public that if they see wildlife responders conducting aversion conditioning, the aim is not to harm or harass the animal, but rather that this action represents a humane, nonlethal intervention aimed at cultivating healthy human–wildlife boundaries by reshaping canid behavior.

Just as perceived harassment will offend those who have positive views of coyotes or concerns for animal welfare, such actions, if carelessly applied or insufficiently accompanied by educational efforts, may embolden those who wish to harm coyotes. We have observed communities wherein what was presented as hazing crews have functioned primarily as vigilantes attempting to harass resident coyotes. An example of the latter would be teams that market themselves as nonlethal and humane, but who use weapons, projectiles, or dogs indiscriminately across space, and even around dens. The inappropriate nature of such applications and the risks they pose to both human and coyote safety highlight the importance of education and the need to carefully assess how aversion conditioning programs and practices are applied, perceived, and communicated.

Best practice: When implementing aversion conditioning, public outreach and education should prioritize ensuring that residents understand the purpose of hazing as a humane wildlife response tool and not inadvertently validate unnecessary and inappropriately high levels of wildlife harassment.

Defining behavior and conflict

A limitation in the existing literature is the inaccurate and sometimes inappropriate characterization of coyote behavior. We address several terms and consider how they impact practices and perceptions around success and failure in aversion conditioning delivery. The first of these is the concept of habituation. Habituation is defined as an "animals' decreased responsiveness to humans due to repeated contact" (Geist 2007, 35). Most often the term "habituation," rather than being used as a neutral behavioral descriptor, is norma-

tively loaded as an undesirable, permanent state of a "problem animal." For instance, there is the claim that "habituated animals, those who have developed a psychological patience with our presence, are potentially much more dangerous than non-habituated, or 'wild' animals, because habituation is a state of unconsummated interest on the part of the animal, expressing itself as tolerance of and even an attraction to humans" (Geist 2007:35). Habituation as a descriptor of a fixed state is problematic due to the challenges in contextually defining a given animal's behavior and the limited evidence to support the prevailing assumptions that it is both a permanent state and inherently dangerous.

Based on field experiences of the CRTs of CWC deploying wildlife response measures, we advance that "proximity tolerance" is a more accurate description of coyote behavior, which reflects the complex and contextual interrelationship between individual coyotes and humans. Over time and based on experiences, coyotes' proximity tolerance with respect to humans (as well as other species, like domestic dogs) may change. This tolerance will depend on contextual factors, including the number, characteristics, and behaviors of the humans present, presence of dogs, if there is a food resource being accessed, and history of food provisioning and interactions. Just as experiences of food provisioning and positive interactions with humans may increase an individual's proximity tolerance, negative interactions such as hazing can effectively decrease this tolerance. Our experiences challenge the assertion that coyotes with high human proximity tolerance are always inherently dangerous. Our observations in the field have yielded no evidence that links proximity tolerance and aggression toward humans. However, it is in a community's interest to establish healthy boundaries with all wildlife, including coyotes, and restoring natural avoidance behaviors can be an important part of this. Unlike "habituation," "proximity tolerance" highlights that these behavioral characteristics do not represent a fixed state but rather a fluid relationship that can, with proper response, be reshaped.

Best practice: "Proximity tolerance" should replace "habituation" in wildlife research, management, and policy vocabularies.

A further consideration is how conflict scenarios or problem coyotes are defined. A current limitation in both the scholarship and for wildlife practitioners is that "the definition of a 'problem coyote,' and what behaviors that coyote displays, varies greatly" (Draheim et al. 2019, 8). A frequently cited conceptualization of problematic coyote interactions is Baker and Timm's (2017; drawing on Baker and Timm 1998, Baker 2008) "Behavioral Progression of increasing coyote habituation to suburban environments." It progresses from level 1, "increase in coyotes on streets and in yards at night," to level 7, "coyotes acting aggressively toward adults in mid-day." The common assertion stemming from this classification is that once a situation has attained stage 3, "coyotes on streets, and in parks and yards, in early morning/late afternoon," or greater, "problem" individuals will need to be lethally removed, as nonlethal interventions such as aversion conditioning alone will not sufficiently address the problem (Baker and Timm 2017). For instance, Timm et al. (2004, 55) concluded: "once coyotes have begun acting boldly or aggressively around humans, it is unlikely that any attempts at hazing can be applied with sufficient consistency or intensity to reverse the coyotes' habituation. In these circumstances, removal of the offending animals is probably the only effective strategy." Due to the difficulties of testing such a claim in a non-experimental (naturalistic) setting, it is difficult to either support or challenge this widespread belief.

Coyote Watch Canada observations and experiences in deploying aversion conditioning do not support the assumption that it is not possible to reshape the behavior of coyotes who are beyond a certain level of "habituation." Our CRTs have experienced regular success in mitigating instances of human–coyote conflict even when encounters would have ranked highly on this scale, even at stages 5 or 6. The reason we do not include stage 7 is 2-fold. First, no member of our CRT has encountered a situation in which a coyote has acted aggressively toward humans. Second, the definition of "aggression" in the context of human–coyote interactions remains ill-defined within public discourse, policy, and management realms, as well as the scientific literature. We need more nuanced approaches to characterizing specific,

contextual behavioral responses, as opposed to assumptions and generalizations. Often "defensive-aggressive" behavior (as defined in the canid behavior literature, Fox 1970) is misinterpreted as "offensive-aggression," which can be frightening to those who do not understand what they are seeing. For instance, a coyote may demonstrate defensive behaviors toward domestic dogs within their home ranges or shadow humans with dogs to ensure they leave an area with pups or an active den, and such behaviors are often incorrectly interpreted as aggressive coyotes threatening or stalking humans. Rather than aggression, these are naturally protective behaviors in response to threats to self, family, or territory. There is also a noted trend of humans being bitten by coyotes while intervening in an encounter between a coyote and domestic dog (White and Gehrt 2009, Alexander and Quinn 2011), but as we noted above, incidental injuries as a result of canid–canid conflict should not be defined as "aggression" toward humans.

Furthermore, we find Baker and Timm's (1998, 2017) Behavioral Progression classification to be arbitrary. Why should stage 6, "coyotes seen in and around children's play areas, school grounds, and parks in mid-day," be ranked as more habituated than stage 5, "coyotes attacking and taking pets on leash or near owners; chasing joggers, bicyclists, other adults"? School grounds and parks often represent resource-rich areas containing human refuse and the small animals it attracts, so we would question why the presence of coyotes exploiting these resources in such areas would be characterized as highly problematic habituation, rather than simply signaling the need to manage direct human feeding and anthropogenic food attractants within such spaces.

Again, we assert that food conditioning and proximity tolerance should not be seen as fixed states, but rather as fluid, contextual relationships between individual humans and coyotes that can be reshaped. Similar findings have been noted elsewhere, for instance in Bogan's (2012, 103) research where "the 1 case of emboldened behaviors was sustained as a tendency for 4 weeks, and then transitioned back to avoidance behavior." Thus, we agree with Bogan's (2012, 104) assessment that "conflict interactions may result from short-lived, situation-specific events in which an animal quickly reverts back to an avoidance state." Along with attractant removal and responsible pet care practices, aversion conditioning can be an important part of reshaping coyote behaviors within such temporary conflict scenarios.

Best practice: Nonlethal interventions such as aversion conditioning should be seen as an appropriate response and mitigation tool for coyotes engaging in any behavior that is deemed undesirable by the community.

Conclusions

Our recommendations and considerations for aversion conditioning center on key questions wildlife researchers and practitioners grapple with in implementing this increasingly promoted tool. In terms of what aversion conditioning should entail, we detail the importance of consistency, adaptability, humaneness, and clear goals. In terms of who should implement these techniques and when, we speak to the difference between basic and high-intensity hazing, outlining recommendations in terms of training and proactive implementation. In terms of the how, we contend that aversion conditioning should not be implemented in isolation, but rather as part of a comprehensive wildlife coexistence program that centers on prevention, investigation, education, and enforcement.

