

From: lesley@thefurbearers.com
To: [Economic and Community Development](#)
Cc: "Michael Howie"; aaron@thefurbearers.com
Subject: Support re ban on wildlife feeding
Date: May 27, 2022 1:10:48 PM
Attachments: [2022-04-07 - Vancouver Wildlife Feeding Regulation Bylaw.pdf](#)
[2022-04-06-Feeding-Lit-Review-V.2.pdf](#)

Dear Economic and Community Development Committee members,

Established in 1953, The Fur-Bearers is a registered charity that works to protect fur-bearing animals through conservation, advocacy, research and education. We have approximately 60,000 supporters across Canada, with tens of thousands of supporters living in the Toronto-area.

For the past few years, our organization has grown increasingly concerned about the intentional (and unintentional) feeding of urban wildlife.

The creation of a new feeding wildlife by-law in Toronto will create tools to prevent and mitigate negative encounters with animals.

As tempting as it is to get close to nature by feeding wildlife, there are negative consequences and effects. When a wild animal is directly or indirectly fed by people, it begins to change their behaviour. Be they a squirrel, a raccoon, a coyote or any one of the many wild animals who call Toronto home, they start to take risks.

Wildlife will cross busy roads they would otherwise avoid, because of a high-value reward; they will hang out and approach people, expecting a reward, because that's what people are teaching them to do. The pattern is the same as how we treat domestic animals in our homes: we provide food rewards with the expectation that they will continue this behaviour.

The trouble is that some people may not recognize these far-reaching consequences. And that's why we support wildlife feeding by-laws.

A wildlife feeding by-law is a two-sided tool; in an educational context, it provides clear, consistent messaging about feeding wildlife throughout the city and the consequences of doing so; in an enforcement context, it gives the City of Toronto a tool that can be used when necessary to curb behaviour that is leading to public health and environmental problems. Cities and towns of all sizes across North America have instituted wildlife by-laws, which have allowed them to successfully prevent negative encounters from escalating.

At its core, feeding wildlife presents a health and safety issue for both people and animals.

We support the City of Toronto's desire to promote a safe community for both people and animals.

Enclosed are supporting materials including recent information from the City of Vancouver and a copy of our Urban Feeding of Fur-Bearing Wildlife literature review. This review, compiled by Amelia Porter, MSc, EP, RPBio, organizes and provides an overview of the available studies and general state of knowledge related to wildlife feeding in urban areas.

Thank you for your consideration.

Lesley Fox (she/her)

Executive Director

The Fur-Bearers

604-435-1850 ext. 803

www.TheFurBearers.com

Facebook.com/FurFree

Twitter.com/Furbearers

Instagram.com/Furbearers

Charitable Registration #130006125RR0002

[Become a Monthly Supporter](#)

Our Mission: To protect fur-bearing animals in the wild and in confinement through conservation, advocacy, research and education (C.A.R.E.).

Respectfully acknowledging I work remotely from my home office which is located on the traditional territories of the Hupacasath and Tseshah First Nations.

This email and any files transmitted with it are confidential and intended solely for the use of the individual or entity to whom they are addressed. If you have received this email in error, please notify the system manager. This message contains confidential information and is intended only for the individual named. If you are not the named addressee, you should not disseminate, distribute or copy this email. Please notify the sender immediately by email if you have received this email by mistake and delete this email from your system. If you are not the intended recipient, you are notified that disclosing, copying, distributing or taking any action in reliance on the contents of this information is strictly prohibited.



REPORT

Report Date: March 28, 2022
Contact: Saul Schwebs
Contact No.: 604.873.7040
RTS No.: 14436
VanRIMS No.: 08-2000-20
Meeting Date: April 13, 2022
[Submit comments to Council](#)

TO: Standing Committee on Policy and Strategic Priorities
FROM: General Manager of Development, Buildings and Licensing
SUBJECT: Wildlife Feeding Regulation By-law

RECOMMENDATION

- A. THAT Council approve, in principle, a new Wildlife Feeding Regulation By-law to prohibit people from feeding or attempting to feed wildlife and from providing, leaving, or placing attractants on any property in a manner that attracts or could attract wildlife;

FURTHER THAT Council instruct the Director of Legal Services to bring forward for enactment a new Wildlife Feeding Regulation By-law generally in accordance with Appendix A.

- B. THAT Council approve, in principle, amendments to the Ticket Offences By-law to make wildlife feeding a ticket offence with a stipulated fine of \$500.00;

FURTHER THAT the Director of Legal Services be instructed to bring forward for enactment a by-law to amend the Ticket Offences By-law generally in accordance with Appendix B.

REPORT SUMMARY

Council directed staff to prepare for consideration a by-law to prohibit intentional wildlife feeding, provided it was legally authorized. Staff undertook a review and confirmed that under the *Vancouver Charter*, Council could enact by-laws for preventing, abating, and prohibiting nuisances and wildlife feeding that could be considered a nuisance. This report recommends that Council enact a Wildlife Feeding Regulation By-law that will prohibit wildlife feeding in Vancouver. Further, staff recommend establishing a ticket offence for violating the by-law with a stipulated fine, upon conviction, of \$500.

Wildlife feeding leads to a number of negative outcomes for the public and wildlife including public safety concerns. Complaints about wildlife feeding are currently enforced through existing by-laws, which focus on garbage and waste management as well as property maintenance standards. While the current approach allows the City to respond to the complaints about wildlife feeding, it does not address the human behaviour that leads to wildlife/human conflict in an urban environment. If approved by Council, the proposed By-law will prohibit intentional wildlife feeding and leaving attractants, acting both as a deterrent for the public and as a tool for enforcement by City staff. The proposed By-law strives for a balanced and safe co-existence with wildlife in our urban environment. When combined with the Vancouver Parks Control By-law's prohibition of wildlife feeding, a major benefit of the proposed approach is a consistent, city-wide ban on intentional feeding of wildlife.

COUNCIL AUTHORITY/PREVIOUS DECISIONS

On March 31, 2021, Council directed staff to report back on Council's authority to prepare a by-law to prohibit wildlife feeding and encourage management of wildlife attractants as unintentional feeding sources. If authorized by the *Vancouver Charter* or other authority, Council directed staff to prepare for consideration a by-law to prohibit intentional wildlife feeding. Council further directed staff to consider and prepare amendments to the Ticket Offences By-Law to create a ticket offence for intentional wildlife feeding.

Under section 323(a) of the *Vancouver Charter*, Council has the authority to make by-laws for preventing, abating, and prohibiting nuisances. As outlined below, feeding of wildlife may interfere with a person's enjoyment of property, thereby creating a nuisance, so Council has the authority to prohibit wildlife feeding as a nuisance under the *Vancouver Charter*.

CITY MANAGER'S COMMENTS

The City Manager recommends approval of the foregoing.

REPORT

Background/Context

Between 2016 and 2022 (up to March), the City received over 900 incident reports regarding wildlife such as complaints of feeding, sightings and aggressive attacks. The attack on over 40 people by coyotes in Stanley Park in 2021 highlighted the issue of increased wildlife/human interaction and conflict in Vancouver. While the majority of reported incidents occurred within parks, there have been reports of wildlife feeding and attacks that occurred on private property and City streets.

In order to manage co-existence with wildlife in the urban environment, it is important to understand the potential negative impacts of certain human activities that lead to changes in animal behavior and potential risks to public safety. Both intentional and unintentional feeding of wildlife is a significant factor contributing to animals becoming habituated to being fed and associating people with food sources. Unintentional feeding of wildlife occurs when people leave out unsecured garbage, waste, compost or unharvested fruits (both on trees and on the ground) that can potentially attract wild animals in urban environment who are in search of alternative food sources. Intentional feeding of wildlife occurs when people leave out food with the objective to attract and feed wildlife. Both activities can lead to a number of negative consequences and nuisances, such as:

- Increased public health concerns including spread of disease, increased rodent activity and infestation;
- Increased risk of animal/human conflict and aggressive behavior;
- Accumulation of waste, feces, and filth as a result of leaving food attractants for the animals and birds;
- Increase in numbers and migration of animals and birds within the city in search of food in urban environment;
- Property damage by rats, raccoons, birds, etc.;
- Undesirable smells and noise from animal presence/activity; and
- Habituation, loss of natural fear and reliance on human-fed food.

As a result, wildlife/human interaction creates an imbalance and changes to animal behavior, impacting one's ability to safely enjoy their spaces and, thereby, becoming a nuisance. The creation of a Wildlife Feeding Regulation By-law as outlined in Appendix A, if approved by Council, will clearly identify and prohibit the intentional feeding of wildlife feeding.

Regulation of Wildlife Feeding Under Existing By-laws

The City of Vancouver currently has several by-laws that regulate and manage garbage, waste and food refuse on private property and streets that are not specific to wildlife feeding but are currently being used to address unintentional wildlife feeding:

- Standards of Maintenance By-law - sections 4.1 (12) and 4.1 (13) specifically prohibit a person from harbouring or allowing a property to be infested with pests, and sections 21.10 (a), 21.11 and 21.12 regulate pests and garbage management at a lodging house.
 - To encourage compliance with the Standards of Maintenance By-law, should voluntary compliance not be achieved and/or the complaint needs immediate attention, staff may resolve the issue through formal letters and legal orders. Failure to comply with the Standards of Maintenance By-law may result in a referral to the City Prosecutor with a request to approve charges. If charges are subsequently laid, liability upon conviction can result in a ticket of not less than \$500.00 for each day that the offence continues.
- Untidy Premises By-law - section 6.1 also regulates garbage and waste management on private property, requiring every owner or occupier to keep the property clear of “any accumulation of rubbish, discarded material, garbage, ashes or filth”. The Untidy Premises By-law does not refer to managing food sources or food waste, however, accumulation of these items may be addressed through this By-law as rubbish, garbage and/or filth.
 - To encourage compliance of the Untidy Premises By-law, should voluntary compliance not be achieved and/or the complaint needs immediate attention, staff may resolve the issue through formal letters and legal orders. Failure to comply with the Untidy Premises By-law may result in the City hiring a contractor to carry out the work as authorized under section 6(2), and invoice the cost of the work to the owner. If the costs incurred are not paid, the City will add such costs to the property tax roll for collection.
- Solid Waste By-law – Several sections of this bylaw require that the lids of garbage carts, green bins, and commercial waste containers remain closed while not in use, and that waste containers not be overfilled so as to prevent the lid from closing completely. Staff typically seek voluntary compliance through education and, if not achieved, may issue a legal order requiring compliance or issue a \$250 ticket.

- Street and Traffic By-law prohibits placement on any street or other public space of “any rubbish, sweepings, leaves, construction or demolition debris, paper, handbills, refuse or other discarded materials or things”. The stipulated fine for the offence of leaving refuse on a street is \$250.

While these by-laws regulate management of waste and garbage, they do not specifically address the issue of intentional feeding of wildlife. Under the current enforcement approach, staff respond to complaints about pests, accumulation of waste or garbage within a property, and unsightly premises by applying the Standards of Maintenance and Untidy Premises By-laws to bring those responsible for the property into voluntary compliance through awareness and education. Ensuring garbage and green bins are kept closed and are not overfilled is regulated under the Solid Waste By-law, and can be enforced through the Ticket Offences By-law, with a fine of \$250. Littering on the streets can be enforced through the Ticket Offences By-law, with a stipulated fine of \$250. Should voluntary compliance not be achieved and/or the complaint needs immediate attention, staff may resolve the issue through warning letters, legal orders, tickets (for some by-law clauses) or referral to City Prosecutor.

This report does not consider amending the existing by-laws to manage wildlife attractants as unintentional feeding sources because they are already effectively used to regulate and enforce complaints about untidy premises and property maintenance standards as well as the management of solid waste. Specifically, section 6 of the Solid Waste By-law requires all owners and occupiers to have an organic waste diversion plan but does not directly prohibit leaving out food sources as an attractant for wildlife. The Solid Waste By-law also requires that all garbage carts, green bins and commercial waste containers remain closed when not in active use and the private contractors servicing commercial solid waste containers must not cause or permit pests to enter them. Untidy Premises and Standards of Maintenance By-laws also address improper garbage and waste management on private property without directly prohibiting leaving it out as an attractant for wildlife. These by-laws focus on the outcome (waste and garbage placed or left on the street or property), rather than the action that creates wildlife/human conflict.

Other Jurisdictional Authority Regulating Wildlife Feeding

Both the federal and provincial government regulate wildlife. Provinces and Territories have jurisdiction over most wildlife within their borders, with the exception of wildlife on federal lands, such as in national parks; aquatic species such as fish and marine mammals; and migratory birds. At the provincial level, the *BC Wildlife Act* prohibits feeding of “dangerous wildlife”, which includes bears, cougars, coyotes and wolves. It does not apply to other wildlife that is more common and subject of concern in Vancouver such as raccoons and squirrels.

The *Community Charter* authorizes BC municipalities other than Vancouver to regulate wildlife through by-laws regarding animals. Several municipalities also apply the authority to regulate in relation to public health and nuisances. Under the *Vancouver Charter*, while wildlife is not mentioned directly, section 323(a) grants Council the authority to enact by-laws to prevent, abate, and prohibit nuisances in Vancouver.

