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RESEARCH ARTICLE

Anticoagulant rodenticide exposure in raptors from Ontario, Canada

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Abstract

Anticoagulant rodenticides (ARs) are used globally to control rodent pest infestations in both urban and agricultural settings. It is well documented that non-target wildlife, including predatory birds, are at risk for secondary anticoagulant exposure and toxicosis through the prey they consume. However, there have been no large-scale studies of AR exposure in raptors in Ontario, Canada since new Health Canada legislation was implemented in 2013 in an attempt to limit exposure in non-target wildlife. Our objective was to measure levels of ARs in wild raptors in southern Ontario to assess their exposure. We collected liver samples from 133 raptors representing 17 species submitted to the Canadian Wildlife Health Cooperative (CWHC) in Ontario, Canada, between 2017 and 2019. Liquid chromatography-tandem mass spectrometry (LC–MS/MS) was used to quantitatively assess the level of exposure to 14 first- and second-generation ARs. Detectable levels of one or more ARs were found in 82 of 133 (62%) tested raptors, representing 12 species. The most commonly detected ARs were bromadiolone (54/133), difethialone (40/133), and brodifacoum (33/133). Of AR-positive birds, 34/82 (42%) contained residues of multiple (> 1) anticoagulant compounds. Our results indicate that AR exposure is common in raptors living in southern Ontario, Canada. Our finding that brodifacoum, difethialone, and bromadiolone were observed alone or in combination with one another in the majority of our sampled raptors indicates that legislative changes in Canada may not be protecting non-target wildlife as intended.

Keywords Anticoagulant rodenticide · Brodifacoum · Bromadiolone · Difethialone · Raptors · Wildlife

Introduction

Rodenticides are used in both agricultural and residential settings to control pest rodent populations. While intended for use on pest species, rodenticides work indiscriminately and can affect target and non-target species that eat the poisoned baits or the carcasses of dead rodents. They therefore pose a risk to wildlife, including both mammalian and avian scavengers and predators (Erickson and Urban 2004).

Although there are a number of different active chemicals used in rodenticides, including zinc phosphide, bromethalin, cholecalciferol, and strychnine (Erickson and Urban 2004), anticoagulant rodenticides are used most commonly (Elliott et al. 2016). Poisoning by anticoagulant rodenticides (ARs) may result in fatal hemorrhage by antagonizing vitamin K epoxide reductase (VKOR) which is necessary to maintain vitamin K in its active reduced form for subsequent carboxylation of the clotting factors II, VII, IX, and X (Pelfrene 1991). Anticoagulant rodenticide compounds accumulate in liver tissues and have variable half-lives (Vandenbroucke

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et al. 2008). First-generation anticoagulant rodenticides (FGARs), including warfarin, coumatetralyl, chlorophacinone, diphacinone, pindone, and valone, typically have a short half-life in blood plasma and liver tissue and a limited ability to bio-accumulate. Second-generation anticoagulant rodenticides (SGARs) were developed in the 1970s when evidence of FGAR resistance appeared in rodent populations (Thijssen 1995). Second-generation anticoagulant rodenticides include difethialone, brodifacoum, bromadiolone, flocoumafen, and difenacoum and are more acutely toxic than FGARs. SGARs also have longer half-lives in plasma and liver tissue, a greater tendency to bioaccumulate (Erickson and Urban 2004), and may be called "single-dose rodenticides," as a lethal dose may be achieved in a single feeding.

Anticoagulant rodenticides are toxic to the animal that consumes them directly, and SGARs also bioaccumulate through the food chain, leading to secondary anticoagulant rodenticide exposure. While a rat may die from consuming a lethal dose of an AR, an owl that consumes multiple poisoned rats over its lifetime may face different consequences. Many non-target wildlife species, especially apex predators, are at risk of secondary AR exposure following consumption of poisoned prey, and secondary AR poisoning of non-target wildlife is reported globally and extensively (López-Perea and Mateo 2018). However, it is important to note that exposure does not equal disease, and the threshold of AR exposure prior to the development of clinical signs is variable between individuals and species. Although anticoagulant toxicosis and death are the commonly measured outcome resulting from AR exposure (Rattner et al. 2014b), there are also concerns about sublethal effects related to AR exposure in raptors. Measured effects include prolonged clotting time, decreased hematocrit, and gross and microscopic hemorrhage (Rattner et al. 2014a; Rattner et al. 2018). In captive wildlife, observed behavioral changes include anorexia, lethargy, and wing droop (Rattner et al. 2014a; Rattner et al. 2018). The sublethal effects of ARs in free-ranging wildlife are not known, although decreased egg-hatching and fledgling rates were observed in barn owls (*Tyto alba javanica*) (Naim et al. 2011) and hypothetical linkages relating the multiple-organ response to ARs with decreased fitness, decreased body condition, and increased susceptibility to disease are described (Rattner et al. 2014a).

Most previous studies of AR exposure in avian predators in Canada were conducted in British Columbia. These studies demonstrated both widespread AR exposure in raptors in that region of Canada (Albert et al. 2010; Hindmarch et al. 2019) and an overall increase in rodenticide use between 1995 and 2009 (Elliott et al. 2014). While anticoagulants remain one of the most popular methods of pest control, in 2013, Health Canada's Pest Management Regulatory Agency (PMRA) further restricted the use of SGARs in Canada to reduce the risk of AR exposure to children, pets, and non-target wildlife (PMRA 2012a). Brodifacoum, bromadiolone, and difethialone were the three SGARs of greatest interest due to their widespread use and effects on non-target wildlife (Erickson and Urban 2004). Reports of SGAR exposure in Ontario wildlife are limited to the subset of great-horned owls (*Bubo virginianus*) and red-tailed hawks (*Buteo jamaicensis*) sampled by Thomas et al. (2011), and Ontario raptor exposure has not been evaluated since the 2013 changes in SGAR use. Our primary objective was to assess current levels of exposure of wild raptors to anticoagulant rodenticides in southern Ontario. In addition, we examined bird level factors that may be associated with AR exposure, including cause of death, bird type, and feeding ecology, on AR status in birds. If exposure dynamics are dominated by direct predation on rodents and predation on low level predators of rodents by apex predators, then we expect the risk of exposure to be driven by both trophic level and dietary preferences. We predicted that exposure to ARs should be greatest for large bodied apex generalists (e.g., great-horned owls and red-tailed hawks) that consume rodents and also consume smaller rodent predators. Specialists that rarely eat rodents and whose typical prey does not eat rodents (e.g., Cooper's hawks) would be expected to have lower risk of exposure. Finally, because AR use differs between rural and urban areas, based on the need for pest control and legal application methods, we investigated the relationship between land-use and AR status in birds.

Materials and methods

Liver samples were collected from raptor carcasses submitted to the Ontario/Nunavut region of the Canadian Wildlife Health Cooperative (CWHC) in 2017, 2018, and 2019. Submissions included raptors that were found dead or donated by a rehabilitation facility after the bird died while in care or from euthanasia. No birds were euthanized for the purposes of this study. Location data of where each specimen was collected was included on a standard CWHC submission form and was either provided as exact GPS coordinates, a street intersection, or the city name, in which case we used the GPS coordinates of city hall. Specimens submitted to the CWHC for general wildlife disease surveillance had a full post-mortem exam conducted by a veterinary pathologist to determine cause of death. A small subset of birds known to have died due to trauma were submitted specifically for this project and were chemically analyzed for the presence of AR residues but did not undergo a full post-mortem examination. A minimum of 5 g of liver was collected from each carcass and frozen at − 25 °C. Testing for West Nile virus (WNV) was conducted on all birds collected between June 1 and November 30 prior to further chemical analysis to ensure workplace safety of laboratory staff.

The Animal Health Laboratory, Laboratory Services, University of Guelph in Ontario, Canada, conducted chemical analysis using liquid chromatography-tandem mass spectrometry (LC–MS/MS) based on the extraction protocol described by Smith et al. (2017). We completed a quantitative analysis of 14 ARs, including first-generation anticoagulant rodenticides (FGARs), warfarin, chlorophacinone, coumachlor, coumafuryl, coumatetralyl, dicoumarol, diphacinone, pindone, and valone, and second-generation anticoagulant rodenticides (SGARs), brodifacoum, bromadialone, difethialone, difenacoum, and flocoumafen in liver tissue. For tissue extraction, liver tissue (1.0 ± 0.1 g) was weighed and vortexed with 6 mL of 10% methanol in acetonitrile for 3 min and then spun down in a centrifuge for five minutes at 3,000 rpm. The tissue extraction was cleaned up using a QuEChERS (Quick Easy Cheap Effective Rugged Safe) clean-up process; the supernatant from the extraction was mixed with QuEChERS reagents, vortexed vigorously for 30 min, and spun down in a centrifuge for 5 min at 1932 g. The supernatant was dried under nitrogen in a 40 °C water bath and reconstituted in 1 mL of methanol. The solution was filtered through a 0.22-µm syringe filter into an amber autosampler vial. The extract was analyzed using a LC–MS/MS consisting of a Shimadzu LC and Sciex 4000 Q Trap system. Separation was achieved using an Agilent Poroshell EC-C18 (2.7 µm, 2.1 mm × 100 mm) column with a mobile phase gradient of 0.01 M ammonium acetate and methanol. Detection was by MS/MS with electrospray ionization in negative mode. Quantitation was achieved with a matrix matched calibration curve using warfarin-d_5 and diphacinone-d_4 as internal standards. The method detection limits are 1 ppb (0.001 µg/g) for difethialone, dicoumarol, and coumafuryl; 2 ppb (0.002 µg/g) for flocoumafen, difenacoum, chlorophacinone, and warfarin; 3 ppb (0.003 µg/g) for coumachlor, pindone, and valone; 6 ppb (0.006 µg/g) for bromadiolone, diphacinone; 14 ppb (0.014 µg/g) for coumafuryl; and 19 ppb (0.019 µg/g) for brodifacoum.

Data analysis

All statistical analysis was performed in STATA version 15.0 (STATACorp, College Station, Texas, USA), and we used $\alpha = 0.05$ to determine significance in all statistical tests.

We generated four groups according to the feeding ecology of each bird species (NatureServe 2020) to examine the effects of prey base on AR-status of birds. Birds were classified under four categories: "generalist predator," hunting both land and aerial prey of varying sizes (105/133, Table 1); "bird specialist predator," hunting aerial prey (22/133, Table 1); "small rodent specialist predator," hunting ground prey (3/133, Table 1); or "fish specialist" (3/133, Table 1). Due to sample size limitations, we were only able to compare generalist to bird specialist predators; we fitted univariable logistic regression models to investigate the difference in the odds of being AR-positive (vs negative) between these two groups.