In terms of the why, our underlying assumption is that, where possible, nonlethal interventions are always preferable to lethal control, as is increasingly advocated by the conservation community (Dubois et al. 2017). Not only is this an ethical imperative, but nonlethal methods have the potential to be more sustainable and effective in the long term. Lethal coyote management has been the status quo for hundreds of years, and the evidence of its inadequacy in mitigating human–coyote conflict is increasingly dramatic (Sterling et al. 1983, Knowlton et al. 1999, Kilgo et al. 2017).

Management implications

Coyotes are part of the fabric of our urban communities and will remain as such, whether humans wish it or not. Whether grounded in utilitarian arguments of ecosystem service

provision or based on ethical claims about our obligations to other species, we have an opportunity to reshape the nature of our relationships with urban canids into one that is based on promoting compassionate coexistence, and aversion conditioning is a key tool in working toward this end. Wildlife managers should not automatically conclude that there are fixed states of advanced habituation that require lethal removal. Further research based on field observations and community engagement should be conducted to better understand behavioral plasticity in coyotes and the efficacy of appropriately deployed nonlethal interventions such as aversion conditioning.

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Coexisting with Canids

Basic Prevention and Safety Tips

Know your wild neighbours.
We share our urban and rural spaces with an array of fascinating species. Be wildlife-aware. Enjoy your surroundings and keep a safe and respectful distance from wild animals.

Don't invite unwanted houseguests.
Keep your home properly sealed to exclude and discourage wildlife. Remove food attractants: secure garbage/compost containers, pick up dog feces, and clean outdoor grills. Reconsider bird feeders: they attract small mammals which, in turn, encourage carnivores to visit your yard.

Be a responsible pet owner.
Free-roaming pets are vulnerable to a multitude of dangers. 92% of conflict between wildlife and domestic dogs occurs when dogs are running at large. For everyone's safety, obey leash laws and keep cats indoors or in a secured enrichment area.

Do not feed wildlife.
Feeding a wild animal will increase its proximity tolerance to people and pets. Direct feeding also attracts unintended/secondary wildlife and can ultimately put animals and people in harm's way.

Visit **coyotewatchcanada.com** for comprehensive resources about human-wildlife safety and coexistence.

What to Do if a Coyote or Fox Approaches You

STOP: Pick up children and small pets, if necessary.

STAND STILL: Never run from a coyote, fox or domestic dog.

MAKE YOURSELF BIG: Wave your hands above your head.

BE LOUD AND ASSERTIVE: Shout "Go Away!", stomp your feet or clap your hands.

SLOWLY BACK AWAY: Be assertive as you leave, so the animal knows it is not welcome.

Keeping Coyotes Away

Setting Boundaries Using Humane Deterrents

Humane hazing (or aversion conditioning) is a method of negative association that **safely compels wildlife such as coyotes, foxes or wolves to move away from humans**, sometimes through the use of deterrents. **Hazing has been used with great success around the world** with many species, including bears and tigers.

Basic Hazing Techniques

- **Stand tall, make yourself big, shout (don't scream) "Get Back!" and wave your arms** until the coyote retreats.
- **Use a noisemaker**, such as: your voice, an air horn or whistle, pots and pans banged together, a shake can (such as a pop can filled with coins or pebbles), a large plastic garbage bag being snapped , jingling keys, or an umbrella popping open and closed.
- **Use a projectile (toward, not AT the coyote)**, such as: sticks, clumps of dirt, small rocks, or a tennis ball.
- **During warm months, use liquids**, such as: a garden hose, a water gun, or water balloons.

For more information about coyotes in urban spaces, coyote behaviour, genetics, safety and coexistence, visit **coyotewatchcanada.com**.

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Coyote Watch Canada is an all-volunteer, not-for-profit organization dedicated to fostering human-wildlife coexistence.

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COYOTE WATCH CANADA

Winnipeg's Urban Coyotes: Getting Ahead of the Curve

by

Matthew Walker

A report submitted to the Department of Environment and Geography,
University of Manitoba,
in partial fulfillment of the requirements for course
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April, 2015

Abstract

The opportunistic and generalist nature of coyotes has allowed them to inhabit a large range of habitats, both natural and human-created. In many cities throughout North America, coyotes have become a part of the urban ecosystem. Coyotes play an important role in the urban wildlife food chain; however, the more emphasized effects of coyotes in an urban landscape often involve conflict between humans and coyotes. Cities have adopted a variety of management strategies to minimize these negative human-coyote interactions and some cities have been more successful than others. This project attempts to gain a better understanding of the urban coyote situation in Winnipeg and provide insight for future management. The human dimensions component of this project involved interviews with individuals involved in the issue from cities across North America and Winnipeg. Differences in perspectives among interviewees were evident when categorized in terms of the level of conflict experienced in their respective city. Coyote sighting reports in Winnipeg have increased since 2011 and a larger amount of sightings were reported in the dispersal season. Management recommendations were made based on conversations with the interviewees.

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1. Introduction and Background

Coyotes are arguably one of the most wide-spread carnivores, occupying much of North America (Bekoff and Gese 2003). Their current range stretches from Panama, through Mexico and up to Northern Alaska (Bekoff and Gese 2003; Hidalgo-Mihart et al. 2004). The opportunistic and generalist nature of coyotes have allowed them to survive on a variety of food types depending on the availability of prey and plant sources and has allowed widespread colonization (Bekoff and Gese 2003). Coyotes may form packs, typically in the breeding season, allowing them to effectively capture ungulates (Gese et al. 1988). Other factors such as territoriality, cooperative defense and prey abundance can also determine if packs are formed (Bekoff and Wells 1980). Coyotes have three biological periods during the year: breeding (January 1 – April 30), pup-rearing (May 1 – August 31) and dispersal (September 1 – December 31) (Quinn 1997; Gehrt et al. 2009; Lukasik and Alexander 2011).

Typically, coyotes inhabit natural landscapes such as forests, grasslands, desserts and mountains; however, coyotes are easily capable of adapting to and inhabiting human altered landscapes, including many cities across North America (Bekoff and Gese 2003; Gehrt 2007). Coyotes have become urbanized for a few reasons. In some areas, undisturbed patches of habitat have been enclosed by development (Quinn 1995) where as in other areas coyotes have been actively colonizing urban settings (Gehrt 2007). In an urban landscape, coyotes often choose green spaces less heavily used by people such as industrial yards, or cemeteries and golf courses at night (Magle et al. 2014). Given the opportunistic nature of coyotes, they are capable of feeding on many types of food that can be abundant in urban landscapes including, seeds, fruit, small mammals and birds and

coyotes can easily switch between these food sources when some sources are more abundant than others (Murray et al. 2015). Coyotes can substitute their natural diet with human provided food such as garbage, pet food left outside, or other food sources linked to humans (Murray et al. 2015; Newsome et al. 2015). This can lead to habituation and a loss of fear towards humans, which in turn may be linked to human-coyote conflict (Timm et al. 2004; Lukasik and Alexander 2011; Lukasik and Alexander 2012).

1.1 Positive Impacts of Urban Coyotes

Urban coyotes play an important role in ecosystem function in the urban landscape (Crooks and Soulé 1999; Bekoff and Gese 2003). Some argue that coyotes in cities can maintain small bird populations since coyotes help control mesopredators such as feral cats and mustelids (Crooks and Soulé 1999). Others also suggest that coyotes can help control Canada geese, rodent and deer populations within cities (Gehrt 2004; Hesse 2010; Piccolo et al. 2010; Alexander and Quinn 2011). People may also enjoy seeing coyotes for the joy of getting the opportunity to view a wild animal (Kellert 1985; Alexander and Quinn 2012).

1.2 Negative Impacts of Urban Coyotes

Coyotes are capable of living in close proximity to people, posing little threat to human safety (Gehrt et al. 2009); however, the more emphasized aspects of human-coyote coexistence often involve the negative impacts. Conflicts between humans and coyotes can pose a risk to human health and safety and often have negative consequences for wildlife. Minimizing these conflicts is a priority for wildlife managers, government officials and residents (Poessel et al. 2013). Once coyotes rely on humans for food (either

intentionally or accidentally), they could lose their fear of humans and human-coyote conflict may be more likely to occur (Timm and Baker 2007). Alexander and Quinn (2011) found that there was evidence of food conditioning in all of the articles about coyote attacks in Canadian media between 1995 and 2010. Some of these articles stated that there was partially digested human food found in the coyotes' stomachs or that there were residents who would feed wildlife (Alexander and Quinn 2011). In addition to provoking fear, there can be disease transfer, attacks on pets and in more rare cases attacks on humans (Carbyn 1989; Webber 1997; Lukasik and Alexander 2011; Alexander and Quinn 2012; Watts and Alexander 2012).