The Park Board has jurisdiction to regulate all structures, programs and activities within parks. In September 2021, the Park Board amended the Parks Control By-law and the Park Board Ticket Offences By-law to better regulate wildlife feeding in parks¹. The Park Board approved a

¹<https://parkboardmeetings.vancouver.ca/2021/20210927/REPORT-ParkBoardBylawUpdates-FeedingWildlifeParks-20210927.pdf>

\$500 ticket for the offence. Park Rangers and the Vancouver Police Department enforce the by-law.

Strategic Analysis

Staff considered three options for addressing the issue of wildlife feeding in Vancouver:

- Option 1: status quo – continue to respond to complaints within the current by-law framework (Untidy Premises By-law, Standards of Maintenance By-law, Solid Waste By-law, Street and Traffic By-law). While this approach does not require additional resources, it does not directly address the concern of intentional wildlife feeding. Also, the enforcement of the by-laws is aimed at the owner or occupier of the property, which may not be the subject of complaint.
- Option 2: prohibit wildlife feeding on private property only. This prohibition would not apply to city streets, resulting in an inconsistent regulatory approach as wildlife is not bound only to private property. It may also be confusing for the public as the activity would be prohibited in some parts of the city (private land and parks through their by-law) and not in others (public land). It may also create challenges for enforcement depending on where and how the incident occurs.
- Option 3: create a by-law to prohibit intentional wildlife feeding and placing food as an attractant for wildlife, and make the by-laws enforceable by ticket information. This approach would clearly identify and prohibit undesirable behaviour and establish an enforcement tool regardless of where the wildlife is fed.

While many complaints could be responded to and enforced under the current by-laws, staff recommend a new by-law directly prohibiting wildlife feeding. The proposed by-law will clearly identify and prohibit unwanted human behaviour that leads to a number of negative consequences and risks. This enforcement approach will target the cause (human behavior of feeding wildlife) rather than the result and possible outcome of that behavior (food and waste on premises, infestation, change in animal behaviour).

Based on the 3-1-1 complaints data referencing wildlife, while the majority of wildlife feeding occurs in parks and on private property, feeding can occur throughout the city. The proposed by-law will apply to both private and public land, consistently prohibiting wildlife feeding in all areas of the city. Together with the approved Vancouver Park Board By-law, the prohibition of wildlife feeding will apply to all areas of the city. If the proposed by-law is approved by Council, staff will develop and disseminate education materials to make it clear for the public that this activity is prohibited in Vancouver.

Staff also recommends an amendment to the Ticket Offences By-law to establish a ticket offence with a stipulated fine of \$500. By creating a ticket offence, City staff will be able to directly respond to complaints of wildlife feeding. The ticket may also act as a deterrent. However, staff will first seek voluntary compliance through awareness and education.

Jurisdictional Scan

Staff conducted a jurisdictional scan of wildlife feeding regulations in other municipalities (see Appendix F). In B.C., Coquitlam, Maple Ridge, Port Coquitlam, Victoria, Nanaimo, Princeton, Tumbler Ridge, and Esquimalt have by-laws that prohibit wildlife feeding. The reviewed

municipalities rely on their authority to regulate animals, public health and nuisances under the *Community Charter* when prohibiting wildlife feeding. While the specific language of the by-laws vary between municipalities, most prohibit intentional wildlife feeding and leaving attractants in such a manner as to be accessible to wildlife. Some municipalities also prohibit other specific behaviour that can be considered unintentional feeding such as not harvesting ripened fruits (Coquitlam, Maple Ridge, Princeton) or having coops or pens accessible to wildlife (Princeton).

The ticket offences for a wildlife feeding offence in BC ranged from \$100 to \$1,000, and in Ontario and Nova Scotia the fine amount ranged from \$500 to \$5,000.

Birdfeeders

Hummingbird and songbird feeders are an important component of human interaction with birds in an urban environment and can be an essential food source for birds during times when natural food sources are scarce. They are also not considered to be the cause of wildlife/human conflict and do not pose a considerable risk to public safety. Other municipalities that regulate wildlife feeding allow birdfeeders as long as they are inaccessible to other wildlife.

None of the municipalities reviewed prohibited birdfeeders. Coquitlam, Maple Ridge, and Princeton have by-laws for prohibiting wildlife feeding that exempt birdfeeders, as long as the area was kept clean and did not attract wildlife. Port Coquitlam, as well as Brantford and London, Ontario, while not directly mentioning birdfeeders, defined wildlife feeding and attracting wildlife in such a manner that birdfeeding was not prohibited as long as the area was kept clean and did not attract other wildlife.

The BCSPCA Model Animal Responsibility By-laws recommend prohibiting feeding or providing access to food for songbirds between April and September (the period of bear activity) with the exception of liquid feeders. This seasonal restriction is not relevant to Vancouver as bears are not a common cause of concern. Therefore, staff recommend exempting hummingbird feeders and other birdfeeders from the proposed By-law as long as they are inaccessible to other wildlife provided the area is kept clean, as outlined in Appendix A.

Stakeholder Consultation

Staff consulted with the BC SPCA, BC Wildlife Federation, BC Conservation Officer Service, the Park Board and Vancouver School Board on prohibiting wildlife feeding as a nuisance in Vancouver (see Appendix C). With the exception of BC Wildlife Federation who supported an education-based approach, the stakeholders were supportive of prohibiting wildlife feeding through a by-law.

Staff consulted with Animal Control staff from several BC municipalities to discuss enforcement. The approach to enforce against wildlife feeding was similar across all jurisdictions:

- A combination of enforcement and education approaches is typically used, with warnings issued for most first time offenders
- Enforcement is typically reactive, responding to complaints from residents
- Affordability of tickets can be a challenge, especially with repeat offenders

Recommendation

Staff recommend the Wildlife Feeding Regulation By-law, as outlined in Appendix A, prohibit feeding of wildlife or leaving attractants in such a manner that might attract wildlife on any property with an exemption for hummingbird and other birdfeeders. Staff also recommend an amendment to the Ticket Offences By-Law to establish a ticket with a stipulated fine of \$500 for the violation of feeding, attempting to feed or attracting wildlife. The proposed Wildlife Feeding Regulation By-law can also be enforced by ordering compliance. The objective of the recommendations are to clearly define the prohibited behaviour that leads to wildlife/human conflict and create a ticket offence in order to protect both residents and wildlife from the negative consequences of wildlife feeding.

Proposed Compliance Strategy

The authority to enforce the By-law will be included in the Ticket Offences By-Law with a stipulated fine of \$500 for the violation of attracting or feeding wildlife.

Subject to approval of the proposed Wildlife Feeding Regulation By-law, staff will inform the public of the By-law and the associated ticket offence through the City website and City's social media channels. City staff will also disseminate information about the By-law when responding to complaints. Combined with the existing signage installed in City parks, this messaging will raise awareness and understanding of the negative impacts of wildlife feeding. Installation of signage outside of parks would require significant additional financing and staff resources.

Staff will work with 3-1-1 to improve and monitor data collection to evaluate if additional enforcement or educational resources are required. In combination with the Parks Control By-law prohibiting feeding of wildlife, this proposed By-law should reduce the number of reported incidents.

Legal

The proposed Wildlife Feeding Regulation By-law is authorized by the City's nuisance powers set out in the *Vancouver Charter*.

CONCLUSION

Staff recommend that Council approve the Wildlife Feeding Regulation By-law to prohibit intentional wildlife feeding and leaving attractants as a nuisance, as well as an amendment to the Ticket Offences By-Law to make wildlife attracting or feeding a ticket offence. While complaints about waste and garbage can be responded to and enforced through existing by-laws, intentional feeding of wildlife would be best addressed through a specific by-law targeting intentional feeding of wildlife as outlined in the Appendices A and B. It will also align with the Vancouver Park Board's By-law to prohibit wildlife feeding and accompanying ticket offence. By clearly defining and prohibiting intentional wildlife feeding behavior and establishing a ticket offence, feeding wildlife will be consistently regulated across the city and strive for a balanced and safe co-existence with wildlife in an urban environment.

BY-LAW NO. _____

A By-law to Regulate Wildlife Feeding

THE COUNCIL OF THE CITY OF VANCOUVER, in public meeting, enacts the following:

**SECTION 1
INTERPRETATION**

Name of By-law

1. The name of this By-law, for citation, is the “Wildlife Feeding Regulation By-law”.

**SECTION 2
DEFINITIONS**

2. In this By-law:

“ATTRACTANT” means food or food waste, meat, a carcass or part of a carcass of an animal or fish, compost or any other waste that could attract wildlife.

“WILDLIFE” means all amphibians, reptiles, birds, and mammals, both native and not native to the Province, excluding any domesticated animal under the control of a human.

**SECTION 3
OFFENCES**

Feeding Wildlife

3.1 In order to avoid creating a nuisance, a person must not:

- (a) feed or attempt to feed wildlife; or
- (b) provide, leave or place an attractant on any property in a manner that attracts or could attract wildlife.

3.2 Section 3.1 does not apply to a person who feeds hummingbirds on private property or feeds other birds with a birdfeeder that is inaccessible to other wildlife, provided the area is kept clean.

**SECTION 4
ENFORCEMENT**

4.1 The Manager, Property Use Inspections and any Property Use Inspector or Street Use Inspector may issue a written order to a person directing that the person take necessary steps to comply with a provision of this By-law by a date specified in the order.

4.2 No person shall fail to comply with an order issued pursuant to section 4.1.

Stakeholder Consultations

BC Society for the Prevention of Cruelty to Animals (BC SPCA):

- There is support for bylaws to prohibit direct and indirect wildlife feeding as a nuisance;
- Efforts to educate the public on the consequences of wildlife feeding have not had enough effect, and that the activities need to be prohibited and enforced with ticket offences;
- There are different scenarios where people feed wildlife (e.g., a one-off situation where person who feeds a coyote to get a picture for social media, or a person who leaves out dog food for raccoons every day), all need to be addressed with warnings and ticket offences;
- Birdfeeders (nectar for hummingbirds or seed for other songbirds) can be allowed as long as the feeders are kept clean, wildlife proof, and do not attract an excessive number of birds.

The BC SPCA has published model animal responsibility bylaws², which include a section on wildlife feeding. These have served as a starting point for some BC municipalities which have prohibited wildlife feeding. The SPCA recommends implementing wildlife feeding and attractant management bylaws as:

- Wildlife feeding increases risks to human health and safety and neighbourhood conflicts associated with food-conditioned wildlife.
- The presence of food waste attracts unwanted wildlife that can become a nuisance through the presence of wildlife, noise, and droppings, and can lead to increased rodent activity and public health concerns.

The model bylaws define “attractant”, “songbirds”, “waste”, and “wildlife” and prohibit feeding wildlife or providing them access to food, storing attractants or waste so that it is accessible to wildlife, and attracting wildlife onto a property such that it will create a nuisance for other properties. An optional prohibition on birdfeeders between April and September is only recommended for communities with bear activity (which is not relevant for Vancouver).

BC Conservation Officer Service:

- Strong support for by-laws to prohibit direct and indirect wildlife feeding;
- That municipalities that have implemented effective bylaws and enforcement related to wildlife feeding have fewer wildlife being killed and a decrease in vermin, which has led to a decreased coyote population;
- That effective educational approaches they have seen have focused on children in schools, as well as signage emphasizing the financial implications of tickets;
- That they are challenged to enforce provincial wildlife feeding laws due to resource availability and the large geographical region they cover.

BC Wildlife Federation:

- Opposition to municipal by-laws to prohibit wildlife feeding beyond what is prohibited by the *Wildlife Act* (feeding of dangerous wildlife); they feel that enforcement under the provincial Act is more effective;
- That they prefer an education-based approach to healthy wildlife management;
- That it is important for people in urban environments such as Vancouver to have opportunities to interact with certain animals, such as birds.

² <https://spca.bc.ca/wp-content/uploads/BC-SPCA-Model-Animal-Responsibility-Bylaws-Sept-2017.pdf>

Vancouver School Board:

- Support for by-laws to prohibit wildlife feeding;
- That schools have policies that don't allow staff or students to feed wildlife on school grounds, though several schools have birdfeeders on the grounds;
- Some concern that people unaffiliated with a school may leave attractants or waste; staff do a morning sweep of the grounds and clean up any significant messes.

Vancouver Park Board:

- Support for by-laws to prohibit wildlife feeding;
- Concerns that wildlife feeding can cause artificial wildlife population growth and is untidy (food, waste, feces, etc.);
- That they have concerns over enforcement of similar Parks by-laws since Park Rangers do not have the authority to compel a person to show identification.

Authority to Regulate Wildlife Feeding in BC***Provincial Jurisdiction - BC Wildlife Act***

- Sec. 33.1 prohibits feeding or leaving attractants for dangerous wildlife (only applies to cougars, bears, coyotes, and wolves)

Vancouver Charter

- Sec. 323 (a) grants Council authority to make by-laws for preventing, abating, and prohibiting nuisances.