We generated three new groups to test for intra- and inter-trophic group differences and to compare great horned owls and red-tailed hawks, the most represented species in this study. The first two groups: (1) great horned owls ($n = 17$) and (2) red-tailed hawks ($n = 39$), both generalist predators, allowed us to compare intra-group exposure to ARs. The third group, (3) the "other" category ($n = 77$), combined all other species consisting of bird, fish, small rodent specialists, and generalist predators to allow inter-group comparison. We fitted univariable logistic regression models to investigate the difference in the odds of being AR-positive (vs negative) of these three groups, as well the influence of being a great horned owl as compared to a red-tailed hawk on being exposed to the ARs of greatest interest (brodifacoum, bromadiolone, difethialone). Further, for birds found to be AR-positive, we compared the odds of being diagnosed with multiple different ARs compared to one AR for the three groups.

We generated four new groups based on the identified cause of death for each bird, to investigate potential co-morbidities between AR status and cause of death. The cause of death or morbidity was classified as "Disease" (58/133), "Toxin" (including AR- and lead-poisoning, 4/133), "Trauma" (40/133), and "Undetermined" (31/133). We used univariable logistic regression models to investigate the difference in the odds of being AR-positive (vs negative) between these groups. We also used logistic regression models to opportunistically investigate potential associations between AR exposure and West Nile virus infection status, by analyzing the odds of testing WNV-positive (87/133) for AR-positive birds compared to AR-negative birds. Due to previous work indicating that infection prevalence of WNV is greater for great horned owls and red-tailed hawks than other raptor species (Smith et al. 2018), we included the groups "great-horned owl," "red-tailed hawk," and "other" as a fixed effect in the WNV model.

We fitted univariable linear regression models to investigate the differences in mean detected levels of the three ARs of greatest interest (brodifacoum, bromadiolone, difethialone) between the groups "great horned owl," "red-tailed hawk," and "other"; to achieve homogeneity of variance and normality, we log-transformed the mean detected AR levels (the outcome for each model).

To investigate AR burdens from birds collected in different land-use areas, we used the human population size of the 2016 census subdivisions and delineations from Statistics Canada (2011). Carcass locations from the collected location data were mapped by QGIS version 3.6 (QGIS Geographic Information System, Open Source Geospatial Foundation Project) and then classified as originating from a non-urban

Table 1 Detection frequency of anticoagulant rodenticides in 17 raptor species submitted to the Canadian Wildlife Health Cooperative in Ontario, Canada, between 2017 and 2019

Species group	Species[a]		Feeding Category[b]	Number sampled	Birds with detected anticoagulant exposure
Hawks	Red-tailed hawk	*Buteo jamaicensis*	Generalist	39	34 (87%)
	Broad-winged hawk	*Buteo platypterus*	Generalist	2	1 (50%)
	Sharp-shinned hawk	*Accipiter striatus*	Generalist	3	0
	Cooper's hawk	*Accipiter cooperii*	Bird	13	10 (77%)
			Total	**57**	**45 (79%)**
Owls	Great horned owl	*Bubo virginianus*	Generalist	17	15 (88%)
	Snowy owl	*Bubo scandiacus*	Generalist	16	8 (50%)
	Boreal owl	*Aegolius funereus*	Generalist	1	0
	Northern saw-whet owl	*Aegolius acadicus*	Generalist	7	4 (57%)
	Barred owl	*Strix varia*	Generalist	12	4 (33%)
	Eastern screech-owl	*Megascops asio*	Generalist	3	2 (67%)
	Long-eared owl	*Asio otus*	Small rodent	2	0
	Short-eared owl	*Asio flammeus*	Small rodent	1	0
			Total	**59**	**33 (56%)**
Osprey	Osprey	*Pandion haliaetus*	Fish	3	0
			Total	**3**	**0 (0%)**
Falcons	Peregrine falcon	*Falco peregrinus*	Bird	5	1 (20%)
	American kestrel	*Falco sparverius*	Generalist	2	1 (50%)
	Merlin	*Falco columbarius*	Bird	4	1 (25%)
			Total	**11**	**3 (27%)**
Eagles	Bald eagle	*Haliaeetus leucocephalus*	Generalist	3	1 (33%)
			Total	**3**	**1 (33%)**
TOTAL				**133**	**82 (62%)**

[a]Short-eared owl (*Asio flammeus*), peregrine falcon (*Falco peregrinus*), and bald eagle (*Haliaeetus leucocephalus*) are Ontario *Species of concern*

[b]Feeding category assigned based on feeding ecology of each species (NatureServe 2020)

site (< 100,000 people) or large urban population (≥ 100,000 people) center (Statistics Canada 2011). We used univariable logistic regression models to compare the odds of testing AR-positive or positive for brodifacoum, bromadiolone, and difethialone in birds found in urban compared to rural census areas.

Results

Between 2017 and 2019, 133 samples were collected from 17 species of raptors across Ontario (Table 1, Fig. 1). Our study included four species of hawk (family Accipitridae), eight species of owls (family Strigidae), one osprey (the single member in its family Pandionidae and genus *Pandion*), three species of falcon (family Falconidae), and one species of eagle (family Accipitridae, subfamily Aquilinae) (Table 1). Evidence of exposure to ARs was detected in 12 species, with the highest proportion of positive samples detected in great horned owls (88%), followed by red-tailed hawks (87%) (Table 1). AR prevalence was greatest in the hawk species group (Table 1).

The odds of great horned owls testing positive were 10 times greater compared to the grouped "other" species (Table 2); the odds of red-tailed hawks testing positive were nine times greater compared to the grouped "other" species (Table 2). No difference was identified between the odds of detecting an AR in great horned owls and red-tailed hawks. There was no difference in the odds of detecting an AR between "generalist predators" and "bird-specialist predators" (Online Resource 1).

Frequency of AR detections was as follows: 51 birds (38%) contained zero AR residue, 48 birds (36%) contained residue of one AR, 22 birds (17%) contained residue of two ARs, 11 birds (8%) contained residue of three ARs, and one bird (1%) contained residue of four ARs. The majority of tested raptors (82/133, 62%) contained detectable levels of one or more SGARs (Table 1). The most commonly detected AR was bromadiolone, followed by difethialone and brodifacoum (Table 3); the SGARs

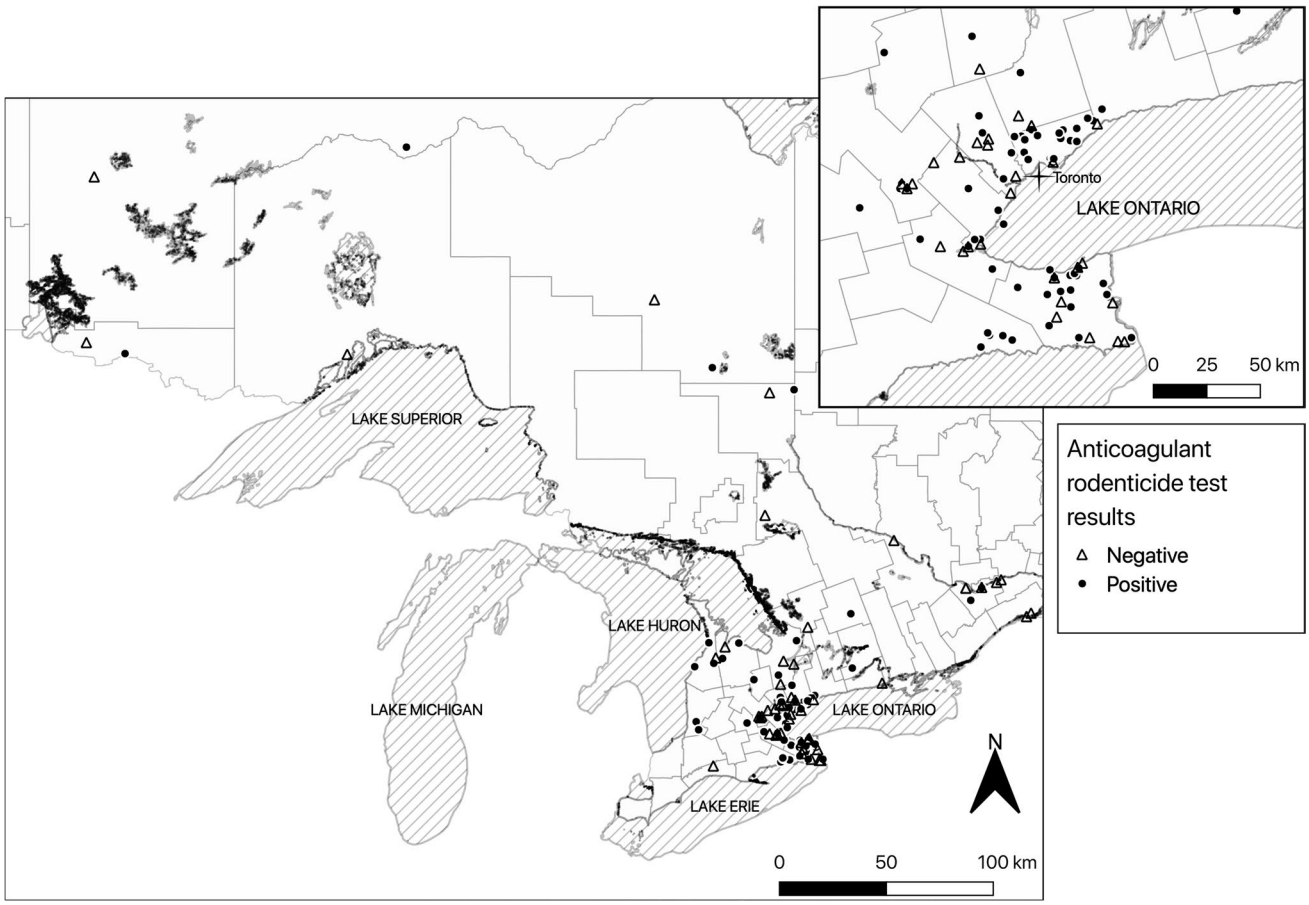

Fig. 1 Distribution and anticoagulant rodenticide test results of raptors submitted to the Canadian Wildlife Health Cooperative in Ontario, Canada, between 2017 and 2019. The inset map focuses on submissions from the Greater Toronto and Hamilton area on the west end of Lake Ontario

Table 2 Univariable logistic regression models indicating the difference in odds of anticoagulant rodenticide (AR) detection in wild raptors submitted to the Canadian Wildlife Health Cooperative in Ontario, Canada, between 2017 and 2019

		Odds ratio	*p* value	95% CI	Walds X^2
Odds of being AR-positive	Great horned owl *n* = *17*	10	0.003	2.14–46.78	< 0.001
	Red-tailed hawk *n* = *39*	9.07	< 0.001	3.20–25.69	
	Other bird species *n* = *77*	Referent			
For AR-positive birds, the odds of detecting multiple AR residues	Great horned owl *n* = *17*	5.33	0.013	1.43–19.94	0.042
	Red-tailed hawk *n* = *39*	2.11	0.154	0.76–5.85	
	Other bird species *n* = *77*	Referent			

difenacoum and flocoumafen were undetected. There was no difference in the likelihood of detecting bromadiolone, brodifacoum, or difethialone in great horned owls compared to red-tailed hawks (Online Resource 2). Detected AR levels ranged from 0.00126 to 0.52 µg/g (Table 3); there were no significant differences in mean liver concentrations of brodifacoum, bromadiolone, or difethialone between great horned owls, red-tailed hawks, and the other grouped species (Online Resource 3). Evidence of exposure to SGARs was detected more frequently in raptors than FGARs; only two raptors tested positive for residues of an FGAR: warfarin (0.089 µg/g) and coumatetralyl