Coyotes elicit many strong emotional responses in citizens (Jacobs 2009). There is often a wide gap between the perceived fear and the risk of negative repercussions of co-existing with coyotes (Alexander and Quinn 2011). The wide variation in public attitudes and perceptions of coyotes are evident by looking at the media coverage about human-coyote interactions and the discourse the media provokes. After the fatal attack in Nova Scotia, there was a large increase in the number of articles about urban coyotes since the possibility of death became a well-known possible outcome of human coyote interactions (Alexander and Quinn 2011).

Some species of urban wildlife have higher rates of parasitism and disease for a number of reasons such as, increased stressors, poor nutrition, and/or increased frequency of inter- or intra-species interaction with domestic and wild animals (Watts and Alexander 2012). Urban coyotes in Canada host a wide variety of viral pathogens that are of concern to people and their pets, including rabies, canine distemper virus, and canine adenovirus (Rosatte 1988; Grinder and Krausman 2001; Arjo et al. 2003). Transmission of these parasites can occur directly (through physical contact with a coyote such as bites)

or indirectly (through fecal deposits) (Deplazes and Eckert 2001; Mani and Maguire 2009; Watts and Alexander 2012). Disease transmission is an important impact and must be considered when considering management approaches.

There have been many cases of coyotes attacking pets in urban settings and the dynamics of these types of attacks varies. Coyotes attacking dogs for food is rare but territorial attacks on dogs are more common (Lukasik and Alexander 2011). When attacks on pets occur, often times the owner gets involved and tries to defend their pet and the owner gets bitten as a result (Alexander and Quinn 2011). Attacks on cats are almost always lethal and are thought to be a result of coyotes seeing cats as a prey item (Carbyn 1989; Alexander and Quinn 2011).

Coyote attacks on humans are very rare, however they have occurred throughout Canada and the United States (Timm et al. 2004; Alexander and Quinn 2011). A review of Canadian media between 1995 and 2010 revealed that on average, just less than 3 people were bitten by a coyote per year in Canada (Alexander and Quinn 2011). There is also a perception that children are more likely to be bitten, but on average there was just over one toddler/child was bitten per year between 1995 and 2010 in Canada (Alexander and Quinn 2011). Although human death from a coyote attack is extremely rare (Gompper 2002), there was one lethal attack in Canada which occured in a rural area of Nova Scotia. However, the coyote was suspected to be coyote-wolf hybrid, making it difficult to compare with the behaviour of normal coyotes elsewhere (Alexander and Quinn 2011). As coyote populations increase in areas of high human population densities, the number of attacks on humans are also likely to increase (Gompper 2002).

In contrast to Canada, a larger number of coyote attacks have been recorded in the United States, particularly in Southern California. Timm and Baker (2007) summarized

previously published information coyote attacks on humans in North America and found that in between 1977 and 2004, there have been 111 coyote attacks on humans in Southern California. They also concluded that the second and third ranked states, in terms of number of attacks on humans, are Arizona and Nevada. Many factors may be at play but high population densities are thought be one factor contributing to the large number of coyote attacks experienced in Southern California (Timm et al. 2004). There have been attacks in other cities in the United States but to a lesser degree than what has been seen in Southern California (Timm and Baker 2007).

1.3 Situation and Management in Other cities

The greater Vancouver area witnessed a rapid increase in coyote complaints in the 1980s (Webber 1997). In response they implemented a rigorous coyote management strategy, which included monitoring, education, bylaws against wildlife feeding, and aversive conditioning techniques such as the use of noise-makers (Worcester and Boelens 2007). After seven years in place, human-coyote conflicts have been significantly reduced and remain at a low level presently (A. Nelson, Personal Communication, February 1st, 2016; Worcester and Boelens 2007).

Calgary has been dealing with urban coyote issues for a decade now. Many members of the public became very concerned after a child was attacked in 2005 (Lukasik and Alexander 2011). Calgary implemented a citizen reporting system using the Calgary 311 along with conducting research to get a better understanding of the issue (Lukasik and Alexander 2011). Little active education programs are being undertaken in Calgary at the moment, however passive education is set up, including signage and information on the website (S. Alexander, Personal Communication, February 9th, 2016).

Cities in Eastern Canada have been making great strides in coexisting with urban coyotes. Niagara Falls has implemented a substantial management strategy with an anti-coyote feeding bylaw along with intensive education, reporting, investigating, mitigation and conflict resolution strategies. The initiative was spearheaded by Coyote Watch Canada, a not-for-profit community-based wildlife organization (L. Sampson, Personal Communication, February 8th, 2016). Other cities in Eastern Canada have been jumping on board with coyote management as well. For example, Toronto has implemented an online form where members of the public can report coyote sightings along with an interactive map. The city also has information on the city website and holds open-houses to educate about urban wildlife (City of Toronto Municipal Licensing and Standards 2015).

In New York, there has been an increase in the number of reports from citizens with higher concentrations just north of New York City (Hudenko et al. 2008). In this area as well, there has been an active push by local governments and community groups to come up with strategies to educate and promote coexistence (Hudenko et al. 2008). In 2015, the town of New Castle, just north of New York City, created a coyote management plan which involves education programs, a response protocol for reported incidents, online resources and an interactive sightings map (Coleman and Ferry 2015).

Los Angeles and greater Southern California region have been experiencing human-coyote conflict for over 30 years. As mentioned previously, there have been many coyote attacks, including the only fatal attack ever recorded in the United States (Timm et al. 2004). The situation varies depending on the region but some have speculated that human-coyote conflict has been increasing in recent years (R. Timm, Personal Communication, November 30, 2016). Many management strategies have been

used over the years in different counties in Southern California. These strategies include public education of various forms, reporting systems and lethal control of problem animals by trapping or shooting (Baker 2007).

Denver began experiencing an increase in human-coyote conflict (many sightings, pet attacks, bold coyote behaviour and one human attack) for approximately two years before implementing coyote management guidelines in 2009 (White and Delaup 2012). The guidelines were derived from many stakeholders and focused on monitoring and data collection, education and hazing. The program was successful in reducing the level of conflict with documented reductions in sightings and pet attacks (White and Delaup 2012). Lethal control in Denver is reserved for when there is a human attack only (White and Delaup 2012).

1.4 Study Area

The city of Winnipeg is nestled in a vast mosaic of farmland and has two large rivers running through the urban center along with some smaller rivers and creeks. For the purpose of this study, Winnipeg is defined as the area within which all the coyote sightings reported to Manitoba Conservation and Water Stewardship, Winnipeg District fall. This area can be described as the perimeter of Winnipeg with a 3-kilometer buffer extending outwards. The city has witnessed an increase in coyote sightings over the past few years (K. Sinclair, personal communication, March 2, 2016) and there has also been media coverage of coyote activity in Winnipeg.

1.5 Research Purpose and Objectives

The purpose of this project is to get a better understanding of the urban coyote situation in Winnipeg and provide insight for future management. This project will assess the perceptions held by individuals that work in the wildlife field in Winnipeg and other cities in North America and compare the situations between these urban areas in terms of conflict level and management approach. Having an understanding of the human dimensions side of the issue serves as an important tool for wildlife managers (Webber 1997; Proulx 2015). The objectives of my project are as follows:

1. Conduct a literature review of urban coyote issues in other cities in Canada and the United States and examine the management practices that have been adopted in these cities.
2. Gather opinions and perspectives on the issue from individuals that are working on coyote issues (or have worked on coyote issues in the past) in our jurisdiction and other jurisdictions in Canada and the United States.
3. Gain an understanding of the issue in Winnipeg by analyzing temporal and spatial patterns.
4. Make recommendations for future management based on findings.