Untidy Premises By-law

- Sec. 6(1) "Where the owner or occupier of any real property fails to remove from such property any accumulation of rubbish, discarded materials, garbage, ashes or filth, or fails to keep the said property cleared of weeds, brush, trees, or other growths, or is otherwise in breach of this By-law, the Director of Licenses and Inspections may cause a notice to be served upon the owner of the real property requiring such owner to remedy the condition within ten days".
- Ticket Offence \$250 - \$10,000

Standards of Maintenance By-law

- Sections 21.11 and 21.12 regulate garbage and waste management at a lodging house;
- Section 4.12 requires "every owner of land must keep the land, and any building or accessory building on it, in such condition that it will not afford harbourage for or become infested with pests".
- Ticket Offence \$250 - \$10,000

Solid Waste By-law

- Sections 4.2, 6.6, 9.1, and 9.2A of this bylaw require that the lids of garbage carts, green bins, and commercial waste containers remain closed while not in use, and that waste containers not be overfilled so as to prevent the lid from closing completely
- Part 6 outlines requirements for food waste management through the green cart service and requires every owner or occupier to have an organic waste diversion plan.
- Fines on conviction range from \$250 - \$10,000
- Ticket Offences \$250

Street and Traffic By-law

- City Engineer and Police Officer have authority to enforce Section 84: "No person shall deposit upon any street or other public place, any rubbish, sweepings, leaves, construction or demolition debris, paper, handbills, refuse or other discarded materials or things."
- Fines on conviction range from \$250 - \$10,000
- Ticket Offence \$250 (Ticket Offences By-law)

Animal Control By-law

- Does not address feeding of wildlife

Parks Control By-law

- Section 9A of the By-law prohibits any person from feeding or attempting to feed wildlife as well as placing attractants that could attract wildlife.
- Ticket Offence \$500

BC SPCA Animal Responsibility Bylaws

Wildlife feeding and attractant management

Risks to human health and safety and neighbourhood conflicts associated with food-conditioned wildlife are municipal issues that can be addressed with enforcement warnings and fines. Bylaws are required in conjunction with public education to ensure residents understand their role in attracting wildlife and the consequences of increased wildlife habituation (e.g., expensive and ineffective deer culls).

Many species of wildlife can be unnaturally attracted to communities and human residences, leading to conflict. 7 Common examples include deer, raccoons, skunks, squirrels, gulls, crows and even seals, where feeding by residents and tourists increases habituation of wildlife. Compost, garbage, pet food and even bird feeders will attract unwanted wildlife that can become a nuisance to residents through their increased presence, noise and droppings. Further, improper waste management and wildlife feeding can lead to increased rodent activity and public health concerns.

Managing waste for, and preventing feeding of, “dangerous wildlife” (bears, cougars, wolves and coyotes) only is regulated by the Province in section 33.1 of the Wildlife Act. Thus, managing attractants for all other wildlife species is a municipal responsibility. Please note, sections 9(1)(c) and 9(3)(c) of the Community Charter require ministerial approval prior to a Council adopting a bylaw in relation to wildlife. Provision 4 below may be optional depending on the proximity of the community to bear activity.

Bylaw Adapted from District of Squamish Bylaw No. 2053, Village of Kaslo Bylaw No. 1070 and City of Kamloops Bylaw No. 3411

Definitions

“Attractant” means any substance or material, with or without an odour, which attracts or is likely to attract animals; and without limitation includes antifreeze, paint, food products, unclean barbecues, pet food, livestock and livestock feed, beehives, bird feeders, offal, improperly maintained composts, restaurant grease barrels, accumulation of fruit in containers or on the ground;

“Songbirds” means any Passerine, excludes Corvidea (e.g., crows, ravens and jays) and includes hummingbirds;

“Waste” means any discarded or abandoned food, substance, material, or object, whether from domestic, commercial, industrial, institutional or other use; and

“Wildlife” means any undomesticated free-ranging animal, exempting songbirds for the purposes of feeding.

Wildlife Feeding

1. No person shall knowingly or willingly feed any wildlife, or in any manner provide them or allow access to food or any other edible substance.
2. No person shall store any attractant or waste in such a manner that it is accessible to wildlife.

3. No person shall attract wildlife onto a property such that these wildlife create a nuisance for other properties.

4. No person shall feed or provide access to food for songbirds between April and September, exempting liquid feeders.

Jurisdictional Scan

Municipality	Wildlife feeding	Bird feeding exception	Attracting Wildlife	Exceptions / Additional Conditions	By-law	Ticket Offence	Enforcement
Coquitlam	Y	Y	Y	Owner of property cannot allow conditions that could attract Vectors Specific potential attractants prohibited (e.g., must harvest ripe fruit)	Wildlife and Vector Control	\$1000	<ul style="list-style-type: none"> • City Solicitor • Assistant City Solicitor • Manager, Bylaw and Animal Control Services • Bylaw, Licensing and Animal Control Supervisor • Bylaw Inspector 1 • Bylaw Inspector 2 • Property Use Supervisor • Property Use Inspector • General Manager, Engineering & Public Works
Port Coquitlam	N	N/A	Y	Owner of property must not provide food, shelter, or breeding conditions that could lead to a nuisance caused by rats or mice	Vector Control	N/A	<ul style="list-style-type: none"> • Vector Biologist
Port Coquitlam	N	N/A	Y	Garbage must be stored in wildlife resistant containers	Solid Waste	\$1000	<ul style="list-style-type: none"> • Bylaw Enforcement Officers • Manager of Bylaw Services • Royal Canadian Mounted Police

Municipality	Wildlife feeding	Bird feeding exception	Attracting Wildlife	Exceptions / Additional Conditions	By-law	Ticket Offence	Enforcement
Maple Ridge	Y	Y	Y	Wildlife feeding applies only to dangerous wildlife Specific potential attractants prohibited (e.g., must harvest ripe fruit) Garbage cannot be put out until 5am on collection day	Wildlife and Vector Control	\$100-500 (feeding = \$500, attracting = \$400)	<ul style="list-style-type: none"> • Bylaw Compliance Officer • Director of Bylaw & Licencing Services • Environmental Planner • Environmental Technician • Manager of Bylaw & Licencing Services • R.C.M.P.
Victoria	Y	Y	Y	Feeding applies to deer, raccoons, squirrels, and feral rabbits; as well as pigeons, crows, and gulls within downtown core	Animal Control	\$125-\$350	<ul style="list-style-type: none"> • Animal Control Officer • Bylaw Officer • Police Constable
Princeton	Y	Y	Y	Garbage must be stored in wildlife resistant containers and cannot be put out until 5am on collection day Specific potential attractants prohibited (e.g., must harvest ripe fruit)	Wildlife Attractant	\$150-\$500 (Feeding or attracting = \$500)	<ul style="list-style-type: none"> • Building officials • Fire inspectors • Bylaw enforcement officers
Nanaimo	Y	Y	Y	Wildlife feeding applies only to deer, raccoons, squirrels, feral rabbits, and dangerous wildlife	Animal Control	\$350	<ul style="list-style-type: none"> • Poundkeeper • Bylaw Enforcement Officers

Municipality	Wildlife feeding	Bird feeding exception	Attracting Wildlife	Exceptions / Additional Conditions	By-law	Ticket Offence	Enforcement
Esquimalt	Y	Bird feeding is not prohibited	Y	Wildlife feeding applies only to bears, cougars, wolves, coyotes, raccoons, eastern grey squirrels, deer, and Canada Geese Attractants only applies to fruit fallen from trees or bushes	Animal Management Bylaw	\$100	<ul style="list-style-type: none"> • Director of Development Services • Bylaw Enforcement Officer
Tumbler Ridge	Y	Y	N	Feeding birds by hand is allowed	Animal Responsibility	\$100	<ul style="list-style-type: none"> • Peace officers • Bylaw Enforcement Officer • RCMP • Animal Control Officers
Brantford, ON	Y	N (though if area is kept clean and feeder is wildlife proof bird feeding would not be prohibited)	Y	Prohibition is specific to feeding that causes animals to congregate in a manner that causes property damage	Public Nuisance	Up to \$5,000	<ul style="list-style-type: none"> • Bylaw Enforcement Officer

Municipality	Wildlife feeding	Bird feeding exception	Attracting Wildlife	Exceptions / Additional Conditions	By-law	Ticket Offence	Enforcement
Waterloo, ON	Y	Y	Y	Wildlife feeding and attracting wildlife is prohibited if it causes a nuisance, which includes attracting a large numbers of wild animals or wild birds, results in a potential health or safety risk (including but not limited to the accumulation of feces), or is likely to interfere with the normal use or enjoyment of property (including through odour or noise)	Animals	N/A	<ul style="list-style-type: none"> • Municipal Law Enforcement Officers • Humane Society • Police Officers
London, ON	Y	N (though if area is kept clean and feeder is wildlife proof bird feeding would not be considered "nuisance feeding")	Y	Nuisance feeding of wildlife is prohibited, which is defined as feeding or leaving out food which results in one or more of the following: excessive accumulation of food, excessive accumulation of wildlife feces, unreasonable interference with the normal use and enjoyment of nearby premises, or excessive attraction of rodents or predatory wildlife	Public Nuisance	Up to \$500	<ul style="list-style-type: none"> • Municipal Law Enforcement Officer • London Police Service
Halifax, NS	Y	Y	N	Feeding of birds and wildlife is not permitted if it creates a nuisance	Respecting Animals and Responsible Pet Ownership	\$200-\$5000	<ul style="list-style-type: none"> • Police Officer • By-law Enforcement Officer • Special Constable (appointed pursuant to the Police Act)



URBAN FEEDING OF FUR-BEARING WILDLIFE

Contents

Introduction	4
Background.....	4
Purpose and Objectives	4
Types of feeding	5
Wildlife species	5
Questions	5
Literature Review	6
Human Dimensions.....	6
Why do people feed wildlife?.....	6
Extinction of experience	6
Human health and wellbeing.....	6
Concern for wildlife conservation & welfare	7
Social Demographics.....	7
Wildlife Implications.....	8
Wildlife Behaviour	8
Food-conditioning and human-wildlife conflict: species examples.....	8
Wildlife Health	11
Nutrition, immunity and disease	11
Implications for human and domestic animal health	12
Cascading Ecological Impacts.....	13
Mitigation Strategies	15
Tools for Managers and Educators	15
Framework to Identify Unacceptable Feeding.....	15
Coexistence plan.....	16
Urban and Park Design	16
Education and Messaging.....	17
Law Enforcement.....	20
Discussion	22
Research Gaps.....	23
Human dimensions.....	23
Wildlife impacts	23
Mitigation.....	24
Recommendations	25
References	28



Urban Feeding of Fur-Bearing Wildlife
Literature Review
Copyright © March 2022

Prepared for The Fur-Bearers by:
Amelia Porter, M.Sc., EP, RPBio.

Additional recommendations and information about the 2020/2021 Stanley Park coyote case study were added to this literature review.

About The Fur-Bearers

Established in 1953, The Fur-Bearers is a leading Canadian wildlife protection charity whose mission is to protect fur-bearing animals through conservation, advocacy, research and education (C.A.R.E).

INTRODUCTION

Background

The practice of intentionally feeding wildlife in parks and neighborhoods has become an important issue with increasing urbanization. Recent stories in the Canadian media report of people feeding wolves and bears at national parks, coyotes in city parks and neighborhoods, and raccoons and squirrels in parks and backyards. People are often motivated to feed wildlife in green spaces and backyards as a means to seek experiences with nature, cultivate personal wellbeing, or they are concerned for the welfare of wildlife.

Feeding may be carried out with good intentions; however, there are a number of detrimental consequences to both wildlife and humans. Ultimately, feeding wildlife leads to shifts in behaviour and ecology, dependence on unreliable food sources, aggression, and human-wildlife conflict (Cox and Gaston, 2018). In the long-term, feeding can cause suffering and poor welfare of animals (Dubois and Fraser, 2013a). Where problem situations arise from humans feeding wildlife and the subsequent progression of food-conditioned behaviours, species individuals or populations are often killed (Cox and Gaston, 2018; Dubois and Fraser, 2013a). In severe cases, feeding-induced aggression has led to human fatalities (Orams, 2002).

Despite a number of direct species benefits cited in the literature, (e.g., increased survival, productivity, and population growth), intentional recreational feeding has been evaluated in the scientific literature as an inappropriate and unacceptable form of feeding (Dubois and Fraser, 2013a; Murray et al., 2016). Experts have deemed intentional recreational feeding as unacceptable since it results in poor animal welfare, human-wildlife conflict, is poorly controlled, it does not serve a conservation purpose (Dubois and Fraser, 2013a), and has negative consequences for wildlife nutrition and disease spread in both wildlife and humans (Murray et al., 2016).

Purpose and Objectives

The purpose of this literature review is to provide an overview of the state of knowledge on urban wildlife feeding. Specifically, the drivers and consequences of intentional urban wildlife feeding are discussed. Sources reviewed include scholarly journal articles, books, and government resources. The literature review is organized by relevant topics and combines both summary and synthesis of information. Sources are discussed in the context of their contribution to the understanding of the subject. Relationships are discussed between works where applicable and interpretations are made. Following the literature review, a summary of key findings is outlined, research gaps are identified, and recommendations are provided.