Table 3 The detection frequency, mean residue level, and range of anticoagulant rodenticides detected in wild raptors submitted to the Canadian Wildlife Health Cooperative in Ontario, Canada, between 2017 and 2019

Active ingredient	Individual birds with detectable residue (N (%))	Number of species with detected residue (N)	Mean (µg/g)	Range (µg/g)
Difethialone	40 (30%)	8	0.067	0.00126–0.38
Brodifacoum	33 (35%)	9	0.085	0.019–0.52
Bromadiolone	54 (40%)	10	0.122	0.00642–0.45

Table 4 Final cause of death of raptors, and anticoagulant rodenticide detection status, and univariable logistic regression models indicating the difference in odds of odds of detecting an AR associated with each cause of death in wild raptors submitted to the Canadian Wildlife Health Cooperative in Ontario, Canada, between 2017 and 2019 as compared to birds with an *undetermined* cause of death

Cause of death[a]	Number of individual raptors	≥ 1 ARs detected	> 1 AR detected
Trauma[b]	40 (30%)	27	13
Disease[c]	58 (44%)	35	14
AR poisoning	2 (1.5%)	2	1
Lead toxicity	2 (1.5%)	0	0
Undetermined	31 (23%)	18	6
Total	**133**	**82**	**34**
The odds of being AR-positive			
	Odds ratio	***p* value**	**95% CI**
Trauma	1.5	0.414	0.57–3.97
Disease	1.1	0.835	0.45–2.67
AR poisoning or lead toxicity	0.72	0.76	0.09–5.81

[a]As determined by a veterinary pathologist

[b]*Trauma* includes motor vehicle collisions, window collisions, electrocution, and animal attacks

[c]*Disease* includes emaciation, aspergillosis, fungal pneumonia and air sacculitis, herpes virus, oral squamous cell carcinoma, multifocal encephalitis, trichomoniasis, West Nile virus, intestinal carcinoma, peritonitis, and biliary carcinoma with bile duct obstruction

(0.032 µg/g). The FGARs coumachlor, coumafuryl, coumatetralyl, dicoumarol, diphacinone, pindone, and valone were undetected.

Of AR-positive birds, 34/82 (42%) contained residues of multiple (> 1) anticoagulant compounds (Table 4). The odds of a positive great-horned owl containing residue of more than one AR was five times greater than the grouped "other" species (Table 2).

No difference was identified between the odds of detecting an AR in any of the mortality groups (Table 4). Using our opportunistically collected West Nile virus data, we determined that there was no significant association between testing AR-positive and testing WNV-positive based on the multivariable logistic regression models, which included the variable for grouped species (Online Resource 4).

No difference was identified between the odds of a bird testing AR-positive by land-use classification (odds ratio = 1.68; CI = 0.83, 3.41; $p = 0.147$); however, the odds of detecting bromadiolone in a bird was greater for birds found in urban areas as compared to non-urban areas (odds ratio = 2.94; CI = 1.43, 6.05; $p = 0.003$). There was no difference in the odds of detecting brodifacoum ($p = 0.053$) or difethialone ($p = 0.336$) in birds found in urban areas as compared to non-urban areas.

Discussion

We detected similar overall prevalence of AR residues in raptors as reported globally (Stone et al. 2003; Albert et al. 2010; Thomas et al. 2011; Hughes et al. 2013; Geduhn et al. 2016; Lohr 2018), and we found ARs in the majority of species sampled. All taxonomic groups included in our study, except for osprey, tested positive for AR residues, further demonstrating that AR exposure in raptors in Ontario is common.

Hawk and owl species, particularly red-tailed hawks and great horned owls, had the highest prevalence of AR, which is not surprising given the rodent-heavy prey diet of both these generalist predators (Marti and Kochert 1995). Previous studies have reported higher hepatic SGAR concentrations in red-tailed hawks than great horned owls in New Jersey and lower hepatic SGAR concentrations in red-tailed hawks than great horned owls in Ontario (Stansley et al. 2014; Thomas et al. 2011). However, we found no difference in the likelihood of detecting an AR, detecting a specific AR compound, or detecting multiple AR compounds between red-tailed hawks and great horned owls. The large prey base and widespread distribution of red-tailed hawks and great horned owls throughout Canada may make them useful sentinels for ARs in the environment.

We detected higher mean liver residues of both bromadiolone and brodifacoum than Huang et al. (2016), as well as a higher maximum liver concentration of brodifacoum. When compared to the findings of Thomas et al. (2011), our overall maximum detected liver concentrations of bromadiolone and

brodifacoum were greater than those measured in red-tailed hawks, but lower than those detected in great-horned owls. Our range and maximum detected bromadiolone and brodifacoum liver concentrations was lower than that detected by Albert et al. (2010), though they did analyze samples spanning a 15-year period. Additionally, difethialone was previously only recorded in three species of owls in Canada (Albert et al. 2010; Thomas et al. 2011; Huang et al. 2016). Thomas et al. (2011) reported eight great horned owls with difethialone residue; in our study, we detected difethialone in 40 individual birds of eight different species. We also report higher difethialone residue concentrations across all species than the 0.003–0.03 µg/g wet-weight and 0.047 µg/g reported by Thomas et al. (2011) and Huang et al. (2016), respectively. Difethialone was present in about half of all birds that tested positive for ARs in our study; we observed higher prevalence, greater number of species affected, and higher detected residue concentration of difethialone compared to Thomas et al. (2011) and Huang et al. (2016). Assuming similar AR usage across provinces, our data indicates that difethialone exposure to non-target birds of prey in Ontario is likely increasing.

As of 2013, bromadiolone, brodifacoum, and difethialone are only licensed for commercial pest control, and additional stipulations include the use of protective bait boxes and baiting in areas not accessible to non-target wildlife, pets, and children (PMRA 2010, 2012a, 2012b). Notably, brodifacoum and difethialone, SGARs that may pose the greatest overall risk to non-target wildlife (Erickson and Urban 2004), are licensed for indoor commercial use only. However, since it is impossible to control the movement of wild rodents, ARs may move from the interior to the exterior of a building via a rodent prior to its death, therefore still exposing predatory animals (Elliot et al. 2016). Our data suggests that raptors are likely being exposed to ARs multiple times in their lives (as determined by the detection of multiple ARs within a single animal). As Lohr (2018) observed in Australian owls, the detection of SGARs only meant to be used by licensed professionals, in such high values, is of concern. Our findings that brodifacoum, difethialone, and bromadiolone were observed alone, or in conjunction with one another, in the majority of our sampled raptors, indicate that the legislative changes in Canada may not be protecting non-target wildlife as intended.

Further, while we detected no difference in the odds of testing AR-positive between birds found in urban vs rural census areas, there were significant differences between the odds of detecting bromadiolone between these areas. Our results suggest that birds found in more concentrated human-use areas, here categorized as "urban," had greater odds of containing residues of bromadiolone than birds found in other areas. This may reflect differing application methods of ARs, different prey intake by the raptors, or a different secondary poisoning pathway as a result of different hunting strategies between areas. However further research into the differences in secondary AR poisoning between areas of concentrated human habitation and other land use areas are needed to further inform regulations surrounding AR application methods.

Based on necropsy and LC–MS/MS findings, AR toxicosis was identified as the cause of death in only two (1.5%) raptors in this study; despite testing positive for AR residues post-mortem, the cause of death of most of the birds was not AR toxicosis. However, sublethal levels and effects of AR exposure are important because not all birds that are exposed to ARs are likely to receive a lethal dose (Newton et al. 1990). No clear biologically relevant levels of ARs for raptors have been defined in the literature, and without accurate toxicity parameters, we cannot postulate on the individual, population level, or ecological effects of AR exposure (Murray 2018; Quinn 2019). AR levels of concern to raptors vary wildly between species and anticoagulant compound (Rattner et al. 2011, 2014a; Nakayama et al. 2019). A "toxicity threshold" of 0.1 µg/g liver wet-weight derived from experimental toxicosis of barn owls (*Tyto alba*) (Newton et al. 1998, 1999) has been cited as a threshold for many raptor species and used to estimate exposure risks (Thomas et al. 2011) for lack of a more specific or representative value. Nevertheless, several birds in our study were found to have residual levels of ARs greater than 0.1 µg/g but were determined by post-mortem exam to have an unrelated cause of death. Most sublethal effects of rodenticides for exposed raptors originate from antagonism of the vitamin K-dependent clotting factors and manifest as coagulopathy. Changes in fitness are also observed, though the toxicity pathways for these changes are unknown (Naim et al. 2011; Rattner et al 2014a; Rattner et al. 2018). The effect of these sublethal effects on survival in free-ranging populations is not clear, and we cannot add to this knowledge due to the design of our study. The difficulties of interpreting AR toxicity following secondary exposure are detailed in multiple publications, which all highlight similar themes. They include but are not limited to differences in AR compound potency, toxicokinetics, and residue accumulation in different species under different field conditions, multiple exposures, the potential for long-lasting effects of residue on toxicosis, and the importance of nutritional planes in AR metabolism and accumulation (Rattner and Harvey 2021). In addition, at the population level, we do not know what proportion of the population is actually compromised by AR exposure or how frequently and at what magnitude non-target predators and scavengers are being exposed to ARs if their diet does not include target species (Quinn 2019). Given the gaps in our knowledge, the current literature struggles to translate laboratory-based toxicology studies into real-word adverse effects and risks (Murray 2018; Quinn 2019). No-choice,

continuous exposure experimental conditions in toxicology trials, the effects of consuming multiple ARs (though assumed to be additive (Thomas et al. 2011)), and the understudied pharmacokinetics of ARs in predatory birds contribute to difficulties in completing practical ecological risk assessments (Rattner et al. 2018).

The detection of AR residues in species classified as "Special concern" as defined in Ontario legislation by the Ontario Ministry of Natural Resources (OMNR 2007) may be of particular conservation concern. Three of the raptor species designated "Special concern species" in Ontario were sampled in this study, and ARs were found in both bald eagles (*Haliaeetus leucocephalus*), and peregrine falcons (*Falco peregrinus*). The implications of anticoagulant rodenticide for threatened raptor conservation have been described in endangered Réunion marsh harrier (*Circus maillardi*) (Coeurdassier et al. 2019), with the main challenge being that this species has a limited breeding population, and increasing Réunion marsh harrier deaths attributed to ARs are mainly in these productive, adult birds. Correlations between AR concentrations and harrier breeding density were observed, with these birds most likely to breed in these resource-rich areas also the most likely to be exposed to ARs. Despite the lack of evidence supporting a toxicological mechanism between reproductive success and AR exposure (Naim et al. 2011; Quinn 2019), the death of a productive adult in any endangered population is a loss and should promote more investigation and careful integrated pest management planning.