2. Methods

2.1 Interviews

One-on-one telephone interviews were conducted with individuals who are or have been involved in working with urban coyotes in Canada or the United States. The interviewees were chosen based on recommendations by my advisor, literature searches and searches

for coyote education programs. Some were also chosen by informant-based or "snowball" approach where interviewees recommend other interviewees (Hudenko et al. 2008). The interviews were conducted over the phone for all participants except for two for which it was possible to have a face-to-face interview in Winnipeg.

Each interview started with five demographic questions regarding their work on the subject, their educational background and whether they grew up in a rural or urban environment similar to Kellert (1985). The rest of the interview consisted of 21 questions, both open and closed, to guide the interview. A semi-structured approach allows the researcher to adjust the sequence of the questions and add questions based on the context of the responses (Zhang and Wildemuth 2006). The body of the interview was broken down into three main categories: concept, management strategies and emotion. The concept section served to gather information regarding information on the situation in whichever city the interviewee has done their work on. The goal of these questions is to get a general sense of the scale of the issue in these various cities such as the level of conflict. The questions on management strategies were posed to get a sense of the interviewee's opinions on various management strategies. Questions were also asked about what management strategies have been implemented in their city and their thoughts on what else needs to be done. The final category of questions were designed to get a sense of the local public's perspective on the issue and other aspects such as the media's role in educating the public.

Each interview was digitally recorded after receiving verbal consent from the participant. Interviews were subsequently transcribed to allow for analysis, capturing key examples, justification for responses and descriptions (Hudenko et al. 2008). The responses were coded and categorized into common themes (Patton 2002; Ryan 2006;

Bloomberg and Volpe 2008; Hudenko et al. 2008). The closed questions serve as a way to get a short, pre-coded answers that can be easily summarized and compared among interviewees (Torkar et al. 2011). Responses to the closed questions and the important themes from the open questions were summarized in a data summary tables, which are useful for determining initial patterns in the data and aiding in the analysis later (Bloomberg and Volpe 2014).

The analysis was done using the "constant comparative method" described by Glaser and Strauss (1967), which involves "generating and plausibly suggesting many categories, properties, and hypotheses about general problems". This method does not attempt to prove or impose universality of the suggested causes and does not provisionally test hypotheses (Glaser and Strauss 1967). During the coding process, patterns emerge from the data and allow the researcher to make categories along with a range of potential properties under that category (Glaser and Strauss 1967). The categories were chosen after the data was coded based on the emerging trends in the data but were also refined to serve the primary intention of the research, which is to examine the perspectives of individuals involved with urban coyotes and ultimately apply this insight to the situation in Winnipeg.

2.2 Spatial Analysis

In Winnipeg, Manitoba Conservation and Water Stewardship is responsible for dealing with problem wildlife in the city. When people call in to report a sighting or incident, the details get summarized in a District Occurrence Report (DOR). The locations from District Occurrence Reports were plotted using ArcGIS 10.2 over road and water layers obtained from the Manitoba Land Initiative. A heat map was created to visually represent

the density of the points across Winnipeg. The heat map was created in ArcGIS 10.2 by spatially joining the point data with a grid of one-by-one kilometer cells. A color gradient was then assigned to the cells to categorize them based on the various counts of District Occurrence Reports found within. A heat map is a visual way to spatially identify areas where there are a higher numbers of coyote sightings. In knowing where hotspots of human-coyote interactions are, management effort can be targeted to these high density areas (Poessel et al. 2013).

2.3 Temporal Analysis

The dates of the all the reports (regardless if they were plotted or not) were entered into a database and graphed to assess temporal differences in coyote sightings between month and biological period. Temporal patterns are also useful for implementing management strategies (Poessel et al. 2013).

3. Results

3.1 Interviews

A total of eleven interviews were conducted with individuals that are currently working on coyote issues (or have worked on coyote issues in the past) in our jurisdiction and other jurisdictions in Canada and the United States. The interviews were conducted from November 2nd, 2015 to March 2nd, 2016. The interviews of digitally recorded interviews were recorded. The average length of interviews was 38 minutes, 22 seconds with the shortest interview lasting 25:07 and the longest lasting 1:04:10. Due to a low sample size (N=11) connections and inferences made from the analysis should not be taken as

representative of all wildlife professionals across Canada and the United States. A study from Victoria, Australia, used a low sample size of fifteen to examine perspectives held by wildlife managers (Miller and McGee 2001). Therefore, for the purpose of providing guidance and insight for coyote management in Winnipeg, a low sample size and an interview format is adequate.

3.1.1 Demographics

Five of the eleven interviewees were from academia, three were from grassroots organizations including Coyote Watch Canada, Furbearer Defenders, Fort Whyte Alive and the Denver Coyote Project and the remaining two were from Manitoba Conservation and Water Stewardship, the wildlife management authority here in Winnipeg. Those from academia have studied coyotes in urban centers from a variety of angles including the human dimensions aspects of the issue and the biology of urban coyotes. The interviewees' experience working with wildlife ranged from 6 years to 44 years. The sample contained 4 females and 7 males. Five interviewees had PhDs, four had bachelor's degrees and two had post-secondary diplomas. All respondents indicated that they have either worked or grew up in a rural environment.

3.1.2 Situations in their cities

When asked to describe the current situation in their cities, the interviewees responded with a wide range of descriptive terms, ranging from high conflict with attacks on pets and humans to situations where there are lots of sightings with no conflict, no confirmed pet deaths and no attacks on humans. When asked to rate their city based on conflict level, the interviewees from Winnipeg gave ratings between 1 and 4, whereas

interviewees from the other urban centers gave ratings between 5 and 10. Eight respondents indicated that coyotes in their city were feeding on either "natural" or "primarily natural" food sources and the remaining three respondents stated that coyotes were feeding of both human and natural food sources. As one respondent pointed out, "the majority of coyotes are not living strictly off garbage, in any city you go to." (Respondent 9, Calgary). Four respondents indicated that there is seasonal variation as to when coyotes inhabit urban areas in their city and the remainder stated that coyotes are found year round.

When asked whether they feel the level of sightings have changed in the past ten years, four said it has not changed or that sighting levels have been variable while the rest said there has been an increase. Many respondents pointed out that increased sightings could be from vegetation changes or increased human population and not necessarily related to increase in coyote abundance.

When probed about their perspectives on the overall impact of urban coyotes on their cities, eight respondents said that they have an overall positive impact on the city, two stated that they contribute in both positive and negative ways, and one stated that urban coyotes have an overall negative impact.

3.1.3 Management Approaches

All but one respondent stated that their city is managing coyotes in some way. The management strategies being conducted by the various cities varied greatly. Eight respondents stated that lethal management is being done in some way. The cities of these eight respondents are Winnipeg, Southern California, Tuscon, Denver, New York and Calgary. Every respondent stated that there is some type of public education occurring;

however, the methods for public education varied greatly. Some common forms of public education discussed were information pages on authority websites, brochures and signage. Other public education methods mentioned less frequently were stakeholder meetings and school programs. One respondent stated: "…they ended up going into schools and teaching children about hazing… we now have like, 7 or 8 year old girls out there that are hazing coyotes…works well" (Respondent 5, Vancouver). When asked when they would take management action, there was a wide range of responses. Responses for when lethal methods should be implemented were once pets start getting attacked, when there was a threat to human health and safety, once the coyote is food conditioned/habituated or when there are many sightings in a specific area.

Many respondents stressed initiating education early on. For example, one respondent stated, "[initiate management] as soon as coyotes begin to coexist with people…. Human behaviour management is one of the biggest things" (Respondent 7, New York).

One of the most important questions of the interview was to determine what the respondents think should be done in a city that has just recently began dealing with issues involving urban coyotes. This question provides valuable insight for Winnipeg since the recommendations are from those who have experienced urban coyotes problems and may have important suggestions moving forward. The answers varied greatly; however, the broad theme of public education was mentioned by eight of the eleven respondents. The specific public education methods varied but five of the eight included hazing as something that should get taught to the public. Once again, this notion of commencing education early was common. Respondents stated things like "go for the proactive education to get in front of the issue" (Respondent 10, Denver) or "taking proactive

approaches is critical and can really prevent some of the sever incidents seen here" (Respondent 6, Denver) or "I think every community should have a coexistence program very early on" (Respondent 8, Niagara Falls). The three respondents (all from Winnipeg), who did not mention public education in their response to what should be done in a city at an early stage, stated that either nothing should be done or that continued use of lethal methods and potentially allow trappers to trap closer to the city. Other sections of their interviews, however, indicated that they did have a positive view on public education. Monitoring and reporting systems also came up many times in the discussions about what should be done in a city at an early stage. When asked if a city that does not experience any human-coyote conflict at this time could benefit from monitoring, all respondents but one said "yes".