Types of feeding

There are various forms of intentional and unintentional wildlife feeding. Unintentional feeding includes anthropogenic foods from garbage, compost, landfills, gardens, fruit trees, and pet food. Conversely, intentional feeding may be carried out for captivity and rehabilitation, research, management, tourism, and opportunistic reasons (Dubois and Fraser, 2013a). Opportunistic feeding is defined as the intentional act of feeding wildlife at roadsides, public spaces and in backyards, and is the focus of this literature review. Literature on tourism feeding may also be included if deemed applicable since it is similar to opportunistic feeding, in that they are both recreational.

Wildlife species

Fur-bearing species such as bears, coyotes, squirrels, chipmunks, and raccoons are discussed in this review. Deer and birds are excluded, however if applicable, they may be referred to due to their prominence in the literature. Effort is made to use Canadian and North American examples as much as possible, but others are included where appropriate.

Questions

This review aims to provide insight into urban opportunistic feeding and answer the following three main questions:

1. Why do people feed urban wildlife? (What are the drivers?)
2. What are the impacts to wildlife and humans in terms of behavior, health, ecology and conflict? (What are the consequences?)
3. What are proven and potential mitigation strategies?

LITERATURE REVIEW

Human Dimensions

Why do people feed wildlife?

Extinction of experience

Globally, half of all people resided in a city or town by the year 2007 (Cox et al., 2018). Cox et al. (2018) point to the 'extinction of experience'; they argue that opportunities for nature interactions are progressively declining. The extinction of experience is largely attributed to growing urbanization of the human population in conjunction with loss of habitat and biodiversity, as well as more human sedentary pastimes (Cox et al., 2018). Simply, there are fewer incidences of human interactions with nature, and therefore, people in urban areas intentionally seek these experiences by feeding wildlife around the home or visiting green spaces for wildlife interactions. Attracting wildlife increases the frequency, duration, and intensity of experiences with nature (Cox et al., 2018).

A study conducted at Bunya National Park in Australia found three main reasons why people feed wildlife: to interact with wildlife, for personal pleasure, and because other people were doing it (Parkin, 2001). People may perceive benefits of others engaging in wildlife feeding and also want to participate in the experience, even if they didn't plan to feed animals on their visit (Parkin, 2001).

Related to experience, (Dubois & Fraser, 2013a) cite a number of reasons why humans feed wildlife. Specifically, benefits to people include feelings of pleasure, usefulness, gained trust of animals, education for adults and children; entertainment; aesthetic benefits; and to observe or photograph animals. Further, some people may even associate wildlife as their own domestic inhabitants, with feelings of attachment, as in a case involving bears in British Columbia or birds in Australia (Dubois & Fraser, 2013a.)

Human health and wellbeing

There is a wealth of evidence demonstrating that interaction with nature has positive impacts to human physical and mental health as well as social wellbeing. Urban bird feeding has been associated with psychological benefits, such as feelings of pleasure, relaxation and connection to nature (Cox and Gaston, 2018). Gains in health and wellbeing from feeding wildlife may encourage even more feeding (Cox and Gaston, 2018).

Despite immediate feelings of connection with nature and positive wellbeing, feeding animals in the long-term often results in negative human health consequences, due to subsequent animal suffering, poor welfare and increase in human-wildlife conflicts (Dubois and Fraser, 2013a; Cox and Gaston, 2018). Cox and Gaston, (2018) highlight a potential missing feedback loop where people who benefit from feeding interactions may not experience the negative impacts or associate their actions with welfare issues. This is why there is a need for effective education to influence and modify human behaviour.

Concern for wildlife conservation & welfare

Many people feed wildlife because they feel they are helping. They may have concerns for the welfare of the animals or they feel they are assisting with conservation (Cox and Gaston, 2018; Howard and Jones, 2004). Wildlife conservation benefits, real or perceived, may include improved survival and population growth (Dubois & Fraser, 2013a.)

Howard and Jones (2004) conducted a survey of managers and wildlife feeders in Australia. Dependency was a common theme in responses, however managers perceived this as a negative factor for welfare, while wildlife feeders perceived it to be positive. The authors concluded the differing constructs of wildlife to arise from the two different means in which information is attained: wildlife managers being strongly knowledge based, while experience based for feeders.

Wildlife feeding interactions may support increased public awareness, thereby fostering further support for conservation (Dubois & Fraser, 2013a.) Fewer interactions with nature have implications for how people relate to nature. In particular, people show less affinity and interest, less value placement, and less inclination to participate in pro-environmental behaviours (Cox and Gaston, 2018). An increased daily interaction around the home has been associated with a greater understanding and empathy toward nature.

Ethical reasons may also play a role, which in turn can motivate more people to feed (Dubois & Fraser, 2013a.). People may believe that they are counteracting negative human impacts such as habitat destruction or lack of natural foods by providing anthropogenic sources (Dubois & Fraser, 2013a.).

Social Demographics

Western societies are currently the focus of literature related to opportunistic wildlife feeding (Chapman and Jones, 2009; Cox and Gaston, 2018). Bird feeding in particular is popular in North America, Europe, Australia and New Zealand (Dayer, 2019). This is an area requiring further research to better understand the role of culture and socio-demographics in intentional wildlife feeding, particularly with fur-bearing animals.

Statistics Canada was contacted for numbers related to Canadians engaging in wildlife feeding, however they did not have any information. Annually in the USA, out of 59 million households feeding wildlife around the home, 97% (57 million) fed wild birds, and 25% (15 million) fed other wildlife (U.S. Fish and Wildlife Service, 2018)¹. In the USA, there has been an overall decreasing

¹ Note that some people fed both birds and other wildlife.

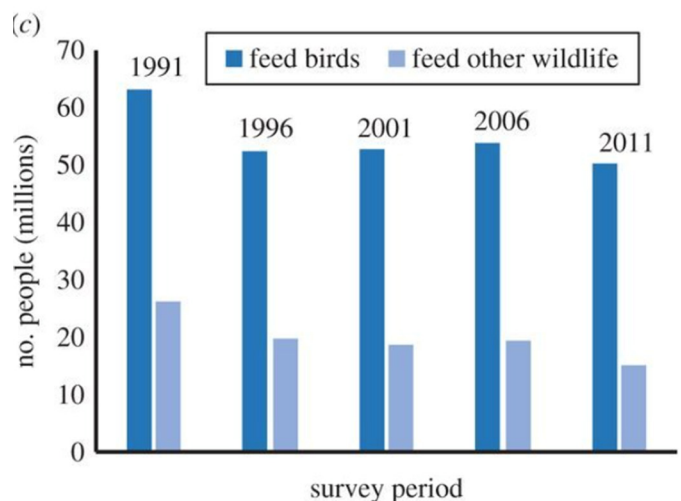


Figure 1 – USA trends in wildlife feeding around the home (adopted from Cox and Gaston, 2018)

trend since 1991 in the number of people feeding other wildlife, suggesting that people may be becoming more aware of the potential issues of wildlife feeding (Figure 1; Cox and Gaston, 2018; U.S. Fish and Wildlife Service, 2018). More research and surveys are needed to understand the prevalence of wildlife feeding in Canada.

Wildlife Implications

Wildlife Behaviour

Behavioural plasticity is the developmental capacity of an individual to exhibit a wide range of behaviours (Gilbert, 1989). Mammalian flexibility or ability to alter behaviour has evolved as a function of large brains and is central to carnivore behaviour and ecology (Gilbert, 1989). Recent research demonstrates the significance of this adaptability feature, even in small mammals (i.e., foraging shifts in the rodent *American pica*), showing that behavioural plasticity may help species survive increasing temperatures associated with climate change. This is because the lag time between behaviour response and environmental change is short (and reversible). Behavioural plasticity can allow organisms to adapt to urban environments faster than genetic evolution due to the quick response time capable of one individual (Murgui and Hedblom, 2017). However, genetic mechanisms influencing behaviour such as microevolution in urban habitats may also play a role (Murgui and Hedblom, 2017).

Certain characteristics make some species more capable of surviving in urban environments such as the propensity to exhibit behavioural plasticity, genetic factors influencing behaviour, together with being a dietary ecological generalist. Specialist species which favour a specific diet or habitat may be most impacted by growing urbanization (Beckmann & Berger, 2003). Therefore, generalist species such as coyotes, bears, raccoons, and squirrels are common in urban environments and are susceptible to food-conditioning and human-wildlife conflict. With increasing urbanization and species capacity to live in close proximity to humans, there is a need to facilitate coexistence safely by avoiding wildlife feeding and food-conditioned behaviour.

Food-conditioning and human-wildlife conflict: species examples

BEARS

Food-conditioning is the attraction of wildlife to human-sources of foods which leads to increased incidence of human-wildlife interaction and conflicts. For example, bears have become increasingly habituated to people (i.e., tolerance of proximity) due to the positive-reinforcement association made with food. Bears learn quickly where food is located, encouraging conflict behaviours such as breaking and entering and intimidation of humans, behaviour that can be observed and learned across generations (Gilbert, 1989; Peine, 2001). In a nature versus nurture study in Alberta, the propensity of grizzly bears to exhibit conflict behaviour was dictated by social learning and not genetic inheritance (Morehouse et al., 2016). Specifically, offspring of problem mothers, not fathers, were more likely to display the same behaviour, highlighting the need to prevent food conditioning of female bears in particular.

For these reasons, there is a long history of human encounters with habituated and food-conditioned bears in neighbourhoods and parks, which are seen as a nuisance problem or threat, and are consequently killed (Gilbert, 1989; Peine, 2001; Dubois and Fraser, 2013b). To put this into perspective, every year in British Columbia, 10,000 bear complaints are made to the government and several hundred black bears are killed (Dubois and Fraser, 2013b).

While most human-bear conflict arises from unintentional feeding attractants (e.g., fruit trees, garbage), one prominent case in Christina Lake, British Columbia is an example of an intentional direct illegal bear feeding operation (Dubois and Fraser, 2013b). In 2010, police discovered that over 20 black bears were fed dog food from a residence for over two decades. What's more is that people in the local community were aware of the ongoing issue and did not perceive it as causing animal harm (see further discussion in Mitigation Strategies below). Habituated and reliant on the food source, officials killed 24 black bears (Dubois and Fraser, 2013a).



COYOTES

Coyotes are ubiquitous in North America, yet attacks on humans are rare despite the perceived risk by the public and management response. However, in cases where attacks involving biting or scratching have occurred in Canada, food conditioning has been implicated in the majority of incidents (Alexander and Quinn, 2011; Boelens, 2006; University of British Columbia Wiki, 2021). The City of Vancouver first saw incidents of children being bitten by coyotes in 2000 and 2001, but after inception of the Co-Existing with Coyotes public education program by the Stanley Park Ecology Society, cases seized (Boelens, 2006). Unusually, in 2020 and 2021 there was a steep surge of attacks in Vancouver's Stanley Park on both children and adults. Wildlife experts attribute this to increased feeding by people during the COVID-19 pandemic, ultimately resulting in habituation and loss of fear to humans (UBC Wiki, 2021). In response, 11 coyotes were culled by the Ministry of Forests, Lands, Natural Resource Operations & Rural Development (UBC Wiki, 2021). Similarly, in recent reporting of coyote attacks in the City of Calgary, officials say neighbours were deliberately feeding meat and providing water to coyotes (Kaufmann, 2021; Lukasik and Alexander, 2012).



Oftentimes, the problem of human feeding is not addressed. Notwithstanding evidence in the scientific literature suggesting solutions for food-conditioning and the ineffectiveness of lethal methods for long-term population control, mass coyote

culling programs have occurred across Canada (e.g., Nova Scotia, Saskatchewan, Alberta and Ontario) (Alexander and Quinn, 2011). This often occurs in response to sensationalized media and misplaced public fear and risk perceptions (Alexander and Quinn, 2012). Research has shown that culling of coyotes on a large scale is not an effective or reasonable approach since (1) typically incidents involve individuals within populations (not entire populations); (2) under pressure from culling, breeding increases among younger individuals, increasing birth rate to compensate; (3) liability issues arise for urban residents and companion animals; (4) there are excessive costs for disproportionate success and sustainability (UBC Wiki, 2021). The Co-existing with Coyotes program in Vancouver has had success over the years through hazing (intensely scaring), education, and feeding avoidance. However, programs like this need to be a pillar within a much wider strategy of solutions embedded within urban planning and management, and our responsibility for continued research on how to coexist and value urban wildlife (UBC Wiki, 2021).

Coyotes are considered keystone predator species, playing a key role in urban ecosystem function to suppress small carnivores and regulate abundant species populations (Alexander and Quinn, 2011; Lukasik and Alexander, 2012; UBC Wiki, 2021). Removing them has implications for urban species assemblages and control of populations seen as pests such as deer, rabbits and Canadian geese.

Similar to coyotes, highly adaptable wildlife will ultimately persist in urban environments. Conflict will continue if the issue of human feeding is not addressed. Scientists and academics are calling for public education and measures for effective coexistence. Particularly, in regard to avoidance of food-conditioning, a precursor for human-wildlife conflict.