The detection of AR in peregrine falcons and two other species of falcon is worth noting because the diet of these species does not generally include the target rodents of most AR pest control efforts. In addition, we found no difference in the odds of detecting AR residues in generalist versus bird-specialist predators, which we did not expect. Although the sample size of these species is small, it bolsters the findings of Thomas et al. (2011), who first reported AR residues in merlin (*Falco columbarius*) and American kestrel (*Falco sparverius*) in Canada. These species, as well as raptors within the genus *Accipiter*, like the Cooper's hawk (*Accipiter cooperii*) (within which AR residue was also detected), primarily consume other bird species and aerial invertebrates (Scott 2016). Our findings of AR residues in these bird-specialist predators further illustrate that the environmental contamination of ARs is likely broader than previously thought (Nakayama et al. 2019). Evidence of brodifacoum in a songbird, carrion beetles (*Dermestes* spp.), and slugs (*Arion* spp.) (Elliott et al. 2014) implicate these species as sources of environmental contamination and support the poorly described additional pathways of secondary AR poisoning involving songbirds and invertebrates both directly feeding from rodenticide baits and consuming contaminated prey (Elliott et al. 2016; Vyas 2017).

Pathways of AR exposure in bald eagles are poorly understood, but as competitive and resourceful predators, it is currently postulated that the routes of exposure are multiple and complex, extending beyond the consumption of rodents (Hindmarch and Elliot 2018; Niedringhaus et al. 2021). A recent study of ARs in both bald and golden eagles across the USA over a 4-year period observed AR residues in 82% ($n = 133$) of tested birds (Niedringhaus et al. 2021). Though only 1/3 bald eagles in our study tested positive for AR residues, this may offer support for secondary AR exposure pathways involving aquatic ecosystems. Fish may be a large portion of the bald eagle diet. ARs are documented as entering the aquatic environment through contaminated wastewater following AR bait placement in sewers and via untreated stormwater overflow (Regnery et al. 2020). Documented bioaccumulation of in the liver of freshwater fish (Regnery et al. 20202020) supports fish as one source of secondary exposure. However, we did not find AR residues in any of our sampled osprey, a species that solely predate on fish, and with the results of our study, cannot speculate further. This possible route of secondary AR exposure should be acknowledged when considering how to mitigate secondary exposure to non-target wildlife.

The data presented in this study suggests that the patterns of contamination extend beyond simply raptors consuming poisoned rodents. Pathways of secondary AR exposure involving invertebrates, non-predatory avian species, and aquatic ecosystems are not well understood, and further research is required. Surveys of pest control companies to understand their primary pest control responses, as has been done in other provinces (Hindmarch et al. 2018), may provide insight into the routes of secondary AR poisoning of raptors in Ontario. It is important to note that new legislation does not mean the compounds instantly stop being applied, and ARs purchased prior to legislative changes may still be owned and used by citizens. Illegal marijuana growing farms on California public lands have been suggested as as sources of AR exposure for fishers (*Martes pennanti*) (Gabriel et al. 2012), providing evidence of suboptimal adherence to AR usage guidelines. Further information is needed to avoid speculation and better inform and enforce policy in the future.

Moving forward, it would be beneficial to expand the geographical scope of this research. The majority of samples for this study were collected from southwestern Ontario, which reflects the opportunistic nature of sample collection through the CWHC. We rely on carcass submission from the public so it is not unexpected that our submission area corresponds to areas of high human population density and areas with increased local-awareness of the CWHC's wildlife health monitoring projects. In addition, examining only deceased individuals inherently biases the sample set of the population by excluding asymptomatic living individuals;

however, a live-capture study was beyond the scope of this project. Even with this limitation and with a relatively small number of samples, we were able to demonstrate common and widespread exposure to AR in Ontario's raptors.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s11356-022-18529-z.

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Author contribution All authors contributed to the study conception and design. Data collection was performed by Grace L. Thornton and Brian Stevens. Laboratory and data analysis were performed by Grace L. Thornton, Shannon K. French, Leonard J. Shirose, Felipe Reggeti, and Nick Schrier. The first draft of the manuscript was written by Grace L. Thornton, and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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Data availability The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate All sampling was conducted on opportunistically collected and donated deceased animals, so no ethics approval is required. No animals were harmed for the purposes of this study.

Consent for publication Not applicable.

Competing interests The authors declare no competing interests.

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The Effects of Secondary Rodenticide Exposure on Non-Target Species at an Ontario Wildlife Rehabilitation Centre

Salthaven Wildlife Rehabilitation & Education Centre is located outside of London and possesses direct experience interacting with victims of rodenticide poisoning in Ontario cities. Salthaven volunteers admit and attempt to treat sick, injured, and/or orphaned wildlife patients. Founder Brian Salt participated in a Fall 2023 webinar on the topic of responsible pest management.

In cities, indirect rodenticide poisoning is often an overlooked issue. "From our perspective we see these animals that come in that have been incapacitated because of secondary rodenticide. It's a very easy diagnosis. You look in a bald eagle's mouth and it's white because they're bleeding internally. It's a very painful slow death that oftentimes there's nothing we can do to help them because they're too far gone," Salt stated.

Bald eagles, known for their strength, often show no signs of distress until it's too late. "We use vitamin K," Salt said, "which is a coagulant to offset the effects of the internal bleeding, but unless we can get them early enough, they don't make it. By that point they're in really deep and we save maybe one out of four." The rest, too far gone, often require humane euthanasia to end their suffering.

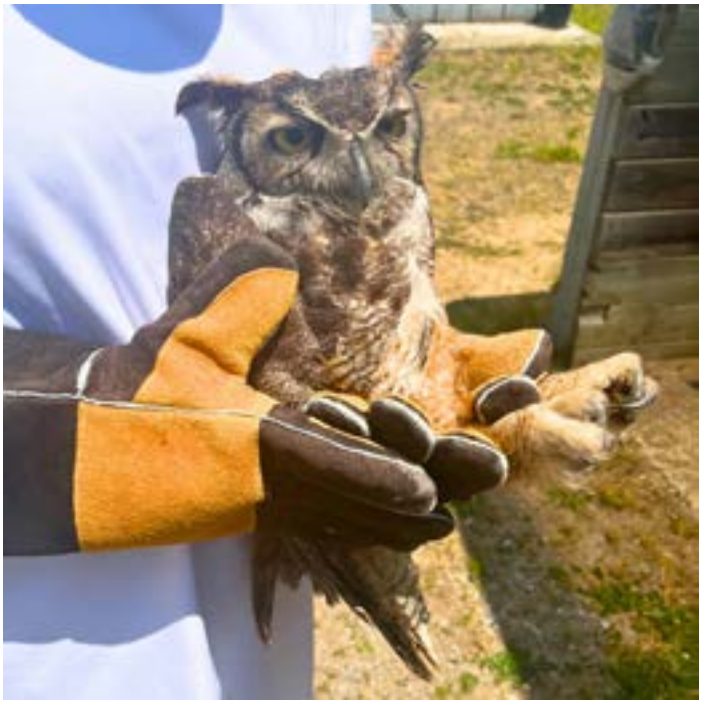
The problem extends beyond bald eagles. As Salt relates, many of Ontario's native and at-risk species are in great danger of rodenticide poisoning. Staggering exposure statistics revealed in academic research from the United States and Canada highlight the widespread nature of the problem. Not limited to raptors, Salt claims that the issue "...affects other species such as family pets. As you know cats and dogs catch mice. The poison can exist in the environment for an incredibly long period of time so it's there on a constant basis."

Birds of prey, such as barn owls and bald eagles, play a crucial role in controlling rodent populations. A barn owl can eat over a thousand mice in a year, and a bald eagle can consume the same number of rats. Once poisoned, rodents become easy prey for predators, leading to their own poisoning. "We're poisoning the very allies that are helping us in rodent population control," adds Salt.

Salt insists that the problem is real and compounded by the fact that for every observed affected bird, "there's probably 10 more of out there that we don't see." Great horned owls, especially in the London area, are heavily impacted, particularly in the spring when they are feeding their young. Eastern screech-owls, too, are quickly succumbing to rodenticide poisoning, often dying before they can be helped. According to Salt, it's not just birds of prey that are affected. Lynx, bobcats, and foxes, which rely on rodents for food, are also at risk.

Exposure also carries sub-lethal effects. Rodenticide has been found in many animals killed by collisions, suggesting that the poison impairs their agility and alertness, making them more vulnerable to hazards. Salt finished by asserting, "There's little doubt in my mind that it incapacitates them to a degree so that they're not as agile or alert. Their ability to catch prey is diminished. Some of the hawks and owls that are brought to us are extremely underweight as their ability to be predators to rodents is compromised."

The Salthaven Centre has previously spoken out on the effects of rodenticide poisoning of non-target species. Through publications on the organization's website, trainers have told the stories of great horned owl and eastern screech-owl patients.



Found hunched over and disinclined to move away from humans, the great horned owl admitted in May of 2023 exhibited very large pupils and difficulty keeping his eyes open. During routine triage it was noted that the owl was emaciated, severely dehydrated, weak, quiet, and possessed a very pale mouth – a sign of internal bleeding. Despite the delivery of hydrating fluids and Vitamin K to promote clotting, the owl did not survive its poisoning, a typical result for many victims.

In March of 2022, an adult Eastern screech-Owl was admitted to Salthaven. Found in London's Springbank Park, the owl was exhibiting symptoms of secondary rodenticide poisoning: a pale mouth (indicating internal bleeding), neurological impairment, convulsions, and an inability to stand on its own. In this state, the owl was already beyond the point of efficacy of Vitamin K treatment upon arrival at Salthaven and required euthanization.

Salthaven believes that local communities can contribute in various ways to the conservation of wildlife and prevention of their death due to secondary rodenticide exposure. The first is educating others on the effects of rodenticides, their mechanisms of action, and other alternatives to rodent population control.

To this objective, it is important to reiterate that anticoagulant rodenticides contain chemicals that specifically interfere with the activation of vitamin K

within the blood – a critical mechanism necessary for the production of clotting factors – causing severe and spontaneous bleeding, leading to cardiovascular shock, and resulting in death. The rodents that become sick from the rodenticides become an easier target for predatory species. When predatory birds ingest any rodent infected by a rodenticide, the raptor's health is at risk.

In a 2022 study published by pathologists at the Canadian Wildlife Health Cooperative and the University of Guelph that assessed anticoagulant rodenticide exposure in predatory birds from Ontario found evidence of exposure in 12 different species. Great horned owls and red-tailed hawks were the most commonly exposed, ten and nine times more likely to exhibit rodenticide exposure than all other tested species. One or more anticoagulant was detected in 62 percent of the overall sample population. Of these, 42% indicated ingestion of multiple anticoagulant compounds.