Three respondents stated that the media plays an important role, four stated that it could play an important role in educating the public, two stated that it does not play an important role and two stated they have mixed feelings saying it can be both good and bad and that it depends on the headline.

3.1.4 Perception of the Public

The perspectives of the interviewees on what the public thinks about urban coyotes in their respective cities are highly variable. Six respondents believe that the public's perspectives on the issue are mixed. Two respondents, both from Winnipeg, believe that the general public is unaware that coyotes are in urban areas. Two other respondents believe that the general public is accepting of coyotes and one respondent believes that the majority is tolerant and aware but concerned. In terms of whether they believe the public is currently educated, eight of eleven responded saying no, two responded saying

yes and one responded saying unsure. Eight out of eleven believe it is not possible to eliminate the public's negative perception on coyotes and three believe that it is possible. Some respondents that claimed it is not possible did, however, say that there can be progress made, for example: "I think you're able to make some changes but some of these attitudes are so heavily rooted and those are a lot harder to change and so I don't know if we would be able to get rid of all the negative sentiment" (Respondent 6, Denver). Another responded stated: "I've seen people make great transition in their thought process but there will always be people that no matter what you give them will not change their view." (Respondent 8, Niagara Falls). Some respondents that said yes, qualified their answer, for example: "It's going to take a lot of money and resources and time…since you're dealing with values." (Respondent 2, Tuscon).

3.1.5 Basis for the Analysis

After coding and summarizing the data in a data summary table, it was evident that there was a spectrum of conflict levels among cities in which I interviewed someone. The classification of cities within the categories of the degree of conflict (high, medium, low) was based on the words used by the respondents to describe the current situation in their city. The three common themes used to describe the situation were coyote sightings, pet-conflict and human-conflict. Niagara Falls and Vancouver were classified under low degree of conflict since the two respondents both mentioned that there were lots of sightings and little conflict. New York, Calgary, Denver and Tuscon were classified in the medium category since respondents stated that there are isolated incidents involving pets and humans. Southern California was categorized under high degree of conflict since the respondent mentioned fatalities, many human attacks and regular pet deaths.

Winnipeg was not classified on this scheme since Winnipeg has just recently been dealing with the issue and has not implemented any major management strategies, whereas all these other cities have been managing coyotes for a number of years and have more experience dealing with the issue. The common themes of each level of conflict are summarized in Table 1. Another comparison was made between respondents from Winnipeg to the respondents of other cities.

3.2 Spatial Analysis

I was able to obtain 173 District Occurrence Reports from Manitoba Conservation and Water Stewardship from April 26th, 2010 to February 21st, 2016. Point locations from a total of 152 reports were mapped (Figure 1) and 21 reports were excluded if the sighting occurred outside of Winnipeg, if the report was vague or if no clear location was reported. Once all points were plotted, a heat map with a one-by-one kilometer grid was created based on the density of the District Occurrence Reports (Figure 2).

3.3 Temporal Analysis

The number of reports per year from 2011 to 2015 is summarized in Figure 3. Monthly totals between 2011 and 2015 were also calculated and are summarized in Figure 4.

Table 1. Comparison of common themes that emerged from the interviews classified based on the degree of conflict as described by the respondent.

Degree of Conflict	Cities classified based on degree of conflict	Parameter					
		Description of the situation		Overall impact of coyotes on the city	Perspectives on lethal methods for management	Perspective on general public's current perception	Perspective on if the public is educated
Low	Niagara Falls, Vancouver	Lots of sightings	Little to no conflict	Positive	Not needed	Accepting	Yes
Medium	New York, Calgary, Denver, Tuscon	Pet attacks and pet deaths	Occasional human attack	Positive and Negative	For isolated incidents, case-by-case	Mixed	No
High	Southern California	Many human attacks	Human fatalities	Negative	Need more lethal management	Mixed	No

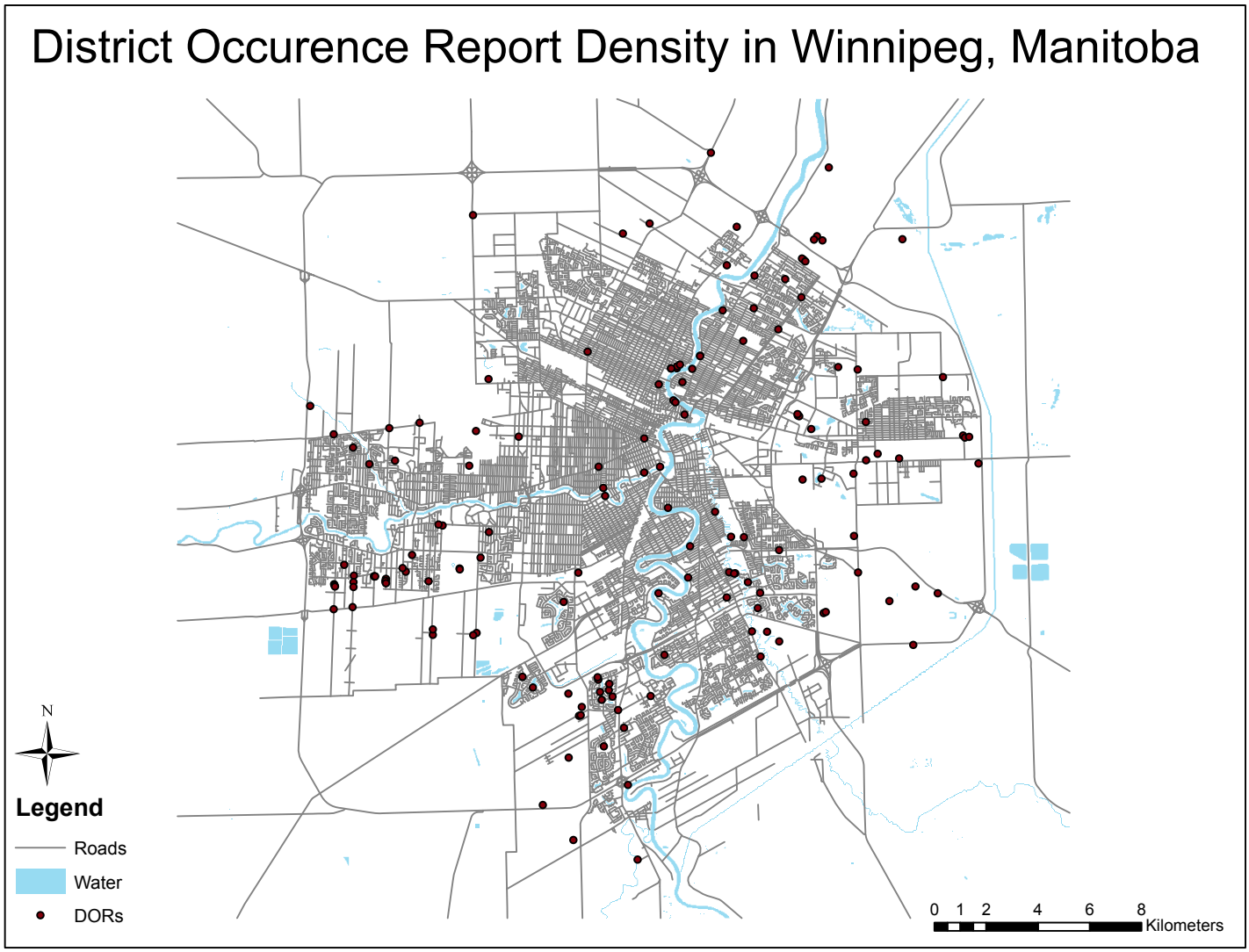

Figure 1. Distribution of District Occurence Reports in the City of Winnipeg from 2010 to 2016.