CHIPMUNKS

At a national park in Utah, researchers noted that even small and infrequent feeding might foster food-attraction behaviour in chipmunks (Marion et al., 2008). Furthermore, when food rewards were reduced, chipmunks competed with each other, becoming more vigorous and aggressive. The authors suggested further research to understand what level of food reduction and time would be required to wean chipmunks from anthropogenic foods and back to natural foraging.

SQUIRRELS

Grey squirrel population density and its relationship to aggression were studied at parks in Washington, DC and Baltimore, MD. The researchers found a statistically meaningful relationship between higher squirrel population density and increased aggression among the squirrels (Parker and Nilon, 2008). They also found that in the squirrel populations with higher density, the squirrels were less fearful of humans. Anthropogenic food comprised 35% of the diet at one park and all of the parks were assessed as not having enough natural foods available to support the existing populations. Foods provided by humans were found to sustain the populations, and elevate populations to unnatural levels. Higher





population densities may promote aggressive behaviours and less weariness to humans (Parker and Nilon, 2008).

SKUNKS AND RACCOONS

Cat food is often used as a food-attractant for small carnivores. Theimer et al. (2015) conducted a study of backyard feeding in neighborhoods in Arizona, using motion-activated cameras. Spilled birdseed had already resulted in attraction on skunks and raccoons, however when a bowl of cat food was added, the number of visits by the animals (and cats) doubled (Theimer et al., 2015). Pet food provided in dish, represented a high-quality 'clumped' source of food distribution, as opposed to the spread out birdseed. The research also showed that, in the presence the bowl of cat food, the number of instances where more than one animal was present together increased, with obvious displays of aggression. Aggressive behaviour included biting

and nipping. Increased wildlife aggression at feeding sites is commonly reported in the literature (Murray et al., 2016), as well as its association with disease transmission (e.g., rabies in raccoons, tuberculosis in wild boars, respiratory diseases in voles and chimpanzees) (Murray et al., 2016).

Wildlife Health

Nutrition, immunity and disease

Feeding wildlife has implications for nutrition, stress, immunity, and disease. Murray et al. (2016) conducted a comprehensive review of supplemental feeding and wildlife health (i.e., malnutrition and stress) and pathogen transmission and disease, spanning 68 species and 35 countries; half of the studies were from North America. Although the studies reviewed also included birds and deer, findings generalized to wildlife showed that feeding negatively affected health. Negative health outcomes were attributed to pathogen transmission from increased contact rates, stress, injury, malnutrition and immunosuppressive contaminants. Health outcomes were also examined by feeding categories (i.e., game management, conservation, tourism, and residential areas). Conservation feeding largely provides positive health outcomes, while recreational feeding (i.e., tourism and residential) is associated with negative health outcomes (Murray et al.; 2016).

Generally, research on disease and immunity as it relates to wildlife feeding is limited. Wildlife pathologists stress the need for a better understanding of wildlife immunity and urban pathogen dynamics (Becker at al, 2015; Strandin et al., 2018). In any case, evidence does show that wildlife-feeding impacts on infection are highly dependent upon specifics of the host-pathogen interaction (Becker at al, 2015). In different circumstances, food provisioning can have both positive and negative implications for wildlife nutrition, immunity and disease (Becker at al, 2015; Strandin et al., 2018). Thus, management of urban wildlife pathogens should be addressed by focusing on specific wildlife species, food sources and pathogen types, as this is what drives the variation in infection outcomes discussed in the literature (Becker at al, 2015).

Additional broad conclusions have been made in this regard. Food provisioning and subsequent changes related to (1) contact and movement behaviour, (2) demographics, and (3) immune defences have the potential to influence pathogen invasion and prevalence (Becker et al., 2015; Strandin et al., 2018). Aggression, increased contact, and altered population densities associated with competition between and within species can also amplify transmission (Becker et al., 2015). Individuals with the poor physiological condition are least able to resist infection, compounding risks of poor condition and infection loads (Strandin et al., 2018). Immunity may become impaired due to poor anthropogenic food sources containing contaminants (e.g., antibiotics, pharmaceuticals, metals) or absence of key nutrients found in natural diets (Strandin et al., 2018). Food of low nutritional quality, such as a lack in protein, can inhibit immune defences (Becker et al., 2015). Public outreach is necessary to create awareness of the potential effects of wildlife feeding on the spread of pathogens within wildlife communities and risk to human exposures (Becker et al., 2015).

Implications for human and domestic animal health

Human wildlife feeding can facilitate transmission among wildlife, but wildlife pathogens can also present risks for humans. For example, raccoon roundworm is a parasite problem in many parts of the world and can infect humans, and other animals including dogs. Raccoon roundworm has long been an issue in Nova Scotia (Anderson, & Mills, 1991). Public messaging for the province states that although rare in humans, confirmed cases typically involve children coming into contact with feces and that feces should be carefully disposed (Government of Nova Scotia, 2021).

The lethal parasite *Echinococcus multilocularis* is an emerging public health concern in North America, Europe and other parts of the world as it can cause a disease called Alveolar echinococcosis in humans. The parasite is a wildlife-borne intestinal tapeworm, particularly prevalent in foxes, but also coyotes and domestic dogs (Catalano et al., 2012; Higgin et al., 2015). The parasite is now reported in red foxes and coyotes in the southern reaches of Ontario, Manitoba, Saskatchewan and Alberta, as well as 13 states of the USA (Catalano et al., 2012). Recent research at the University of Guelph found the parasite in one in four foxes and coyotes in Southern Ontario, suggesting it is well established (Kotwa et al., 2019). Increasing positive attitudes of urban people toward foxes has encouraged foxes to become less fearful of humans, exhibiting more tameness (Higgin et al., 2015). Researchers advocate for keeping foxes shy and abstaining from feeding (Higgin et al., 2015). Increased awareness is necessary in cities (e.g., Calgary) where the human and domestic dogs populations are growing, due to the prevalence of urban coyotes and/or foxes (Catalano et al., 2012).

Cascading Ecological Impacts

Literature sources investigating impacts to ecological systems that are specific to both intentional feeding and fur-bearing wildlife are lacking. However, there are related studies, which offer valuable insight into potential cascading ecological consequences that would be conceivable within other influenced ecological systems.

Focusing on urban recreational bird feeding, Shutt and Lees (2021) investigated the implications to biodiversity from widespread resource provisioning. Direct benefits and risks are known for target bird species, however, they hypothesized that such vast inputs into the environment is likely to have a number of indirect negative ecological consequences. Using British garden birds for illustration, they demonstrate how well-intentioned feeding creates unbalanced ecosystems, altering community structure such that it becomes more homogenous with reduced biodiversity. Compared to more adaptable species, species of concern may decline due to competition, increased predation, new predators, and increased disease. The research suggests that the implications for non-target species (i.e., competitors, prey and predators) are not adequately considered and that there could be extensive adverse impacts on biodiversity (Shutt and Lees, 2021). Galbraith et al. (2015) showed similar findings, demonstrating that bird feeding shapes the structure of bird communities in urban areas, altering the balance between native and introduced species. Finally, while these studies focused on birds, ecosystem cascades are likely to occur to varying degrees in all provisioned ecosystems (Shutt and Lees, 2021).

Ore et al. (2013) synthesized the literature on anthropogenic food subsidies that are provided as wastes (e.g., dumps, crop residuals and fishing discards) and argue that these subsidies have shaped ecological communities we know today. Generally, for opportunistic species these subsidies mean increased survival and population growth. However, this in turn alters processes of competition, predator-prey dynamics, and nutrient transfer with wider implications for communities, food webs and ecosystems (Ore et al., 2013). Based on the researchers meta-analysis of examples in the literature, they illustrated the effects at individual, population, and community and ecosystem levels, as shown in Figure 2. The diagram shows that while direct effects to individuals may be positive, there are a number of negative cascading and indirect effects that reshape wildlife communities and have evolutionary implications. The pervading impacts to entire ecosystems, as shown in Figure 2, has potential to alter stability, flexibility and persistence (Ore et al., 2013).

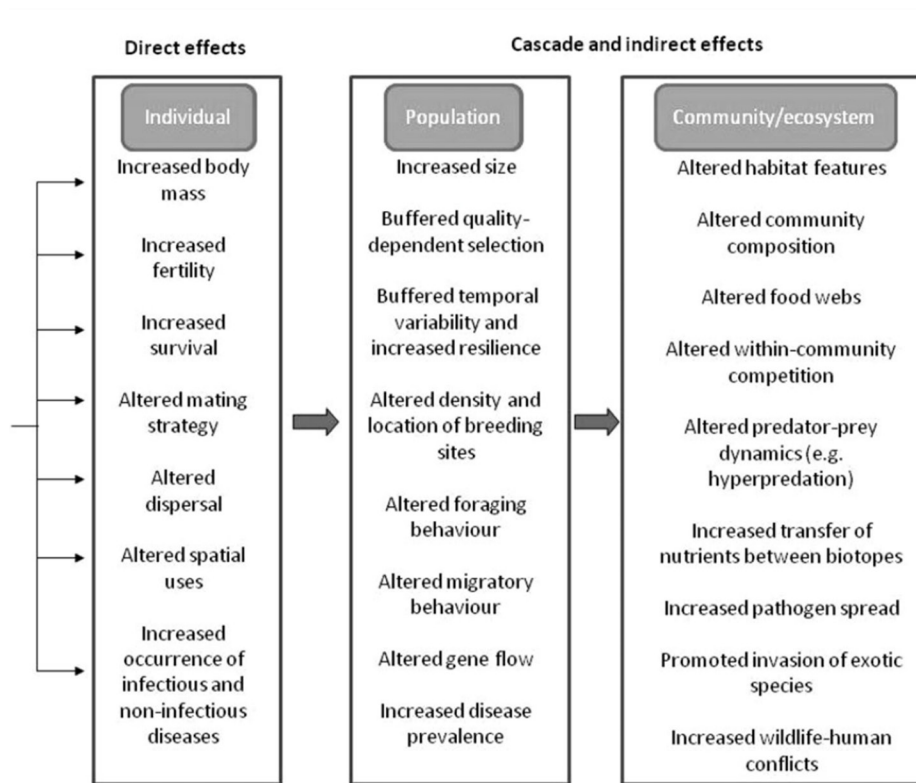


Figure 2 – Influence of food subsidies at the individual, population and community or ecosystem level. Adopted from Ore et al. (2013)

The work by Ore et al. (2013) highlights the complexity of ecological systems, and how food energy inputs can have far-reaching cascading consequences. Other research studies have shown that inputs into ecological systems can shift competition, destabilize communities, and lead to the extinction of non-target species (Ore et al., 2013), which is conceivable through species exploitation of human provided foods over a long period. For example, Tanner et al. (2011) used an invasive crab as a model to demonstrate that modifications to food distributions by humans (i.e., spatially clumped) can lead to aggression, altering species competition dynamics and allow invasive species to populate and persist in highly disturbed landscapes like urban areas.

Similar to Ore et al. (2013), Newsome et al. (2015) conducted a comprehensive global review of studies on the ecological effects of human food subsidies, exclusive to provision for terrestrial mammalian predators. Based on their review of studies from 34 countries, findings revealed that human-provided foods caused changes in predator behaviour and populations, inducing cascades across levels of the food web. Specifically, due to availability of human foods, predator abundance increased, dietary preferences shifted, survival, reproduction and sociality shifted, and predator home ranges and movement shifted. These modifications facilitated predation and competition, thereby indirectly affecting other species.

Mitigation Strategies

Tools to assist managers and educators are discussed first, followed by indirect and direct management actions as they pertain to the human dimensions of wildlife feeding. Mitigation strategies for management of human-wildlife conflict generally fall into two categories: indirect and direct management actions. Indirect practices attempt to influence individual decision-making through public education while direct interventions prohibit unwanted behaviour through regulation and enforcement (Marion et al., 2008). Both recognize the importance of altering human behaviour as a long-term solution (Baruch-Mordo, 2011).

Tools for Managers and Educators

Framework to Identify Unacceptable Feeding

Implementation of an evaluative framework may help managers and educators clearly identify and articulate to the public the appropriateness of various forms of wildlife feeding. Opportunistic feeding is deemed unacceptable; however, mixed messaging among other forms of feeding can be confusing to the public. Application of a formal framework may help guide communication.

Dubois & Fraser (2013a) presented a unique framework for policy makers, educators and managers to distinguish between acceptable and unacceptable forms of wildlife feeding. The framework is intended to assist in making decisions that are rooted in both ethics and biology. In their paper, they applied their framework to evaluate four types of feeding (i.e. research, management, tourism, and opportunistic). The framework uses three factors to assess wildlife feeding: the ability to control the activity, its effects on conservation, and on the long-term welfare of animals. They provide a number of examples from British Columbia, demonstrating that feeding is often motivated by good intentions, but can lead to public safety and conservation problems that are detrimental to the welfare of animals. They found that cases of opportunistic wildlife feeding were generally unacceptable and that this form of feeding is unlikely to change until it becomes seen as socially unacceptable.