Salthaven considers it their responsibility as a wildlife rehabilitation and education centre to educate members of the community and advocate recommended alternatives for our native species. By working purposefully together, we all can play a role in preventing anticoagulant rodenticides from affecting non-target species and maintaining natural mechanisms of rodent population control.

Photos courtesy of Salthaven Wildlife Rehabilitation & Education Centre

BY-LAW NUMBER 2024-XXX

OF THE

CORPORATION OF THE CITY OF KITCHENER

(Being a by-law to protect the natural environment and human health and for prohibiting the use of inhumane methods of rodent control within the City of Kitchener).

WHEREAS: Section 11 (2) of the Municipal Act, 2001, S.O. 2001, c. 25 as amended, authorized municipalities to pass by-laws respecting health, safety and well-being of persons, and protection of persons and property;

AND WHEREAS: Section 10 (2) 9 of the Municipal Act, 2001 S.O. 2001 c. 25 as amended, authorizes the councils of municipalities to pass by-laws respecting animals;

AND WHEREAS: Eliminating non-essential use of rodenticides is consistent with the precautionary principle;

AND WHEREAS: Council acknowledges that rodenticide products are unreasonably dangerous, inhumane, and ineffective;

AND WHEREAS: Preventative measures are the best method of vector control.

AND WHEREAS: The Council of The Corporation of the City of Kitchener deems it desirable, for the protection of the health of the public, to pass a by-law requiring owners and occupiers of property within the geographic limits of the Corporation of the City of Kitchener to prevent their property from becoming infested by vectors that may spread disease;

AND WHEREAS: The Council of The Corporation of the City of Kitchener wishes to enact a by-law regulating and limiting the use of inhumane vector control products to address public concern for the environmental wellbeing of the Corporation, and the health, safety and well-being of its inhabitants;

AND WHEREAS: The Municipal Act, S.O. 2001, C.25, section 8 provides that the powers of a municipality shall be interpreted broadly so as to confer broad authority on

the municipality to enable the municipality to govern its affairs as it considers appropriate and to enhance a municipality's ability to respond to municipal issues.

AND WHEREAS: Ontario's Pesticides Act, R.S.O. 1990, c. P.11 does not preclude municipal by-laws that do not address the use, sale, offer for sale or transfer of a pesticide that may be used for a cosmetic purpose.

AND WHEREAS: The Council of The Corporation of the City of Kitchener deems it desirable and in the public interest to enact an Animal Poison Prevention By-law for protecting wildlife, pets, and people from unreasonable adverse effects caused by rodenticide use for the purpose of:

- Eliminating inhumane methods of pest control;
- Regulating and controlling the use, purchase, and sale of rodenticides;
- Sustaining a healthy natural environment by protecting biodiversity;
- Protecting significant and sensitive natural areas;
- Protecting human health;
- Maintaining water quality; and
- Protecting fish habitat as defined in the Fisheries Act, Revised Statute of Canada 1985.

NOW THEREFORE the Council of the Corporation of the City of Kitchener enacts as follows:

1. This By-law may be cited as the "Animal Poison Prevention By-law."

2. In this By-law:

(a) "Biological control" means the use of living organisms such as insects, nematodes, fungi, viruses, fish or animals to control pests.
(b) "City" includes any place within the limits of the City of Kitchener.
(c) "Corporation" means The Corporation of the City of Kitchener.
(d) "Council" means the Council of The Corporation of the City of Kitchener.
(e) "Glue Trap" means a trap that:
    (i). is designed, or is capable of being used, to catch a rodent; and
    (ii). uses an adhesive substance as the means, or one of the means, of capture.
(f) "Humane" means an action, method, or behavior that cause, involve, or invoke the least possible degree of pain, suffering, and fear practicable.

(g) “Inhumane Pest Management” includes methods of controlling or eliminating pests that cause unnecessary pain, suffering, and/or fear. Inhumane methods include but are not limited to glue traps and rodenticides.

(h) “Integrated Pest Management” (IPM) refers to a strategic approach that aims to reduce risks to humans and the environment by only using pesticides (including rodenticides) as a temporary, last resort. IPM advocates for exclusion, prevention, attractant reduction, habitat modification, non-chemical control methods such as snap-traps, and biological controls whenever possible.

(i) “Officer” means any Property Standards Officer, City municipal Law Enforcement Officer, City By-law Enforcement Officer, member of the Waterloo Regional Police Service, and any other person appointed by the City for the purposes of enforcing this Chapter.

(j) “Owner” means the registered owner of the land on which a violation of this By-law occurs, and includes a trustee acting on behalf of the registered owner, the estate of a registered owner, and a person with a leasehold interest in the land.

(k) “Person” means an individual or group of individuals, unincorporated association, sole proprietorship, partnership, or corporation.

(l) “Property” means a Building or Structure or part of a Building or Structure, and includes the lands, yards and premises appurtenant thereto and all mobile homes, mobile buildings, mobile structures, outbuildings, swimming pools, and erections thereon whether heretofore or hereafter erected, and includes vacant property and designated Heritage Property.

(m) “Prohibited Product” means any product that is deemed to pose unreasonable risks to wildlife, family pets, and human health, and/or inhumane pain, suffering, and/or death, and includes those Products listed in or containing the products set out in Schedule “A” attached hereto, which may be amended by Council, as required.

(n) “Rodenticide” shall mean:

(i). any substance intended to destroy, repel or mitigate rodents and other pests by any method including by preventing normal blood clotting, by causing internal hemorrhaging, or by disturbing nervous system functions; and/or

(ii). a substance that is classified as a rodenticide by regulation.

(o) “Vector” means a carrier organism that is capable of transmitting a pathogen from one facility, waste source, product or organism to another

facility, waste source, product or organism including, but not limited to mice, rats and mosquitoes.

Pest Prevention Standards

3. All properties shall be kept free from rodents, vermin and insects and any condition which might result in the harbouring of such pests in accordance with the Corporation of the City of Kitchener Municipal Code Chapter 665, Standards of Maintenance and Occupancy of property, Article 6.

4. No owner or occupier of property within the Corporation shall cause, allow, or permit any building or improvement; brush, trees, weeds or other growths; water, whether moving or standing; and/or any other condition on that property that provides food, shelter, or breeding conditions that could attract a vector.

5. Except as provided in Section 4(d), no person shall knowingly or willingly feed, or in any manner provide or furnish access to food or any other edible substance, to any wildlife.

6. Bird feeders must be suspended on a cable or other device in such a manner that they are inaccessible to wildlife other than birds.

7. Every owner or occupier of property within the Corporation must ensure that:

   (a) all fruit on trees or bushes be harvested immediately upon ripening;
   (b) all fallen fruit from trees or bushes be removed immediately;
   (c) bee hives are inaccessible to wildlife;
   (d) grease containers are inaccessible to wildlife;
   (e) outdoor refrigerators or freezers are inaccessible to wildlife; and
   (f) dairy products and proteins are not put into compost piles.

8. Rodents, vermin and insects shall be managed in a manner consistent with Integrated Pest Management principles as defined in this By-law.

Use of Prohibited Products

9. No person shall use, handle, release, store, or dispose of products containing a rodenticide.

10. No person shall use, handle, release, transport, store, or dispose of glue traps, glue boards, metal-toothed rodent trap, and/or any other trap or pest management method deemed inhumane by this council.

Sale and Marketing of Prohibited Products

11. No Person shall buy, sell, offer for sale, advertise, or otherwise promote a rodenticide.

12. No Person shall buy, sell, offer for sale, advertise, or otherwise promote glue traps, glue boards, metal-toothed rodent trap, and/or any other trap or pest management method deemed inhumane by this council.

Sunset – Temporary Limited Exception

13. Notwithstanding Sections 9 through 12, any Person who, on the date of the passage of this By-law, lawfully possessed a Prohibited Product, shall within XX days, _____ provided that the product is:

    (a) secured in an air-tight, tamper-proof, or original unopened packaging;
    (b) has never been, or is no longer accessible to wildlife, pets, and children; and/or
    (c) is not stored outdoors, or within 30 meters of a waterbody or shoreline.

Enforcement

14. Administration and enforcement of this By-law including Orders, Service and Appeals of Orders, Certificates of Compliance, Powers of Entry and Inspection , Compliance and Penalties for Non-compliance shall be carried out through mechanisms prescribed under the Building Code Act, S. O. 1992, c.23.

15. An Officer may enter on land at any reasonable time for the purpose of carrying out an inspection to determine whether this Chapter is being complied with. Entry to any place being used as a dwelling may be subject to the requirements of the *Municipal Act, 2001*.

16. For the purposes of an inspection pursuant to this Chapter, an Officer may:

    (a) Require the production for inspection of documents or things relevant to the inspection;
    (b) Inspect and remove document or things relevant to the inspection for the purpose of making copies or extracts;

(c) Require information from any person concerning a matter related to the inspection; and

(d) Alone or in conjunction with a person possessing special or expert knowledge, make examinations or take test, samples or photographs necessary for the purpose of the inspection.

Offence

17. Every person other than a corporation who contravenes any provision of this Chapter is guilty of an offence and is liable upon conviction, to a fine not exceeding $ 50,000 exclusive of costs, for each offence, recoverable under the *Provincial Offences Act*.

18. Every corporation that contravenes any provision of this Chapter is guilty of an offence and is liable upon conviction, to a fine not exceeding $ 100,000 exclusive of costs, for each offence, recoverable under the *Provincial Offences Act*.

19. Failure to correct a violation of this ordinance within thirty (30) days of receiving written notice shall be deemed a separate offense.

Administrative

20. It is hereby declared that each of the foregoing sections of this Chapter is severable and that, if any provisions of this Chapter should for any reason be declared invalid by any Court, it is the intention and desire of Council that each and every of the then remaining provisions hereof shall remain in full force and effect.

21. That this By-law shall come into force and effect on _____.

22. The Clerk of the City is hereby directed to make this by-law a part of The City of Kitchener Municipal Code by adding it to the Concordance and arranging and numbering it as Chapter XXX so as to fit within the scheme of the Code.

PASSED at the Council Chambers in the City of Kitchener this ___ day

of _____, CE. 2024.

_____

Mayor

_____

Clerk

SCHEDULE A to BY-LAW 2024-XXX

Prohibited Products

THE CORPORATION OF THE CITY OF KITCHENER

City of PICKERING

Report to Executive Committee

Report Number: CS 35-23
Date: December 4, 2023

From: Laura Gibbs
(Acting) Director, Community Services

Subject: Animal Poisoning Prevention
- Pest Management Policy
- Rodenticides Education Campaign
- File: A-1440-001

Recommendation:

1. That Report CS 35-23 regarding Animal Poisoning Prevention be received;

2. That Council approve CUL 160 Pest Management Policy, as set out in Attachment 1 to this report;

3. That Council approve the Rodenticides Educational Campaign as set out in Attachment 2 to this report; and

4. That the appropriate City of Pickering officials be authorized to take the necessary actions as indicated in this report.