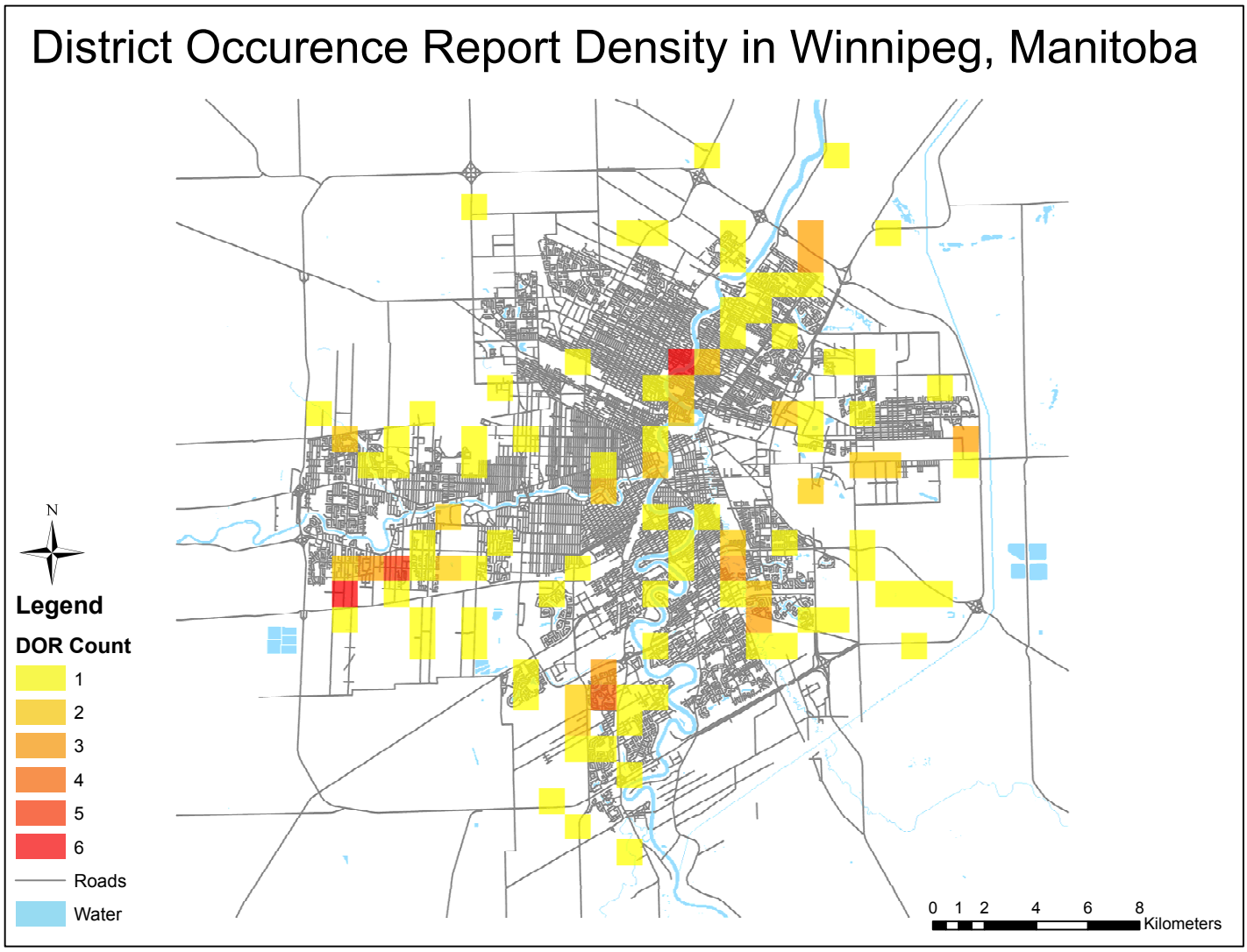

Figure 2. Heatmap displaying the number District Occurence Reports per 1km by 1km cell in the City of Winnipeg.

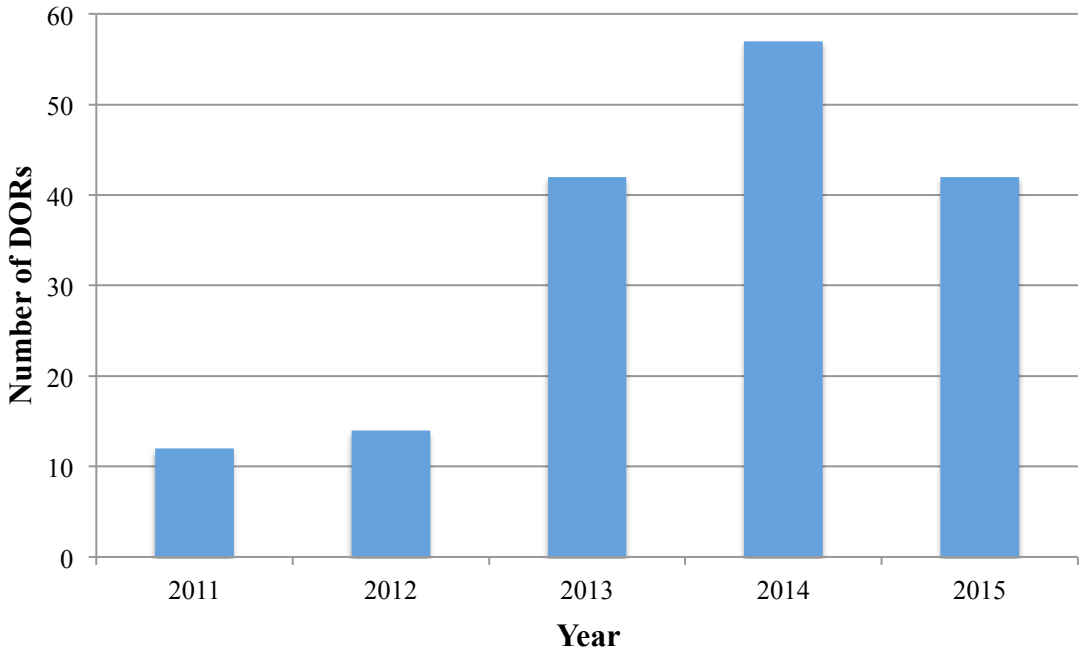

Figure 3. Number of DORs per year between 2011 and 2015 in the City of Winnipeg.

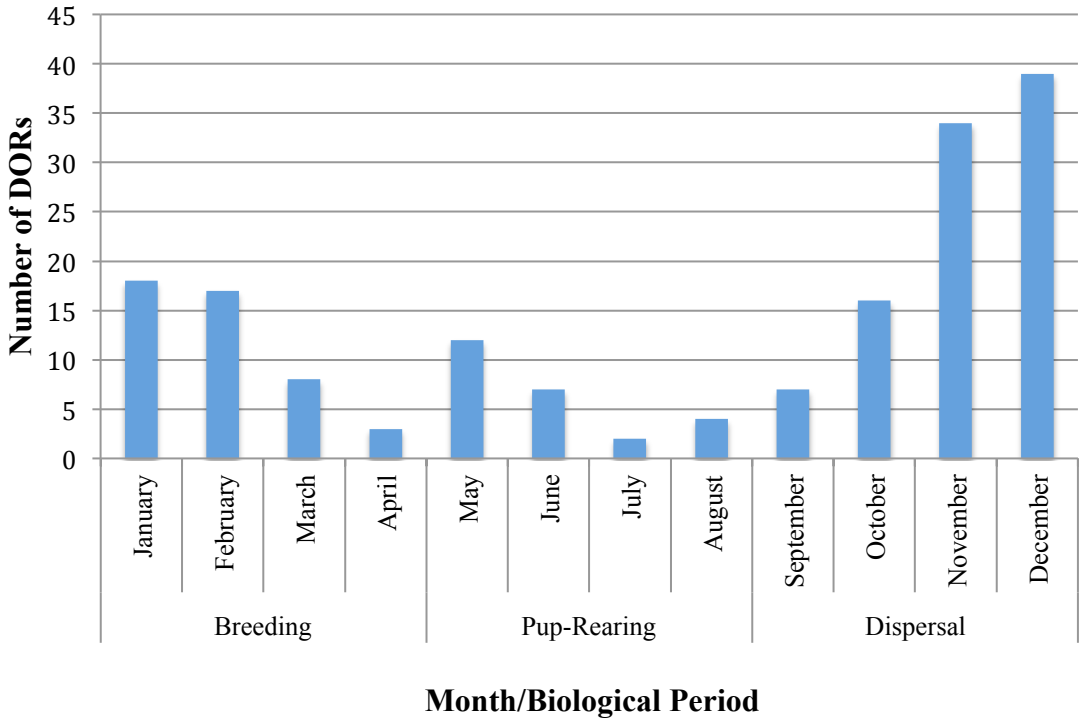

Figure 4. Number of DORs per month along with the biological seasons from 2011 to 2015 in the City of Winnipeg.