Disease transmission associated with wildlife feeding aggression has become a prominent factor in the literature. As such, Murray et al. (2016) built upon the original framework of Dubois & Fraser (2013a) by adding evaluations of health and disease. Specifically, mechanisms for changes in health (i.e., contact rates, immune function, stress hormones, contaminants, and nutrition) were assessed as negative, no effect, or positive.

Wildlife feeding acceptability framework: four types of feeding activities evaluated by their ability to be controlled (C) and their effects on conservation (E) and animal welfare (W).

Factors (C, E, W)	Research	Management	Tourism	Opportunistic
C: feasible to regulate/monitor/intervene	++	+	-	--
C: safe for the public	++	+	-*	-*
E: contributes to understanding the species	++	+	+	-
E: contributes to saving endangered species	+	++	-	-
E: contributes to population survival	+*	+*	-	-
E: does not facilitate poaching or disease	+	-*	-	-*
E: contributes to public education	N/A	N/A	+/- **	+*
E: provides economic benefits	N/A	+	+/- **	-
W: effects relatively few animals	++	+	-**	--
W: does not cause physiological stress to animal	+	+	-*	-*
W: does not cause physical harm to animal	+	-*	-*	-*
W: affects only a small portion of lifespan	++	+	--*	--*
W: does not disrupt natural foraging	+	-	--*	--*

Items are rated high (+ +), somewhat high (+), somewhat low (-) or low (- -), not applicable (N/A) based on general knowledge of the literature. The use of * indicates that the evaluation may vary for different cases; specifically, * = depends on the species involved and ** = depends on the tourism operator.

Coexistence plan

Coexistence plans emphasizing food-conditioning avoidance and effective response is necessary. The University of Calgary campus has implemented Living with Wildlife, a peaceful coexistence program led by Dr. Shelley Alexander, with four cornerstones: prevention, education, enforcement and mitigation. Dr. Shelley Alexander, a wildlife ecologist specializing in wolves and coyotes, offers a Wildlife Co-Existence Outreach Program for communities via free virtual webinars. Encouraging communities to seek this expert advice may help with adoption of coexistence practices including prevention of food-conditioned wildlife.

Urban and Park Design

Green park features can be designed or adapted such that they minimize human-wildlife interactions. Using the red squirrel, Uchida et al. (2021) studied how park characteristics influenced the degree of human avoidance behaviours (i.e., flight initiation distance and tree climbing height). Findings demonstrated that high feeding intensity decreased the degree of these human avoidance behaviours, while high green space, high tree density, and high density of recreational

equipment increased the degree of human escape behaviours (Uchida et al., 2021). In situations where the intended goal is to minimize human-wildlife interactions, parks can be designed with higher density of trees and recreational equipment. Manipulating such characteristics can be one effective tool for park managers, as part of their repertoire of strategies to decrease opportunities for wildlife feeding to occur.

Education and Messaging

Education programs are capable of successfully imparting knowledge and reducing undesirable human-induced environmental and social outcomes (Marion et al., 2008). There is a large body of research demonstrating that the effectiveness of education programs intended to shift behaviour are dependent upon peoples' inherent values and beliefs, and social norms, in conjunction with messaging content and delivery (Marion et al., 2008). In order to prevent or address wildlife feeding problems, managers are tasked with achieving the following:

- (a) Communicate that feeding wildlife is an inappropriate and harmful activity,*
- (b) develop effective educational efforts that discourage intentional or unintentional wildlife feeding,*
- (c) monitor wildlife feeding and wildlife food attraction behaviours, and*
- (d) modify human behaviours (Marion et al., 2008, p.430).*

Message characteristics

Marion and Reid (2007) conducted a review of a number of educational programs carried out in protected areas and made drew several broad conclusions. They found that all studies of education programs positively influenced human knowledge, behaviour, attitudes and/or impact. Therefore, suggesting that visitor education is an effective management strategy. Researchers in this field have identified four critical components to educational efficacy: message content, delivery, audience characteristics, and theoretical grounding, as summarized from Marion and Reid (2007) below.

Message content

- Message objectives need to be set and agreed upon.
- Messages should be simple, interesting, clear and concise, while providing useful information limited to a small number of topics and clearly identifies desirable and undesirable behaviour.
- Message content must be consistent in order to achieve successful effectiveness.
- Messages containing ecological rationale rather than social reasons, may be more effective in altering behaviour.
- Message content should target defined audiences who are more likely to engage in wildlife feeding in order to address their behaviour, as research indicates variation in impact behaviour among user groups.

Message delivery

- Messages should be delivered at the correct timing. Evidence demonstrates that education must occur near the timing and location of potential wildlife feeding (Hockett, 2000).
- Messages should be provided by credible sources as research shows the degree of credibility influences persuasion.
- Messages should be delivered via multiple media methods to maximize effectiveness. Research is unclear on which method (i.e., personal, signs, brochures, or computers) is best. Although communication theory supports personal delivery, some findings agreed with this while others found it no more effective than other methods. This is further discussed below.
- Messaging should be widespread and repetitive.

Audience characteristics

- Awareness of the audience's level of knowledge related to wildlife feeding impacts. Understanding the audience and their receptivity to education allows for targeted messages that resonate with different audiences.
- Communication should target specific fundamental beliefs shared by the target audience, rather than only factual information on the problem human behaviour. Understanding which beliefs influence wildlife feeding behaviour can help improve messaging content.

Theoretical basis

- Managers can better understand the mechanisms influencing behaviour by incorporating a theoretical basis for their educational program. Theoretical paradigms to explain how people make decisions, outlined in Marion and Reid (2007), include moral development, reasoned action/planned behaviour, decision-making, and persuasion. For example, Hockett and Hall (2007) drew from the Elaboration Likelihood Model of Persuasion to explore moral and fear based messaging. Theoretical motivations which underlay wildlife feeding, and its application in education, is an area that could benefit from further research.
- Researchers have demonstrated that a multifaceted approach is more effective than no theoretical basis or only a single focus (e.g., incorporating persuasive and moral techniques or targeting multiple stages of moral development).

Message delivery: case study

Research conducted by Marion et al. (2008), at a national park in Utah, was aimed to evaluate human and wildlife feeding behaviour in response to a message delivered via two approaches: posted signage and personal conveyance. Observations of visitor feeding behaviour and chipmunks success in obtaining food as well as food attraction behaviour were documented. Although results for both signage and personal conveyance showed significant improved visitor behaviours and reduced human food available to chipmunks, differences between the two methods were

marginal. Findings among similar studies in the literature were inconsistent on effectiveness of personal versus printed messages.

The researchers suggest that other messaging characteristics as described above (Marion and Reid, 2007) may have comparable or greater importance. For example, the timing and location of message relative to the occurrence of wildlife feeding, as well as source credibility. However, while the literature generally acknowledges the benefits of interpersonal communication, it's not the most efficient when used alone. Recent research studies support mixed media communication approaches for greater effectiveness (Abrams et al, 2020).

Messages of morality for wildlife feeding

Hockett (2000) and Hockett and Hall (2007) found that both moral and fear appeals were effective in reducing the behaviour of deer feeding. Although the fear based message affected attitude to a greater degree, the authors concluded moral may affect behaviour as much or more since people were reminded of already held knowledge at the most advantageous timing. It is also important to note that the moral appeal used humour, which has mixed results in the literature; therefore moral messaging requires deeper analysis.

Further, the authors found that people discounted the fear of deer, suggesting that the effectiveness of fear appeals is species dependent. Therefore, fear based messaging should be carried out cautiously and based on empirical evidence, particularity with large carnivores. Other research discusses the unnecessary social amplification of risk and how it ultimately negatively impacts species. Case in point, coyotes are regularly persecuted more as a function of public perceptions than the actual reality of risk, highlighting the need for clear risk communication (Alexander and Quinn, 2011). Both theories of fear and moral based messaging can be applied with appropriate considerations.

Fear appeals should not solely be relied upon, especially when risk perceptions are low, as researchers have noted in some cases for bears and deer (Dubois and Fraser, 2013a; Abrams et al, 2020). Some research shows fear messaging is less effective than those that facilitate connection to conservation (Schaffner et al., 2015).

Recent research assessing wildlife value orientations found that mutualism focused messages, and not fear based, better predicted agreement with distance-related wildlife messages (Freeman et al., 2021). Mutualist individuals respect the rights of wildlife, are less likely to engage in activities harmful to wildlife and are more caring and empathetic toward wildlife. Freeman et al., (2021) discuss how park visitors are more likely to be characterized by holding mutualism values and that wildlife viewing is related to these values. This is likely also the case with people who engage in wildlife feeding. Therefore, messages grounded in mutualism may be more successful. Examples of mutualist messages are provided below (adapted from Freeman et al., 2021):

"You can respect the rights of wildlife and keep them healthy, safe, and wild by maintaining safe distances."

"You are entering the home of many wildlife species. It is your responsibility to maintain safe distances."

Research conducted by Williams et al. (2021) linking beliefs of the intrinsic value of wildlife to sustained pro-nature behaviour, is in agreement with that of Freeman et al., (2021). The researchers found that sustained behaviour is related to internalised moral standards and a pro-nature social circle. Relevant to wildlife feeding, the authors suggest that those who already recognize the intrinsic value of wildlife but are not yet engaging in pro-nature behaviour may be more persuaded by messaging which creates awareness of harm caused to species. This is an area requiring further testing.

Personal benefit messages and procedural knowledge

Recognizing that there are some barriers to acting on environmental consciousness alone, Abrams et al. (2020) recommend that messages emphasizing the benefits in visitor experience (behavioural compromise). In their study drawing from the theory of planned behaviour, distant-related messaging featured the benefit of safe distance for people at a national park. They also point to a previous study where residents of Ohio had more tolerance for bears when messaging highlighted the benefits of bears to people and ecosystems. Further, the distance campaign considered peoples' desires and addressed behavioural barriers by providing information on getting photographs from a safe distance: "give them room, use your zoom."

The authors employed procedural knowledge into their messaging, clearing communicating what people should do, like how far to stay away from wildlife. When measuring message likability, Schaffner et al. (2015) found that the most likable messaging employed positive emotions but were also informative and provided procedural knowledge. Related to this, appealing graphics is important, such as info-graphic style visualizations to show distance in bus lengths (Schaffner et al., 2015; Abrams et al., 2020).

Abrams et al. (2020) concluded that their approach works better than fear appeals but where problems of food-conditioning and habituated wildlife already exist; additional wildlife and visitor interventions are necessary (Abrams et al., 2020). As such, where there is potential, prevention is crucial.

Law Enforcement

Laws, fines and enforcement are direct management tools to alter human behaviour to reduce conflict. In Canada, wildlife feeding is largely prohibited or discouraged in cities and regional, provincial, and federal parks at applicable levels of government (i.e., local, provincial and federal). Federally, intentionally and unintentionally feeding wildlife at a national park is illegal and you can be charged under the Canada National Parks Act (Parks Canada, 2021). In British Columbia, feeding dangerous wildlife (i.e., bears, cougars and wolves) is prohibited and subject to fines, but enforcement is complaint based (Wildlife Act, 2022). In response to food-conditioned aggression in coyotes, the Vancouver Park Board recently implemented fines of \$500 for people feeding birds and wildlife in city parks (Vancouver Board of Parks and Recreation, 2021).

Currently the City of Toronto is undergoing a review of their wildlife feeding bylaw for private and public neighborhood properties as feeding is only restricted in city parks (City of Toronto, 2022). The City of Hamilton has fines up to \$10,000 upon first offence and \$25,000 thereafter

(City of Hamilton, 2012). Surrounding Toronto, wildlife feeding is subject to fines in cities including Vaughn and Mississauga. Despite regulation from multiple levels of government, human-wildlife conflict due to feeding is common.

Baruch-Mordo et al. (2011) conducted a study to evaluate commonly applied education and enforcement measures in the context of human-black bear conflict related to neighbourhood garbage attractants. Surprisingly, they found that the Bear Aware program had no effect, enforcement by patrolling had no effect, but enforcement by warning notices did change human behaviour. In terms of enforcement, they suggest use of proactive methods (e.g., written notice of the infraction) for greater compliance success. The researchers underscore the importance of developing more effective education programs that are evidence-based and grounded in social science so that resources aren't wasted. Further, after implementation, effectiveness of education programs must be rigorously evaluated. Coupling education and enforcement into management programs is recommended.

Commonly there is the issue of disjoint between law and enforcement (Murray et al. 2016). When regulations and bylaws are enacted, it is assumed there will be compliance. However, without active enforcement, there is often a lack of compliance (Baruch-Mordo et al., 2011). Studies have shown that in order to best improve compliance with wildlife protection laws, an increase in both detection of violations and subsequently enforcement actions must occur (Baruch-Mordo et al., 2011).

There are challenges to understand choices and decision-making of rule-breaking behaviour. Models of enforcement traditionally focus on economic incentives, but Keane et al. (2008) propose the development of a new field of study on the theory and application of enforcement and compliance in conservation. This would help by providing guidance for managers for optimal design of enforcement programs.