Executive Summary: At the Council meeting on June 26, 2023, through Resolution #238/23, Council directed staff to develop a policy banning the use of rodenticides on all City of Pickering properties and a communications strategy for educating residents and business on the harmful impacts of rodenticides and the availability of humane, ecologically sustainable alternatives.

The purpose of the Pest Management Policy is to establish a humane Pest Management Program within City of Pickering properties while banning non-essential use of rodenticides. The Rodenticides Educational Campaign seeks to inform Pickering residents and businesses of the harmful effects of rodenticides and alternatives that can be used for rodent control. The work was undertaken in consultation with the Supervisor, Animal Services.

The purpose of this report is to seek Council's endorsement of CUL 160, as set out in Attachment 1, and the Rodenticides Educational Campaign, as set out in Attachment 2.

Financial Implications: There is no financial impact resulting from the adoptions of recommendations in this report. The costs associated with replacing anticoagulant rodenticide bait boxes with humane traps through service providers will be monitored.

Discussion: Rodenticides are pesticides used to control rodent populations. The most common rodenticide products have active anticoagulant ingredients that cause internal bleeding after ingestion. Rodenticides are used to eliminate rodent populations by causing death by preventing normal blood clotting, causing internal hemorrhaging, or disturbing nervous system functions.

Rodenticides pose threats to Ontario's wildlife (including raptors, songbirds, coyotes, snakes, and raccoons), and the environment (including aquatic ecosystems) through primary and secondary poisoning of non-target species. Predators and scavengers are at a particularly high risk of secondary poisoning because of their dependence on rodents as a food source.

At the Council meeting on June 26, 2023, through Resolution #283/23, Council directed staff to:

1. Prepare a draft policy banning the use of rodenticides on all City of Pickering properties;
2. Include a communications strategy for educating residents and business on the harmful impacts of rodenticides and the availability of humane, ecologically sustainable alternatives;
3. Implement humane practices in regard to pest control on all City of Pickering properties; and
4. Have staff report back to Council no later than Q4.

The draft CUL 160 Pest Management Policy (Attachment 1) prohibits the use of Anticoagulant Rodenticide or other Regulated Substances on City-owned properties, except where expressly authorized as a last resort option by the Director, Community Services.

The draft Policy outlines a Pest Management Program that includes assessment of a property to determine prevention and mitigation measures. Mitigation, planning and implementation of the Pest Management Program shall include access prevention, attractant management and population control. The draft Policy includes monitoring and adaptive management and reporting and compliance procedures.

The Rodenticides Educational Campaign will educate residents and businesses about the negative impacts' rodenticides have, and about alternative, humane methods citizens can use for rodent control. Additionally, the City will place a focus on pet safety – as the use of rodenticides can be of risk to all animals.

Attachments:

1. CUL 160 Pest Management Policy
2. Rodenticides Educational Campaign
3. Resolution #283/23

Prepared By:

Original Signed By

Kevin Hayes
Manager, Facilities

Approved/Endorsed By:

Original Signed By

Laura Gibbs MBA, Msc
(Acting) Director, Community Services

LG:kh

Recommended for the consideration
of Pickering City Council

Original Signed By

Marisa Carpino, M.A.
Chief Administrative Officer

City of PICKERING

Policy

Procedure Title: Pest Management Policy			Policy Number CUL 160
Reference #238/23 Ontario Regulation 63/09 Canadian Environmental Protection Act	**Date Originated (m/d/y)** December 4, 2023	**Date Revised (m/d/y)**	**Pages** 7
Approval: Chief Administrative Officer	**Point of Contact** Director, Community Services		

Policy Objective

The purpose of this Policy is to establish a humane pest management program within City of Pickering properties while banning non-essential use of rodenticides.

Index

01 Policy Statement

The most common rodenticide products currently in use include anticoagulant ingredients. After feeding on these products, rodents first become lethargic and display abnormal behaviour, becoming easier targets for predators that can accumulate these toxic ingredients in their bodies to lethal levels.

To reduce the impact of the City's Pest Management Program on wildlife, it is the Policy of the City of Pickering that:

- The use of Anticoagulant Rodenticide or other Regulated Substances for rodent pest management is prohibited on all City-owned properties, except where expressly authorized as a last resort option by the Director, Community Services; and

- The use of Anticoagulant Rodenticide or other Regulated Substances for rodent pest management is discouraged on private property.

02 Definitions

02.01 **Anticoagulant Rodenticide(s)** – means either a first-generation or second-generation rodenticide that disrupts blood clotting metabolic processes, causing severe or fatal internal hemorrhaging in animals, and is mixed with an attractant for use in pest management activities. Products include first-generation Anticoagulant Rodenticides (FGAR) and second-generation Anticoagulant Rodenticides (SGAR). FGAR is a generally less acutely-toxic rodenticide, requiring multiple feedings to administer a lethal dose, metabolizing quickly in the body tissue of rodents. SGAR is generally a more acutely-toxic rodenticide that requires only a single feeding to administer a lethal dose and remains in the body tissue of rodents longer.

02.02 **Captive Bolt Trap** – means any mechanical device that incorporates a force-driven bolt or piston to kill pests and is authorized for use in Canada.

02.03 **City-owned Property** – means any land, building or structure on such land, either owned or controlled by the City of Pickering, on which legal authority to regulate pest management exists.

02.04 **Electronic Kill Trap** – means any mechanical device that employs electrical current to trap and kill pests authorized for use in Canada.

02.05 **Glue Board(s)** – means trays coated with adhesive, used to eliminate rodents, insects and snakes as an alternative to snap traps or other population control forms.

02.06 **Live Capture Trap** – means a mechanical device authorized for use in Canada, designed so that the capture does not injure the pest.

02.07 **Non-target Wildlife** – means any mammal, insect, bird, amphibian, reptile, or other living organisms that are not the target of pest management or pest management activities.

02.08 **Non-toxic Bait Attractant** – means a substance not listed in the List of Toxic Substances (*Canadian Environmental Protection Act*, Schedule 1) to attract pests for population control.

02.09 **Pest** –refers specifically to rodents targeted by pest management activities.

02.10 **Pest Infestation** – means the occurrence of pest(s) in or around a building or structure such that the occurrence is or is likely to cause damage to the building or structure and/or to generate a health risk to the occupants or users of the building or structure, as determined by a service provider.

02.11 **Pest Management** – means the integrated and comprehensive compilation of actions undertaken to reduce or eliminate a pest infestation.

02.12 **Population Control** – means pest management activities specifically designed to reduce or eliminate and control the pest(s) population inside or near a City-owned property.

02.13 **Property Manager** – means a person or company employed by either the City or a leaseholder to perform property management and maintenance activities on City-owned property, or a person who otherwise represents the City regarding a City-owned property or the leaseholder on City-owned property.

02.14 **Regulated Substance** – means any substance identified as regulated or prohibited in the Ontario Regulation 63/09, known as the *Pesticides Act*.

02.15 **Service Provider** – means a company or corporate entity or person approved to conduct business on City-owned property to administrate a pest management program.

02.16 **Snap Trap** – means any mechanical device that incorporates a spring-loaded mechanism to trap and/or kill pests.

03 Roles and Responsibilities

03.01 Council to:

a. Approve and uphold the Pest Management Policy and any amendments;

b. Approve annual budget including costs of pest management; and

c. Act as an advocate for humane pest management and discouraged use of rodenticides within Pickering.

03.02 Chief Administrative Officer to:

a. Uphold the Pest Management Policy;

b. Recommend revisions to the Pest Management Policy to Council, or amendments to existing policies and procedures when required; and

03.03 Director, Community Services to:

a. Monitor and oversee administration of this policy;

b. Authorize the use of Anticoagulant Rodenticides or other Regulated Substances on City Properties as a last resort option;

c. Annually review this Policy, and associated procedures and standard operating procedures and prepare amendments when the need is recognized; and

d. Determine requirements for Policy and procedure orientation.

03.04 Manager, Facilities Maintenance to:

a. Oversee and implement the Pest Management Program, including compliance with this Policy and associated procedures and standard operating procedures.

03.05 Corporate Communications to:

a. Educate the public on the harmful side effects of anticoagulant rodenticide use and encourage Pickering residents to follow the Policy Statement outlined in section 01 and alternative pest management options.

04 Procedures

04.01 **Assessment**

a. An assessment is conducted to confirm whether pest(s) are present and whether they are causing or can cause damage to the building or pose a risk to its occupants/users. This assessment may demonstrate that very limited or no pest management activity is required and that population control is unnecessary. If no pest management activity is needed, the assessment results should be recorded and provided to the Manager, Facilities Maintenance, and no further action is required.

b. Prior to any pest management activities, the Service Provider will provide an assessment of the City property.

c. The Service Provider must inspect areas potentially subject to pest management. The inspection may include visual inspection, motion-activated cameras, or other methods to collect evidence of a pest infestation.

d. The Service Provider must record all details and prepare an assessment report on the likely presence of pest(s) inside or within a reasonable distance of the building/structure. The report must identify pest(s) to species level, discuss the evidence gathered, adaptive behavioural traits of the pest(s) influencing this specific occurrence, and any other relevant information. Details on pest ingress into the building/structure (including locations, pictures, and descriptions) should also be included.

e. If pest(s) are confirmed, the next step is to determine whether a pest infestation exists. Using the assessment data, the Service Provider will determine the approximate numbers and species of pest(s) present, pest-specific or potential damage to the building/structure, and human health risks or other risk-related information.

04.02 **Mitigation Planning and Implementation**

Based on the assessment, the Service Provider formulates a mitigation plan in keeping with the level of risk present. Mitigation planning and implementation have three components: (1) Access Prevention; (2) Attractant Management; and (3) Population Control.

04.03 **Access Prevention**: to reduce entry points into buildings and structures.

a. The Service Provider should recommend modifications, where practical, to each pest entry point into the building/structure. This should be done for each pest targeted for pest management activity in the risk assessment.

b. The Manager, Facilities Maintenance must be consulted before changes to the building/structure are made. In particular, building envelope perforations (nails, screws, etc.) must be pre-approved.

c. The Service Provider should also recommend modifications to remove safe harbourage inside or in proximity to the building/structure, including selective vegetation management adjacent to buildings.

d. The Service Provider and Manager, Facilities Maintenance must ensure that any building/structure modifications do not interfere with the harbourage, nest or roost sites for important and protected non-targeted wildlife, including protected bat roosts and bird nests.

04.04 **Attractant Management**: to deny food and water to pests in an area where they are unwanted.

a. In consultation with the Manager, Facilities Maintenance, the Service Provider should prepare an education program to inform leaseholders and occupants on attractant management and specifically recommend changes or modifications to avoid attracting pests and providing harbourage.

b. The Service Provider should identify specific situations that require disinfection cleaning to remove accumulated deposits of attractant materials or health risks (e.g., steam cleaning, etc.).