4. Discussion

4.1 Interviews

When asking interviewees about the effectiveness of various management practices it was clear that there was some ambiguity regarding the term "management". For instance a management approach may be effective at removing the specific problem animal, but not effective at addressing the broader issue of human-coyote coexistence. Also when asked about when they would decide to initiate management action, this could be taken as either when to initiate direct lethal methods of controlling coyotes or when to initiate management in a broader sense, including education and increasing public awareness. Another confounding factor is the notion that an effective management strategy could be a combination of the various methods. A management strategy may therefore be deemed ineffective alone, but effective when used with a combination of other strategies. For these reasons, it is difficult to assess effectiveness of management approaches.

An additional constraint to this research is the low sample size. Since I was aiming to interview people in many different cities as opposed to multiple people in a smaller subset of cities, I was only able to interview one person from Southern California. This means that they were the only respondent in the high conflict category. A larger sample size is required to determine if the perspectives discussed are wildly held among those involved in wildlife among each conflict category.

4.1.1 Comparison - Winnipeg to Non-Winnipeg

It is evident that Winnipeg is at an earlier stage and does not experience some of the more negative human-coyote conflicts when compared to the other urban centers where the

interviewees were from. The major noticeable difference between the responses from the interviewees from Winnipeg to those not from Winnipeg was their response to the question regarding what should be done in a city at an early stage. The interviewees from Winnipeg responded saying either nothing, increase trapping close to the city or continue to use lethal methods when human risk potential is high, whereas the interviewees from elsewhere all mentioned some aspect involving public education. This could reflect the fact that interviewees in these other cities have been dealing with the problem longer or that they have learned from what was not done in their cities early on. For Winnipeg, this means that there may be a required perspective shift into favoring a more proactive approach in order to get a handle on this issue and prevent it from becoming more severe in the future. The respondents from Winnipeg may have also factored in the cost and time required for education and that they believe these costs are not justified at this point in time.

4.1.2 Comparison by Degree of Conflict

The perspectives on if coyotes play a positive or negative role on the city varied between conflict categories and so did the perspectives on lethal methods, perspectives on the general public's current perception, and the perspectives on whether or not the public is currently educated (Table 1). Respondents categorized under low degree of conflict said that overall coyotes have a positive effect on their city, whereas those categorized under medium degree of conflict said both positive and negative and the respondent under the high conflict believed they have a negative impact on the city. These results are to be expected because when conflict is high, the benefit of having coyotes in the area becomes less important since there are many negative impacts on society. If there is no conflict

and people are coexisting with coyotes, the benefits of having coyotes around may be realized by the general public. The perspectives on lethal management varied between cities. Respondents in the low degree of conflict category believed lethal management was not needed, respondents in the medium degree of conflict mentioned it is beneficial in case-by-case, isolated incidents after other techniques have been fully exhausted and the respondent in the high degree of conflict stated that the urban areas have seen more conflict potentially because "they haven't done as enough removal of problem animals" (Respondent 1, Southern California). The cities with low conflict may not need lethal methods since the problem is, for the most part, under control. Whereas the cities with conflict may find they need lethal approaches to protect human health and safety. Naughton-Treves & Treves (2005) made a similar conclusion, stating that those who experienced wildlife conflict are more likely to welcome lethal control. One respondent in the low degree of conflict category mentioned that the "more aggressive the management tactic, the worse problems people end up with in the future" (Respondent 5, Vancouver). Widespread lethal control of coyotes may exacerbate the problem by resulting in a change in social structure, more pups being born and thus greater recruitment which could increase conflict by favoring younger individuals who are less well socialized and prone to exploit human food sources and colonize marginal territories (Fox and Papouchis 2005; Alexander and Quinn 2012; Gese et al. 2012). For these reasons, an interesting proposition would be that wildlife managers in areas with high conflict favor lethal methods which in turn creates higher conflict, whereas those in medium or low conflict believe education is more valuable which has resulted in lower conflict. However, further investigation is needed to assess this relationship.

There may also be a relationship between the level of education and acceptance and the conflict level. A more educated general public may lead to less conflict since a major factor in dealing with human-coyote conflict involves changing human behaviour (White and Delaup 2012). A more educated public may result in people being more careful about feeding wildlife, more cautious with their pets around coyotes, better about securing garbage and even more knowledge about hazing techniques. Respondents in the low degree of conflict viewed the general public as being more accepting and more educated than those in the medium and high degree of conflict categories. This may potentially be a reason as to why they do not experience much conflict. If a large portion of the public is aware and educated on how to prevent negative coyote interactions, conflict will likely be reduced (Timm et al. 2004). Public acceptance may be related to more personal experiences with coyotes. A respondent from the low degree of conflict mentioned, "once they've had to do it [haze a coyote] they realize it's no big deal at all" (Participant 5, Vancouver). Therefore it may only be after many years, once the public has had the opportunity to interact with coyotes, that the public becomes accepting of urban coyotes.

4.1.3 What does this mean for Winnipeg?

Every city should strive for coexistence and eliminate human-coyote conflicts for many reasons. First and foremost, health and safety should be priority and government has a duty to protect citizens. Second, economic benefits may be realized when wildlife response employees do not have to do coyote removal since it can be costly and difficult to target specific problem individuals (White and Delaup 2012). Third, as mentioned many times throughout the interviews, having urban wildlife and urban coyotes more

specifically can bring many benefits such as a better connection with nature or a healthy urban ecosystem.

One inclination to achieve total coexistence may be to emulate the cities in the low degree of conflict category in terms of management approach. However, there are difficulties in making this claim. For instance there may be significant differences in human population size, landscape characteristics, level of experience dealing with the issue and public perception. For example, if Winnipeg were to completely avoid lethal management techniques, like the low conflict cities, the situation will most likely not improve because there has not been the same level of underlying public education and value shifts needed for coexistence. When Winnipeg realizes what the public perceptions are towards urban coyotes, they will have a better idea of what education may be needed raise awareness to levels seen in the low conflict cities. The situation in Winnipeg must first be understood, from both a physical and human dimensions angle, in order to properly implement management strategy ideas from other cities to meet Winnipeg's needs.

4.2 Spatial Analysis

The heat map created from the District Occurrence reports illustrates spatial variation of coyote sightings in Winnipeg (Figure 2). From my observations when plotting the points, it is clear that the sightings were often in residential areas that are on the fringes of Winnipeg and in close proximity to fields, forests and other green spaces such as golf courses, riverbanks and cemeteries. These areas may offer adequate cover and prey to species to sustain coyotes. There are some biases present in this analysis. First, the locations mapped are likely influenced by population density distribution in the city since

more people in an area increases the likelihood of a sighting and subsequently the likelihood of a report (Quinn 1995). Furthermore, spatial bias occurred because more sightings are likely to occur where people are active during the day, such as parks (Quinn 1995; Poessel et al. 2013). Results may also be affected by land cover type, since it is much easier to see a coyote in a field area than in a forest, potentially resulting in more sightings close to open areas. Lastly, a coyote wandering a neighborhood, during the day and in the open, may lead to many reports from many people. This could result in an over-representation of sightings leading to hotspots in areas where there may have only been one coyote at one time (Gehrt et al. 2009). Nevertheless, this spatial analysis proves valuable to get a general sense of where human-coyote interactions have been occurring and where they may be more likely to occur in the future.