Generally, managers and park visitors have favoured indirect educational methods (Marion et al., 2008; Marion and Reid, 2007), however the overall weight of evidence suggests that multiple lines of effort including both indirect and direct methods can be complimented together for maximum impact.

DISCUSSION

Perhaps by ignorance or intended goodwill, the human behaviour of feeding wildlife plays a defining role in perturbation of wildlife aggression and conflict behaviour. As urbanization continues to expand, the need for proactive management through effective education and enforcement will become increasingly important to ensure safe coexistence of people and wildlife. This literature review intended to answer three main questions pertaining to wildlife feeding: what are the drivers, what are the consequences and what are potential mitigation strategies?

Drivers of wildlife feeding are rooted in human behaviour, which is consistent with the current wildlife conservation era emphasizing management of human behaviour, human-wildlife interactions and coexistence. Largely documented in Western societies, people feed wildlife in order to seek experiences with nature as a result of extinction of experience in urban environments. People seek pleasure in interacting with nature, and also experience benefits to health and wellbeing. Finally, people often feed wildlife out of concern for conservation and welfare.



Consequences of opportunistic wildlife feeding include human-wildlife conflict, animal welfare issues, health and disease, and cascading ecological impacts. Intentional feeding interferes with normal foraging and population numbers, enables dependence on humans, and often leads to aggressive behaviour. Generalist species such as coyotes, bears, raccoons and squirrels are common in urban environments and susceptible to food-conditioning behaviour. Food-conditioning behaviour in wildlife can be learned and transferred across generations. Further, recreational feeding has been associated with negative health outcomes including malnutrition, stress, poor immunity and disease. Wildlife aggression has been found to further increase disease transmission among wildlife and with humans. Ecosystem impacts can be far reaching, and include altering processes of competition, predator-prey dynamics, and nutrient transfer with wider implications for communities, food webs and ecosystems (Ore et al., 2013).

Species capacity to survive in urban areas can be attributed to the concept of behavioural plasticity, underlying genetic factors and/or the ecological classification as dietary or habitat generalist. Wildlife species that have these characteristics are able to coexist within the urban communities, and can also provide beneficial ecosystem services. For example, coyotes act as urban keystone predators in controlling rodent populations (Alexander and Quinn, 2011; Lukasik and Alexander, 2012). This highlights that healthy wildlife assemblages can be sustained through natural urban food webs and the necessity for safe coexistence practices in human dominated landscapes.

Ultimately, mitigation strategies need to change social acceptance of intentional wildlife feeding. Scientists and academics are calling for effective measures using the combination of education and enforcement in order to change societal perceptions toward wildlife feeding in urban spaces. Public education has been proven to change attitudes and change behaviour, and shown to reduce the occurrence of wildlife feeding in parks and urban spaces. The utility of education as a mitigation strategy can be significantly improved with enhanced message content, delivery, audience awareness, and theoretical basis. While research supports the effectiveness of evidence-based education, authors consistently suggest further research to improve effectiveness (Dubois & Fraser, 2013a; Marion and Reid, 2007; Baruch-Mordo et al., 2011). Law and regulation can also alter human behaviour, although compliance is ineffective without appropriate enforcement. An increase in both detection of violations and enforcement actions is needed. For maximum impact, both education and legal enforcement together are recommended in the literature.

There are still a number of research gaps related to intentional wildlife feeding, particularly as they relate to an apparent disconnect between scientific evidence, management, public understanding, and altering behaviour. This literature review aims to bridge some of those gaps, and points to areas needing further research in the following section.

Research Gaps

Human dimensions

- Western societies are currently the focus of literature related to opportunistic wildlife feeding (Cox and Gaston, 2018). Further research is necessary to better understand the role of culture and socio-demographics in intentional wildlife feeding.
- The extent of opportunistic wildlife feeding pertaining to fur-bearing animals is a research gap. It is difficult to assess due to a lack of a reliable proxy, such as purchases of seed and supplies as with bird feeding. Public surveys on large scales (e.g., national, provincial) or local (e.g., cities, neighbourhoods, parks) would benefit this understanding. This would provide socio-demographic data, as well as estimates of energetic inputs (Cox and Gaston, 2018).

Wildlife impacts

- Future research, in the form of multi-year assessments or ongoing monitoring programs, is needed to understand what level of food reduction is required to reverse food attraction

behaviour on a species-specific basis.

- There is a need for baseline data on wildlife populations as human distribution continues to expand. Beckmann & Berger (2003) highlight a significant knowledge gap in terms of large carnivores and the lack of temporal datasets on behavioural and ecological parameters. Long-term datasets would aid in conservation by understanding population patterns (distribution and abundance) and recovery targets.
- Further study is necessary to understand the consequences of opportunistic feeding on food web interactions (i.e., population dynamics, non-target species and community structure and trophic cascades). Researchers especially highlight the need to better understand cascades (Dubois and Fraser, 2013; Shutt and Lees, 2021).
- In the context of urban feeding, better understanding of wildlife immunology, disease pathology, transmission and spread dynamics using modern techniques as proposed in the literature:
 - Detailed characterization of immune processes via high throughput molecular techniques, possibly exploring associations with genetic adaptation, behavioural plasticity, or resource competition (Strandin et al., 2018).
 - Predictions of feeding impacts on wildlife pathogen dynamics using mathematical modelling; modelling may capture parasite transmission, impacts on host survival, understanding of spatial scales and movement, shifts in feeding resources, seasonality, predator-prey interactions, and potential consequences for human health (Becker et al., 2015).

Mitigation

- Further research is necessary to evaluate the efficacy of educational programs and messaging in improving the human behaviour of feeding wildlife. Most of the current efficacy research focuses on improvements in knowledge uptake and not how this translates to altered behavioural and reduced feeding impacts.
- Opportunity exists for research exploring the efficacy of utilizing computers (i.e., park websites, community platforms and social media) as delivery methods for wildlife feeding education.
- Exploring different theoretical frameworks specific to wildlife feeding behaviour is an area of future research that could benefit urban park and backyard feeding education programs. Theoretical paradigms to explain how people make decisions, outlined in Marion and Reid (2007) could be explored in terms of the human behaviour of wildlife feeding (i.e., moral development, reasoned action/planned behaviour, decision making, and persuasion).
- Further understanding of the theory behind enforcement and compliance as it relates to wildlife feeding. Keane et al. (2008) suggested the development of a new field of study on the theory and application of enforcement and compliance in conservation.

Recommendations

- Ensure access to nature and encourage safe interaction. Research demonstrates the importance of connection with nature for human health and wellbeing (MacIntyre et al, 2020), and why people intentionally seek out opportunities to feed wildlife (Cox et al., 2018). In urban areas, it is important to ensure access to green space and adequate opportunities are provided for people to safely connect with and enjoy nature. Further, it is recommended to communicate and educate the public on ways to increase connection with nature in a safe manner.
- This literature review focused on direct feeding of mammals. Although birds were excluded, there is an extensive body of literature on the impacts of bird feeding. Further, a subset of this research is dedicated to the cascading impacts of massive bird food provisioning inputs into the ecosystem (e.g., Shutt and Lees, 2021) and impacts on mammal species assemblages. Therefore, given the widespread practice bird feeding and cascading effects to other species, it is recommended that the literature be reviewed on this issue and communicated to the public. This would provide understanding of the impacts of bird feeding to fur-bearing animals and how they can be mitigated through best practices.
- Change terminology; rather than habituation, use 'proximity tolerance' which is more fluid and correctly alludes that the behaviour is in fact reversible (e.g., through hazing scare methods) (UBC Wiki, 2021). In addition, negative terms like 'human-wildlife conflict' exists, but positive terms need increased use such as human-wildlife coexistence and human-wildlife benefits.
- Recognize benefits human-wildlife interactions. Too often, conflict is highlighted through media and within communities, but in order for policy makers and the public to have all the information for optimal risk-benefit decision-making, benefits need to be understood. Beneficial roles in urban ecosystems and intrinsic values need to be highlighted for each species (UBC Wiki, 2021).
- Design communities and parks to foster connection with nature and to minimize feeding. Greater greenspace connectivity in urban areas promotes wildlife movement so that people may experience more natural interactions without the need to attract wildlife (Cox and Gaston, 2018). In situations where the intended goal is to minimize human-wildlife interactions, parks can be designed with more wooded areas, or higher density of trees and recreational equipment (Uchida et al., 2021).
- Plan the development of urban areas for coexistence by considering the impacts to wildlife and their evolution, using modelling projections of future development. Considerations include how urban habitats can best mitigate conflicts, optimization of connectivity for road accident prevention and gene flow, and green infrastructure and wildlife corridors for safe movement and human avoidance.
- Develop coexistence plans that integrate opportunistic wildlife feeding communication, education and issue response framework. Programs and education need to be components within much wider strategies of solutions embedded within urban planning

and management, with a need for continued research on how to coexist and value urban wildlife (UBC Wiki, 2021).

- Researchers consistently emphasize the coupling of effective education and regular enforcement (Beckmann & Berger, 2003; Baruch-Mordo et al., 2011; Dubois and Fraser, 2013a) in order to change public perceptions on wildlife feeding to render it socially unacceptable.
- Apply the evaluative framework developed by Dubois and Fraser (2013a), for policy-makers, managers and educators to better identify and articulate unacceptable forms of wildlife feeding.
- Undertake participatory research/surveys in potential and existing conflict areas, as well as considering applications of citizen science (e.g., the Stanley Park Ecology Society's Co-Existing with Coyotes sightings map).
- Implement education programs on wildlife feeding as evidence demonstrates this as an effective management strategy when applied strategically.
 - Education and messaging should be based on a supported theoretical framework.
 - Message content should be clear, consistent and provide ecological rationale.
 - Moral messages are reportedly more effective than fear based messaging and awareness of harm caused to species may help influence behaviour.
 - Procedural knowledge, clearing communicating what people should do is also important.
 - Info-graphic style visualizations are helpful.
 - Message delivery should occur near the timing and location of potential feeding, by a credible source, and through multiple mediums. It should be widespread and repetitive.
 - Communication should target specific fundamental beliefs shared by the target audience, rather than only factual information on the problem human behaviour.
 - For example, human behaviours leading to conflict are often connected to animal lovers. Therefore, materials can target animal lovers explaining human behaviours necessary to avoid conflict. Information can be distributed via organizations and businesses associated with animal lovers such as veterinarians, pet stores, and outdoors stores (UBC Wiki, 2021).
- Park managers should evaluate the efficacy of various management interventions or conduct ongoing monitoring of visitor feeding and strength of wildlife food attraction behaviour on a species basis, using comparable methods to Marion et al. (2008). This can also be adapted by municipal officials where there are known cases of backyard feeding in the community.

- Implement wildlife-feeding bylaws and fines where they are not currently in place. Proactive methods such as written notices or fines have been demonstrated to be effective (Baruch-Mordo et al., 2011). Further, enforcement must be adequate to ensure compliance. Researchers have called for public officials across multiple jurisdictions to enhance policy and enact laws and regulations to prohibit both intentional (and unintentional) feeding of wildlife (Beckmann & Berger, 2003).

REFERENCES

- Alexander, S. M., & Quinn, M. S. (2011). Coyote (*Canis latrans*) Interactions With Humans and Pets Reported in the Canadian Print Media (1995–2010). *Human Dimensions of Wildlife*, 16(5), 345–359. <https://doi.org/10.1080/10871209.2011.599050>
- Alexander, S.M. and Quinn, M.S. (2012). Portrayal of Interactions Between Humans and Coyotes (*Canis latrans*): Content Analysis of Canadian Print Media (1998-2010). *Cities and the Environment (CATE)*, 4(1), Article 9. <https://digitalcommons.lmu.edu/cate/vol4/iss1/9>
- Anderson, & Mills, J. (1991). Occurrence of the raccoon roundworm *Baylisascaris procyonis* in racoons in Nova Scotia. Dept. of Lands and Forests.
- Baruch-Mordo, S., Breck, S. W., Wilson, K. R., & Broderick, J. (2009). A Tool Box Half Full: How Social Science can Help Solve Human–Wildlife Conflict. *Human Dimensions of Wildlife*, 14(3), 219–223. <https://doi.org/10.1080/10871200902839324>
- Baruch-Mordo, S., Breck, S. W., Wilson, K. R., & Broderick, J. (2011). The Carrot or the Stick? Evaluation of Education and Enforcement as Management Tools for Human-Wildlife Conflicts. *PLoS ONE*, 6(1). <https://doi.org/10.1371/journal.pone.0015681>
- Becker, D. J., Streicker, D. G., & Altizer, S. (2015). Linking anthropogenic resources to wildlife–pathogen dynamics: a review and meta-analysis. *Ecology Letters*, 18(5), 483–495. <https://doi.org/10.1111/ele.12428>
- Beckmann, J. P., & Berger, J. (2003). Rapid ecological and behavioural changes in carnivores: the responses of black bears (*Ursus americanus*) to altered food. *Journal of Zoology*, 261(2), 207–212. <https://doi.org/10.1017/S0952836903004126>
- Boelens, R. (2006). Co-existing with coyotes in Vancouver (and anywhere else, for that matter). *Public Management*, 88(11), 26–30. https://icma.org/sites/default/files/4848_.pdf
- Catalano, S., Lejeune, M., Liccioli, S., Verocai, G. G., Gesy, K. M., Jenkins, E. J., Kutz, S. J., Fuentealba, C., Duignan, P. J., & Massolo, A. (2012). *Echinococcus multilocularis* in Urban Coyotes, Alberta, Canada. *Emerging Infectious Diseases*, 18(10), 1625–1628. <https://doi.org/10.3201/eid.1810.120119>
- Chapman, R.A., and Jones, D.N. (2009). Just feeding the ducks: quantifying a common wildlife-human Interaction. *Sunbird: Journal of the Queensland Ornithological Society*, 39, 19-28.
- City of Hamilton, by-law No. 12-130, Regulate the Feeding of Wildlife By-law. (2012). <http://www2.hamilton.ca/NR/rdonlyres/0FA9F771-85A8-44BF-BFD1-905D5E830FE0/0/12130.pdf>
- City of Toronto. (2022). Animal bylaw review. <https://www.toronto.ca/community-people/animals-pets/enforcement-assistance/animal-bylaw-review/>