04.05 **Population Control**: to reduce pest numbers or control a pest infestation.

a. Population control must be overseen by the Service Provider involved in the previous steps or another Service Provider who has reviewed the last pest management activity. Population control is the final step in mitigation planning and implementation.

b. Trapping as population control can be done using either a Live Capture Trap or other device designed to lethally and humanely kill a pest, with minimal impact on non-target wildlife. A trapping program must be designed and supervised by the Service Provider and be appropriate for specific pest and site conditions. The trapping program should meet the following requirements:

- Snap Traps, Captive Bolt Traps and/or Electronic Kill Traps, or Live Capture Traps can be deployed by the Manager, Facilities Maintenance, or property manager under the oversight of a Service Provider.

- Glue Boards or sticky boards are prohibited, as these have been linked to animal welfare concerns and are not approved for use.

- Rodent bait traps using Regulated Substances, including first or second-generation Anticoagulant Rodenticides (FGARs and SGARs), are prohibited.

- The Service Provider is responsible for ensuring that risk to non-targeted wildlife by any proposed trapping is reduced or eliminated when placing or using traps. Traps should only be accessible to pest(s) that are targeted by pest management activity.

- Trap locations must be recorded on a site plan and include an accompanying monitoring plan appropriate to trap type.

- Traps must be marked with the name and telephone number of the Service Provider and not set in open or publicly accessible areas where the public, non-target wildlife, or pets can easily access them.

- Traps can contain a non-toxic bait attractant.

- The Service Provider must provide a dispatch report for each monitoring visit where trapped pests or non-target wildlife are captured. The report will document the release or disposal of trapped animals.

04.06 **Monitoring and Adaptive Management**

At sites where Attractant Management or Population Control measures are implemented for pest management, the Service Provider must continue to monitor the site to ensure long-term success. A monitoring plan should be prepared for these sites with details on the type of monitoring activity scheduled and the frequency of application for any pest management activity. Access prevention also needs to be monitored and maintained to ensure that pests do not regain access to the building/structure. Monitoring should be documented and provided to the Manager, Facilities Maintenance.

04.07 **Reporting and Compliance**

No further reporting is required if a completed assessment (Step 1) did not identify a pest infestation or recommend any form of mitigation or population control.

After completion of the first cycle of pest management activity (Step 2) followed by a phase of monitoring and adaptive management (Step 3), the Service Provider must document all work. All assessment and monitoring reports must be kept in a format that can be digitally transferred to the City upon request and retained by the Manager, Facilities Maintenance.

05 Application

05.01 Pest management services on City-owned property must be supervised by approved pest management Service Providers in accordance with this Corporate Policy.

05.02 Pest management Service Providers must follow the Policy Statement outlined in Section 01 which is based on the precautionary principle of avoiding the use of toxic chemicals and reducing and/or eliminating the impacts of toxic substances on target and non-target wildlife.

05.03 Private property owners, residents, and businesses shall be educated on the harmful side effects of Anticoagulant Rodenticide use and encourage to follow the Policy Statement outlined in Section 01 and alternative pest management options.

05.04 Monitoring and administration of this Policy is delegated to the Director, Community Services.

Please refer to all associated Procedures and Standard Operating Procedures, if applicable, for detailed processes regarding this Policy.

Communications Plan
Rodenticides Educational Campaign

Project Team

Laura Gibbs – Director, Community Services
Lindsey Narraway – Supervisor, Animal Services
Nicole Hann – Coordinator, Public Affairs & Corporate Communications
Elaine Knox – Community Safety & Well-Being Advisor

Author and Last Updated

N. Hann – November 3, 2023

Background

The City of Pickering received a delegation at the May 23, 2023 Council Meeting on Rodenticides (a group of regulated chemicals generally referred to as 'rat poisons'). At the Regular Council Meeting on June 26th, through Resolution #238/23, Council directed staff to, in part, develop a communications strategy for educating residents and business on the harmful impacts of rodenticides and the availability of humane, ecologically sustainable alternatives.

As a result of learning more about rodenticides, the City will be launching an educational campaign to inform residents on the negative impacts rodenticides have, and about alternative, humane methods citizens can use for rodent control.

Additionally, the City will place a focus on pet safety – as the use of rodenticides can be of risk to all animals.

The City will be utilizing various communications channels to educate residents:

Introduction to Rodenticides & Available Resources (Social Media Posts) – December 2023

National Poison Prevention Week – March 17 to 23, 2024
Responsible Pet Ownership Month – All of May

Objectives

- To inform residents, businesses and other stakeholders on the harmful effects of rodenticides and of the safe alternatives that can be used for rodent control.

- To provide the public with the appropriate resources they need to learn more about rodenticides and humane control options (Ontario Poison Centre, Canadian Association of Humane Trapping, Rodenticide Free Ontario, and Coyote Watch Canada)

City Spokespersons

Lindsey Narraway, Supervisor, Animal Services

Engagement Period

Introduction via Social – December 2023
National Poison Prevention Week – March 17 to 23, 2024 (& annually thereafter)
Responsible Pet Ownership Month – All of May (annually)

Target Audience and Stakeholders

- Residents
- Businesses
- Community Groups

PESO Model

The PESO communications model stands for “paid,” “earned,” “shared” and “owned” media, and it represents a modern way for companies to integrate communications efforts while reaching audiences in an efficient, effective manner. The PESO model integrates:

Paid media: including advertorial content, sponsored content, social media advertising and exclusive, membership-based publishing opportunities.

Earned media: including free placements from media relations campaigns, such as press releases, bylined articles, “newsjacked” placements, investor relations, blogger relations/link building and word of mouth.

Shared media: including organic social media built on curated content, reviews, forums and other online communities.

Owned media: the content your business owns. It’s created specifically for your brand that is published to your website or other owned channels, including videos and other visual content.

Note: the typical thought process starts with Owned>Earned>Shared>Paid.

Channels/Tactics	Due Date
Owned Media	
pickering.ca home page promoting survey	National Poison Prevention Week banner – **March 17, 2024** Rodenticides/Pet Safety banner/Responsible Pet Ownership Month – **May 1, 2024**
pickering.ca dedicated web page on rodenticides (including resources/links to appropriate organizations)	TBD – in advance of – **March 17, 2024**
Digital Community Billboard Signs	National Poison Prevention Week banner – **March 17, 2024** Rodenticides/Pet Safety banner/Responsible Pet Ownership Month – **May 1, 2024**
eNewsletters/Email Groups: - Your City Corporate Newsletter - Business Newsletter and Networks (including APBOT) - Pickering 101 - Corporate Advisory Committees - ActiveNet Distribution List - All Advisory & Taskforce Members via Staff Liaison	
Posters (8.5 x 11) in City facilities	– **March 17, 2024** (leave on display through to summer)
Local Business Community	– **March 17, 2024**
Petapoloooza Event	– **March 11, 2024**
In-Person and/or Virtual Seminar	TBD
Earned Media (Media Relations)	
News Release	Issue release for both key dates – which will include information on rodenticides. National Poison Prevention Week – **March 17, 2024** Rodenticides/ Responsible Pet Ownership Month – **May 1, 2024**
Shared Media (Social Media)	
Corporate Channels	**December 2023** until end of **May 2023**
Pickering Neighbourhood Facebook Groups	
Other City Social Handles - Adult 55+ - Pickering Great Events - Etc.	

Legislative Services Division
Clerk's Office

Directive Memorandum

June 30, 2023

To: Paul Bigioni
Director, Corporate Services & City Solicitor

From: Susan Cassel
City Clerk

Subject: Direction as per Minutes of the Meeting of City Council held on June 26, 2023

Animal Poisoning Prevention

Council Decision — Resolution #238/23

WHEREAS, Council acknowledges that rodenticide products are unreasonably dangerous, inhumane, and ineffective;

And Whereas, rodenticides are highly toxic, persistent and compounds of bioaccumulation used to eliminate rodent populations by causing death by preventing normal blood clotting, causing internal hemorrhaging, or disturbing nervous system functions;

And Whereas, rodenticides pose serious threats to Ontario's wildlife (including raptors, songbirds, coyotes, snakes, and raccoons) and the environment (including aquatic ecosystems) through primary and secondary poisoning of non-target species, and further threaten children and pets;

And Whereas, predators and scavengers are at a particularly high risk of secondary poisoning because of their dependence on rodents as a food source, with countless cases of poisoning across Ontario in the past decade;

And Whereas, rodenticides are an ineffective and counterproductive means of controlling long-term rodent populations because they fail to address the root of infestation problems (i.e., access to food, shelter and other attractants), and kill predators that serve as natural and chemical-free methods of pest control (i.e., a single owl eats around 1,000 rats per year);

And Whereas, the existing risk mitigation measures implemented by the federal and provincial government are incapable of adequately addressing the threats that rodenticides pose to the environment, wildlife, and human health;

And Whereas, preventative measures are the best method of vector control;

And Whereas, eliminating non-essential use of rodenticides is consistent with the precautionary principle;

And Whereas, Council wishes to enact a policy prohibiting the use of inhumane vector control products to address public concern for the environmental wellbeing of the Corporation, and the health, safety and well-being of its inhabitants;

And Whereas, Council deems it desirable and in the public interest to enact an Animal Poison Prevention Policy for protecting wildlife, pets, and people from unreasonable adverse effects caused by rodenticide use for the purpose of:

- Eliminating inhumane methods of pest control;
- Regulating and controlling the use, purchase, and sale of rodenticides;
- Sustaining a healthy natural environment by protecting biodiversity;
- Protecting significant and sensitive natural areas;
- Protecting human health;
- Maintaining water quality; and,
- Protecting fish habitat as defined in the *Fisheries Act*, Revised Statute of Canada 1985.

Now therefore be it resolved, that the Council of The Corporation of the City of Pickering directs staff through the Office of the CAO:

1. To prepare a draft Policy banning the use of rodenticides on all City of Pickering properties;

2. To include a communications strategy for educating residents and business on the harmful impacts of rodenticides and the availability of humane, ecologically sustainable alternatives;

3. To implement humane practices in regards to pest control on all City of Pickering properties;

4. To have staff report back to Council no later than Q4; and,

5. That Council requests that the Mayor write, on behalf of Council, to the provincial Ministry of the Environment, Conservation and Parks (MECP) requesting that the Province of Ontario introduce a Province wide ban on the use of rodenticides, to increase protection for wildlife species.

Please take any action deemed necessary.

Susan Cassel

Copy: Chief Administrative Officer

Staff Report

If this information is required in an alternate accessible format, please contact the Accessibility Coordinator at 905-623-3379 ext. 2131.