4.3 Temporal Analysis

The temporal analysis revealed a general increase in the number of District Occurrence Reports since 2011 (Figure 3). This could be due to many reasons including an larger urban coyote population, increasing suburban sprawl (Gompper 2002) or even a greater media presence which may spur people to report their sightings (Poessel et al. 2013). District Occurrence reports also varied monthly (Figure 4), with a higher number of sightings in the dispersal season. This is not consistent with Lukasik & Alexander's (2011) observations that coyote sightings were reported most frequently during the breeding season. However, movement patterns could potentially explain the high level during the dispersal season since daily coyote movements are typically far greater during the breeding and dispersal seasons than the pup-rearing season (Fox and Papouchis 2005), potentially making them more visible to people (Lukasik and Alexander 2011).

5. Conclusion and Recommendations

In my opinion, Winnipeg is at a turning point where managers and decision-makers have an opportunity to make great strides in ensuring a safe environment for citizens and coyotes. Results from this research show an increase in the number of sightings since 2011, hotspots in the city where there are more frequent sightings and a seasonal pattern of when coyote sightings are more likely. These results serve as an important baseline analysis of the current situation and can help support management decisions in the future. Additionally, the human dimensions component of this research project outline some potential cognitive shifts needed to address this issue. Managers and decision-makers need to be open to initiating and investing resources early on to prevent future conflict. Eight recommendations are outlined below:

1. Proactive approach

One of the most important recommendations evident from discussions throughout this project is to develop a strategy early on. It is very important to begin using the many management tools available before more serious problems occur. The ideal strategy should include proper monitoring and investigation of public reports, public education programs, and a protocol related to using more aggressive management techniques. A proactive approach may be more cost effective since reactive and targeted lethal management can be costly (Naughton-Treves and Treves 2005).

2. Address the underlying issue

The response to coyote incidents must include an attempt to address the underlying issue – usually related to human behaviour. In many cases, simply removing the coyote will only lead to another issue when another coyote enters the area and subsequently develops the same behaviours. This can be accomplished through education programs and thorough investigation of incidents to determine what behaviour needs to be addressed.

3. Citizen Science

Citizen science is where residents and non-professional scientists conduct research and contribute to the knowledge base by reporting their coyote sightings along with specific details about the coyote and its behaviour (Wine et al. 2014). Tracking this information can be beneficial to get a sense of what is currently happening in the community. Once this information has been tracked consistently for longer periods of time, the situation can be assessed and compared. Also, since people participate in the process, they become coyote advocates and feel they have a role to play in the management strategy (L. Sampson, Personal Communication, February 8, 2016; D. Decker, Personal Communication, February 8, 2016).

4. Community working groups

Working groups are useful to bring together many stakeholders in order to coordinate a management approach and foster cooperation. These working groups would involve people from Manitoba Conservation, grass roots organizations (Save Our Seine and Fort Whyte), media representatives, community leaders, and enforcement officers. These working groups have proved to be a valuable tool in Denver, Colorado and similar

approaches are used by Coyote Watch Canada. A working group improves the response to incidents and can educate important community members who are dealing with this issue first-hand (L. Sampson, Personal Communication, February 8, 2016; T. Teel, Personal Communication, February 5, 2016).

5. Systematic Reporting

Gathering the proper information in a consistent fashion must be a priority in order to track this issue through time. The precise location, date and behaviours of the coyote must be collected. Also, proper advertising must be set up so that the public is aware that they can report a sighting even though there has not been an incident. People may be hesitant to call in and report a sighting because they may not want the animal removed.

6. Mixed methods for report collecting

I recommend making it as easy as possible for people to report coyote sightings and by having multiple methods of collecting this information, more data can be collected. Many cities have implemented a coyote hotline where residents can call in and report a sighting. Also, an online reporting tool may be useful which has been implemented in Denver and Vancouver. Providing a publicly available map of the sightings to help educate people and alert people where coyotes are can be valuable. It is important however to ensure that the same information is collected, the information will be compiled into a single database and the language used between these methods is consistent. A clear definition is needed to distinguish when the coyote shows natural aggressive behaviour or if the coyote was shows behaviour that indicates habituation.

7. Collaboration with Coyote Watch Canada

Coyote Watch Canada has worked with many cities to help navigate this issue. When they get involved in a city they provide a framework that has been proven to help mitigate the negative effects of living with coyotes and work towards coexistence. The work they do is extensive and involves cooperation with local authorities as well as citizens.

8. Signage

Signage can be an important tool in managing coyotes and should not be underestimated (Draheim et al. 2011). A benefit of having signs is that they can be placed in the target areas where many reports are originating. Signs also remain visible for long periods of time and serve as a passive education tool that has long term benefits. In Denver, they have used strategically-placed sandwich board signs to inform the public that coyotes in in an area and have also used signs to call citizens to action by either joining the citizen science group or reporting sightings.

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Appendix A: Interview question guide

Interview Questions

Demographics

1) Number of years working as a wildlife manager/current role?
   OR Number of years studying urban coyotes/urban wildlife?
2) Have you worked in a rural environment and if so, in what capacity?
3) Record gender
4) Highest level of education?
5) Were you raised in an urban or rural environment? Outdoor experience/background?

Concept

1. Is there currently an issue regarding urban coyotes in your city? Explain.
2. On a scale of 1 to 10, 1 being no human-coyote conflict and little coyote sightings and 10 being regular human-coyote conflict and many coyote sightings, where would you say your city falls?
3. At what stage would you say your city is at:

    a. Pre-coyote inhabitation: Almost no coyotes
    b. Early stages of coyote inhabitation: coyote sightings
    c. Mid stage: coyote sightings and conflict but no management strategies currently being used
    d. Mid-Late stage: Coyote sightings, conflict and management strategies recently deployed
    e. Late stage: Effective managements strategies put in place along with reduced conflict
4. Do you believe coyotes in your city inhabit urban areas by using natural prey sources or human provided food?
    - If they respond saying natural prey items, what particular sources?
5. Do you believe there is seasonal variation of when coyotes inhabit the urban areas or more year-round coyote residents?
6. Have you experienced a change in coyote sightings (either your own or second hand) over the past 10 years? If yes explain.
7. Do you believe coyotes impact your city positively or negatively? Describe.

Management Strategies

8. Is your city currently managing coyotes in some way? Yes or No
    - If yes, what were the reason(s) as to why they initiated management?
9. How would you decide when to take management action?
10. Which negative impact is the most important driver when deciding if management is needed and why?
    a. Disease transmission
    b. Attacks on pets

c. Attacks on humans
d. Fear

11. What should be done in a city that is in an early stage of coyote inhabitation?
12. Rate the following management strategies on a scale of 1 to 10 in terms of effectiveness (1 being least effective, 10 being most effective) if there is a problem:
    a. ____ Public education for coexistence
    b. ____ Hazing by the public (waving arms, yelling, act threatening, air horn, etc.)
    c. ____ Hazing by assigned personnel (blank rounds, shooting to scare, etc.)
    d. ____ Trap and release
    e. ____ Lethal removal by trapping
    f. ____ Lethal removal by shooting
    g. ____ Legislation to prohibit feeding wildlife
    h. ____ Other: _____
13. Could cities that do not experience conflict at this point in time benefit from coyote monitoring programs?

Emotion

14. How does the media play a role in educating the public?
15. What do you feel is the general public's current perception on coyotes in your city?
16. Do you feel the majority is (choose one):
    a. Excited to see coyotes in their neighbourhoods
    b. Willing to coexist but not excited about their presence
    c. Fearful of coyotes
    d. Do not know coyotes are in their neighbourhood and therefore do not have an opinion
    e. Not concerned because there are so few coyotes
17. Do you feel the public is currently educated on coexisting with coyotes?
    a. If no, what needs to be done?
    b. If yes, what steps were undertaken to educate?
18. Is it possible to eliminate the public's negative perception or fear towards coyotes in an urban setting?
19. What are your personal perspectives on urban coyotes? Urban wildlife in general? Essential part of a city or nuisance?

Other

20. Is there anything else you would like to add on the subject of urban coyotes?
21. Who else would be good to interview on this topic