- Cox DTC, Gaston KJ. 2018 Human–nature interactions and the consequences and drivers of provisioning wildlife. *Phil. Trans. R. Soc. B* 373: 20170092.
<http://dx.doi.org/10.1098/rstb.2017.0092>
- Dayer, AA, Rosenblatt, C, Bonter, DN, et al. (2019). Observations at backyard bird feeders influence the emotions and actions of people that feed birds. *People Nat.*; 1, 138– 151.
<https://doi.org/10.1002/pan3.17>
- Dubois, S., & Fraser, D. (2013a). A framework to evaluate wildlife feeding in research, wildlife management, tourism and recreation. *Animals*, 3(4), 978–994. doi:10.3390/ani3040978
- Dubois, S., & Fraser, D. (2013b). Local Attitudes towards Bear Management after Illegal Feeding and Problem Bear Activity. *Animals : An Open Access Journal from MDPI*, 3(3), 935–950.
<https://doi.org/10.3390/ani3030935>
- Freeman, S., Taff, B. D., Miller, Z. D., Benfield, J. A., & Newman, P. (2021). Mutualism Wildlife Value Orientations Predict Support for Messages About Distance-Related Wildlife Conflict. *Environmental Management*, 67(5), 920–929.
<https://doi.org/10.1007/s00267-020-01414-1>
- Galbraith, J.A., J.R. Beggs, D.N. Jones, and M.C. Stanley. (2015). Supplementary Feeding Restructures Urban Bird Communities. *Proceedings of the National Academy of Sciences of the United States of America*. 112, E2648–57.
- Gilbert, B. K. (1989). Behavioral plasticity and bear–human conflicts. Bear–people conflicts. In *Proceedings of a Symposium on Bear Management Strategies* (pp. 1–7). Northwest Territories: Department of Renewable Resources: 1–7. https://www.bearbiology.org/wp-content/uploads/2019/09/1st-HBC_Bear-People-Conflicts-Proceedings-of-a-Symposium-on-Management-Strategies.pdf
- Government of British Columbia Wildlife Act [RSBC 1996] Chapter 488 Available online: http://www.bclaws.ca/EPLibraries/bclaws_new/document/ID/freeside/00_96488_01 (accessed on 15 February 2022)
- Government of Nova Scotia. (2021). Feeding Wildlife in Backyard Requires Thought and Care. Albert Rand. Available online: <https://novascotia.ca/natr/wildlife/living-with-wildlife/feeding-wildlife-full.asp> (accessed on 16 February, 2022)
- Hall, L. E., & Chalfoun, A. D. (2019). Behavioural plasticity modulates temperature-related constraints on foraging time for a montane mammal. *Journal of Animal Ecology*, 88(3), 363–375. <https://doi.org/10.1111/1365-2656.12925>
- Hegglin, D., Bontadina, F., & Deplazes, P. (2015). Human–wildlife interactions and zoonotic transmission of *Echinococcus multilocularis*. *Trends in Parasitology*, 31(5), 167–173.
<https://doi.org/10.1016/j.pt.2014.12.004>

- Hockett K. S. (2000). The effectiveness of two interpretations on reducing deer feeding behavior by park visitors [Master's thesis, Virginia Polytechnic Institute and State University]. VTechWorks. <https://vtechworks.lib.vt.edu/bitstream/handle/10919/31508/deer.pdf?sequence=1&isAllowed=y>
- Hockett, K. S., and Hall, T. E. (2007). The Effect of Moral and Fear Appeals on Park Visitors' Beliefs about Feeding Wildlife. *Journal of Interpretation Research*, 12(1), 5–27. <https://doi.org/10.1177/109258720701200102>
- Howard, P., and Jones, D. N. (2004). A qualitative study of wildlife feeding in south-east Queensland. *Urban Wildlife: more than meets the eye*, 55-62.
- Kaneko, Y. and Maruyama N. (2005). Changes in Japanese badger (*Meles meles anakuma*) body weight and condition caused by the provision of food by local people in a Tokyo suburb. *Honyurui Kagaku (Mammalian Science)*, 45(2), 157-164. <https://doi.org/10.11238/mammalianscience.45.157>
- Kaufmann, B. (2021, June, 21). 'This is ridiculous': As coyote attacks mount, city says residents feeding the animals. *Calgary Herald*. Retrieved from: <https://calgaryherald.com/news/local-news/this-is-ridiculous-as-coyote-attacks-mount-city-says-residents-feeding-the-animals>
- Keane, A., Jones, J. P. G., Edwards-Jones, G., & Milner-Gulland, E. J. (2008). The sleeping policeman: understanding issues of enforcement and compliance in conservation. *Animal Conservation*, 11(2), 75–82. <https://doi.org/10.1111/j.1469-1795.2008.00170.x>
- Kotwa, J. D., Isaksson, M., Jardine, C. M., Campbell, G. D., Berke, O., Pearl, D. L., Mercer, N. J., Osterman-Lind, E., & Peregrine, A. S. (2019). *Echinococcus multilocularis* Infection, Southern Ontario, Canada. *Emerging Infectious Diseases*, 25(2), 265–272. <https://doi.org/10.3201/eid2502.180299>
- Lukasik, V. M. and Alexander, S. M. (2012) Spatial and Temporal Variation of Coyote (*Canis latrans*) Diet in Calgary, Alberta. *Cities and the Environment (CATE)*, 4(1), Article 8. <https://digitalcommons.lmu.edu/cate/vol4/iss1/8>
- MacIntyre, T. E., Beckmann, J., Calogiuri, G., Donnell, A. A., Jones, M. V., Madan, C. R., Rogerson, M., Brick, N. E., Nieuwenhuijsen, M., & Gidlow, C. J. (2020). Editorial: Human-Nature Interactions: Perspectives on Conceptual and Methodological Issues. *Frontiers in Psychology*, 11. <https://doi.org/10.3389/fpsyg.2020.607888>
- Marion, J. L., & Reid, S. E. (2007). Minimising Visitor Impacts to Protected Areas: The Efficacy of Low Impact Education Programmes. *Journal of Sustainable Tourism*, 15(1), 5–27. <https://doi.org/10.2167/jost593.0>
- Marion, J. L., Dvorak, R. G., & Manning, R. E. (2008). Wildlife Feeding in Parks: Methods for Monitoring the Effectiveness of Educational Interventions and Wildlife Food Attraction Behaviors. *Human Dimensions of Wildlife*, 13(6), 429–442. <https://doi.org/10.1080/10871200802270158>

- McAvoy, L.H., & Dustin, D.L. (1983). Indirect Versus Direct Regulation of Recreation Behavior. *Journal of park and recreation administration*, 1.
- Morehouse, A. T., Graves, T. A., Mikle, N., & Boyce, M. S. (2016). Nature vs. Nurture: Evidence for Social Learning of Conflict Behaviour in Grizzly Bears. *PLoS ONE*, 11(11). <https://doi.org/10.1371/journal.pone.0165425>
- Murgui, E., & Hedblom, M. (2017). *Ecology and Conservation of Birds in Urban Environments*. Springer International Publishing.
- Murray, M. H., Becker, D. J., Hall, R. J., & Hernandez, S. M. (2016). Wildlife health and supplemental feeding: A review and management recommendations. *Biological Conservation*, 204(Part B), 163–174. <https://doi.org/10.1016/j.biocon.2016.10.034>
- Newsome, T. M., Dellinger, J. A., Pavey, C. R., Ripple, W. J., Shores, C. R., Wirsing, A. J., & Dickman, C. R. (2015). The ecological effects of providing resource subsidies to predators. *Global Ecology and Biogeography*, 24(1), 1–11. <https://doi.org/10.1111/geb.12236>
- Orams, M. B. (2002). Feeding wildlife as a tourism attraction: a review of issues and impacts. *Tourism Management*, 23(3), 281–293. [https://doi.org/10.1016/S0261-5177\(01\)00080-2](https://doi.org/10.1016/S0261-5177(01)00080-2)
- Oro, D., Genovart, M., Tavecchia, G., Fowler, M. S., & Martínez-Abraín, A. (2013). Ecological and evolutionary implications of food subsidies from humans. *Ecology Letters*, 16(12), 1501–1514. <https://doi.org/10.1111/ele.12187>
- Parker, T. S., & Nilon, C. H. (2008). Gray squirrel density, habitat suitability, and behavior in urban parks. *Urban Ecosystems*, 11(3), 243–255. <https://doi.org/10.1007/s11252-008-0060-0>
- Parkin, D. (2001). Wildlife feeding, national park policy and visitor practice: where to from here? Project Nature-Ed. Brassall, Qld 4305. Available at <http://www.projectnatureed.com.au/web%20library/wildlife%20feeding%20paper%201%20-%20bunya%20mnts%20study.pdf>
- Parks Canada. (2021). Top tips to respect wildlife and stay safe. <https://www.pc.gc.ca/en/voyage-travel/conseils-tips/faune-wildlife>
- Peine, J. D. (2001). Nuisance Bears in Communities: Strategies to Reduce Conflict. *Human Dimensions of Wildlife*, 6(3), 223–237. <https://doi.org/10.1080/108712001753461301>
- Schaffner, D., Demarmels, S. and Juettner, U. (2015). Promoting biodiversity: do consumers prefer feelings, facts, advice or appeals? *Journal of Consumer Marketing*, 32(4), 266-277. <https://doi-org.subzero.lib.uoguelph.ca/10.1108/JCM-11-2014-1220>
- Shutt, J. D., & Lees, A. C. (2021). Killing with kindness: Does widespread generalised provisioning of wildlife help or hinder biodiversity conservation efforts? *Biological Conservation*, 261(Complete). <https://doi.org/10.1016/j.biocon.2021.109295>

- Tanner, C.J., Salali, G.D. and Jackson, A.L. (2011). Feeding and non-feeding aggression can be induced in invasive shore crabs by altering food distribution. *Behav Ecol Sociobiol*, 65, 249–256. <https://doi.org/10.1007/s00265-010-1033-x>
- Theimer, T. C., Clayton, A. C., Martinez, A., Peterson, D. L., & Bergman, D. L. (2015). Visitation rate and behavior of urban mesocarnivores differs in the presence of two common anthropogenic food sources. *Urban Ecosystems*, 18(3), 895–906. <https://doi.org/10.1007/s11252-015-0436-x>
- Uchida, K., Yamazaki, T., Ohkubo, Y., & Yanagawa, H. (2021). Do green park characteristics influence human-wildlife distance in arboreal squirrels? *Urban Forestry & Urban Greening*, 58(Complete). <https://doi.org/10.1016/j.ufug.2020.126952>
- University of British Columbia (UBC) Wiki. (2021). Coexisting with urban wildlife: A case study of Stanley Park's Coyotes. In M.F. Tomaselli (Ed.), *CONS200: Foundations of Conservation*. University of British Columbia. https://wiki.ubc.ca/Course:CONS200/2021/Coexisting_with_urban_wildlife:_A_case_study_of_St Stanley_Park%E2%80%99s_Coyotes
- U.S. Fish and Wildlife Service, U.S. Department of the Interior, and U.S. Department of Commerce. U.S. Census Bureau. (2018, October). 2016 National survey of fishing, hunting, and wildlife-associated recreation. Available: <https://www.census.gov/content/dam/Census/library/publications/2018/demo/fhw16-nat.pdf>
- Vancouver Board of Parks and Recreation, Park Board By-law Updates - Feeding Wildlife in Parks. (2021). <https://parkboardmeetings.vancouver.ca/2021/20210927/REPORT-ParkBoardBylawUpdates-FeedingWildlifeParks-20210927.pdf>
- Williams, M. O., Whitmarsh, L., Haddock, G., & Mac Giolla Chríost, D. (2021). A Grounded Theory of Pro-Nature Behaviour: From Moral Concern to Sustained Action. *Sustainability*, 13(16), 8944. <https://doi.org/10.3390/su13168944>