Report To:	**General Government Committee**		
Date of Meeting:	June 3, 2024	**Report Number:**	PUB-010-24
Authored by:	George Acorn, Director Community Services		
Submitted By:	Lee-Ann Reck, Deputy CAO, Public Services		
Reviewed By:	Mary-Anne Dempster, CAO		
Resolution Number:		**By-law Number:**	
File Number:			
Report Subject:	Rodenticide Use in Municipal Facilities - Update		

Recommendations:

1. That Report PUB-010-24, and any related delegations or communication items, be received;
2. That Council endorse the expansion of the rodenticide-free program to all municipally operated recreation facilities, effective July 1, 2024;
3. That the 2025 budget include the $3,600 increased pest control costs to maintain this expanded program;
4. Staff will work collaboratively with other departments and stakeholders to expand the rodenticide free program;
5. That Staff develop an administrative pest management directive with the objective to reduce the use of anti-coagulant rodenticides on all municipal properties; and
6. That all interested parties listed in Report PUB-010-24, and any delegations be advised of Council's decision.

Report Overview

This report provides an update on the rodenticide-free trial involving the removal of all rodenticide traps at Courtice Community Complex (CCC). As a substitute method for pest control, tin catch traps have been implemented. According to the bi-weekly assessments conducted by our pest control service provider, no signs of rodent presence have been detected within the premises.

Given the successful outcomes of this trial phase, staff suggest broadening the scope of the program to encompass the rest of the municipally operated recreation facilities, starting from July 1, 2024. This expansion would incorporate the Alan Strike Aquatic and Squash Centre, Garnet B. Rickard Recreation Complex, South Courtice Arena, Bowmanville Indoor Soccer/Lacrosse Bowl, Darlington Sports Centre, and Diane Hamre Recreation Complex.

Staff also propose the creation of a pest control management directive. This administrative document would establish protocols for efficient pest control management, aiming for a responsible and effective extension of the rodenticide-free initiative to all municipally owned buildings and properties.

1. Background

1.1 At the December 18, 2023, Council Meeting report CSD-003-23 was approved authorizing staff to initiate a rodenticide free trial at Courtice Community Complex and to report back on the results prior to summer recess.

1.2 Staff were also to continue investigating the feasibility of a future total ban on rodenticide use for municipal properties and to communicate with other municipalities regarding any actions to date or future plans regarding the use of rodenticides.

2. Trial Program at Courtice Community Complex

2.1 The trial program at CCC commenced January 2, 2024. Municipal staff undertook visual inspections of the exterior of the building to identify potential points of entry. Staff made improvements to exterior envelope to mitigate rodent entry to the building.

2.2 With no exterior rodenticide bait traps in use, staff directed our pest control contractor to remove all interior rodenticide traps from the building. These were replaced with tin catch traps. Since the trial began, the contractor has conducted bi-weekly inspections of the property. To date, no visible rodent activity has been documented.

3. Rodenticide Free Program Expansion

3.1 Based on the results of the trial program at CCC, staff are recommending the expansion of the rodenticide free program to include all remaining municipally operated recreation facilities. Effective July 1, 2024, staff will direct the contractor to remove all interior rodenticide bait traps at the six remaining recreation facilities. They will be replaced with catch tin traps. There are currently no exterior rodenticide bait traps in place at these facilities.

3.2 Data will continue to be collected and will help inform future expansion to remaining municipally owned properties. The goal of this program is to eliminate anti-coagulant rodenticide use responsibly and effectively at all municipal properties with the aim of minimizing potential adverse impacts and public health risks.

3.3 In other municipalities where rodenticide bans are in place, controlled use of anti-coagulant rodenticides or other regulated substances is permitted only under the direction of senior staff as a last resort. This approach is included in pest management policies, and similar guidance will be incorporated into our pest management directive.

4. Rodenticide Use in Other Municipalities

4.1 Following Council direction, Community Services staff have continued to communicate with previously identified communities on their experience and current practices.

4.2 In December 2023, the City of Pickering adopted a pest management policy that bans all non-essential rodenticide use on municipal properties. However, the policy allows for the authorized use of anti-coagulant rodenticides or other regulated substances for rodent pest management, only when expressly authorized as a last resort option by the Director of Community Services. To date, the staff at the City of Pickering have not identified any issues related to this approach.

4.3 Staff have recently been advised that the City of Toronto continues to investigate this matter and have indicated work on this topic is planned to begin by end of 2024 and continue into 2025.

4.4 Based on discussions with staff at the Township of Minden Hills it has been confirmed that there has been no initiation of a ban on rodenticides.

4.5 Apart from the City of Pickering, staff are not aware of any initiatives being undertaken on the ban of rodenticide use in the remaining lakeshore municipalities.

5. Financial Considerations

5.1 The additional cost to expand the rodenticide free program at the remaining municipally operated recreation facilities for the remainder of 2024 is approximately $1,800. These costs will be incorporated into the approved 2024 operating budget and no tax levy impact is expected. The annualized cost of approximately $3,600 for this expansion will be included in the 2025 Budget Update as a service level change.

5.2 The cost to further expand the program to other municipal buildings will also be included in the 2025 Budget update to recognize the additional resources that will be required to meet the new service delivery method. These costs are currently being determined.

6. Strategic Plan

6.1 Not applicable.

7. Concurrence

7.1 This report has been reviewed by the Deputy CAO/Treasurer, Finance and Technology who concurs with the recommendations.

8. Conclusion

8.1 It is respectfully recommended that Council approve this report and instruct staff to finalize the expansion of the rodenticide-free program at municipally operated recreation facilities, and to formulate an administrative pest management directive. The primary goal of this directive will be to broaden the scope of the rodenticide-free program to include all buildings and properties owned by the municipality.

Staff Contact: Rob Farquharson, Supervisor, Aquatic Operations 905-623-3379 ext. 2541 or rfarquharson@clarington.net.

Attachments:

Not Applicable

Interested Parties:

Allison Hansen

Janice Freund

Report: Rodent Pest Management by the City of London
Prepared in May, 2024 by members of AWCAC and ESACAC

Executive Summary
The Animal Welfare Community Advisory Committee has raised concerns about the use of rodenticides within the City of London in light of secondary risks posed to wildlife, pets, children and the environment. Background information about this issue is available from this 2021 science review. There is a lack of data to indicate whether the City's existing approach to managing rodent pests in its buildings is resulting in effective control. Alternative strategies are discussed, including development of public education and adjustments to the City's contract.

Recommendation
AWCAC pass a motion in the spirit of the following:

1. AWCAC requests that the Senior Manager of Facilities return to AWCAC prior to the City renewing its contract for pest control service in 2025 to review the scope of the contract and discuss alternative strategies to use of poison at municipal facilities.
2. AWCAC will strike a working group to prepare recommendations for print and online communications to support public education about best practices to prevent rodent infestations and apply rodent exclusion methods at residential buildings.
3. AWCAC request that Civic Administration forward this report to the Community and Protective Services for consideration.

How are rodent pests managed at municipal facilities?
The City of London has a contract for pest management at municipal facilities that gets renewed every two years. This contract is arranged by staff in the Procurement and Supply office, subject to the Procurement of Goods and Services Policy. A competitive bid is advertised and bid upon. This information is not reported to Council as it is considered low-dollar and operational. The current contract is held by a group called Metro King Pest Control, a Canadian company with operations in London, Toronto, Windsor and elsewhere.

The terms of the contract are given in a quote report that was presented by staff (Val Morgado, Senior Manager, Facilities) to AWCAC on April 4, 2024. There are two types of pest control services rendered, with Type 1 being the relevant to the discussion about rodenticides. In the staff report, section 3.4 Successful Bidder Responsibilities includes:

n) The Contractor shall inspect and refill bait, insect and rodent bait stations (units) monthly.
o) The City may request the Contractor to remove and dispose of dead animals at the Facilities.

Type 1 services provide high level rodent control using interior and exterior rodenticide bait traps. The primary purpose is to control pest issues. Currently rodenticide bait stations are used at 27 different locations operated by the City of London. These locations tend to be operations yards (e.g. EROC where sanitation trucks go, City Hall, community centers; locations are specified in the staff report).

The City's approach to dealing with rodents is reactive. The contractor will only ever use poison to respond to rodents. However, they do not apply exclusion methods to prevent rodents from entering buildings. Live traps are occasionally used for larger animal relocations.

Environmental impact
Under the Kunming-Montreal Global Biodiversity Framework, Canada is obligated to reduce by half the overall risk posed by pesticides and highly hazardous chemicals by 2030 (Target 7). The rodenticide compound used in the bait stations is *Bromadiolone* (sold under the name *Contrac* by Bell Laboratories). Product information is available here. Bromadiolone is one of the compounds researchers have detected in most birds of prey tested in Ontario, indicating it poses a risk of bioaccumulation (source). Use of Bromadiolone is restricted in British Columbia and California. Wildlife and domestic animals in London are susceptible to secondary rodenticide poisoning, with many documented cases involving predators such as eagles, owls and pet dogs and cats. The extent of harm caused by rodenticides is expected to be underreported in London; animals typically exhibit symptoms only in the final stages of lethal poisoning.

Existing pest management is not evidence-based
Inspections at each municipal facility are performed once a month by the service contractor, to detect if there is an infestation of rodents and to maintain bait boxes. If signs of an infestation are found, additional poison may be applied. The City does not collect any data on the effectiveness of their existing contract for pest control service. The contractor will keep a log of how the bait stations are maintained but there aren't formal metrics or key performance indicators. **AWCAC is concerned that applications of poison to kill rodents will lead to more rodents taking their place, resulting in a positive feedback loop that does not resolve the root causes of infestations, while perpetuating significant and unnecessary environmental contamination.**

A proactive approach: pest-proofing buildings
Outside of the pest control service contract, as part of building maintenance the Facilities team does regular building audits and inspections, which include checking exterior and interior areas for damage or openings that could be problematic. If issues are found, the City will usually try to fix these in-house before going to a pest control company. However, inspections are not necessarily checking for rodent points of entry, which tend to follow predictable patterns at most buildings.

In the London Plan City Building Policies, section 400 (page 38) describes building maintenance, including: *6. An Integrated Pest Management Plan may be required and implemented to manage pests in accordance with all applicable federal, provincial, and municipal laws.* In general, the pest control service contract deals with Integrated Pest Management. A building manager and facilities staff will look after particular types of buildings. Some buildings have unique challenges associated with their uses, structure, location, etc. However, there is no city-wide Integrated Pest Management plan, and no documentation of pest control measures for individual buildings. Pest control is dealt with separately by individual service areas of the City.

The Pickering Model
In December 2023 the City of Pickering became the first municipality in Ontario to implement a policy on rodenticide use. This policy restricts the use of rodenticide on municipal land and in municipal facilities. Pickering also provides public information about pest management on its website (referring to information from Durham Region emphasizing alternative strategies to poison). The Facility manager in Pickering is Kevin Haynes who has been engaged by City of London staff regarding this policy and lessons learned. Staff in other municipalities such as Clarington and Toronto are currently reviewing the Pickering model.

Next Steps

At the April 4, 2024 AWACAC meeting, the Facility Manager indicated they would be open to receive community feedback for when the next contract cycle is up (est. March 2025). In particular they expressed interest in pursuing preventative strategies that will ultimately be more effective than reacting with poison (noting that poison killing rodents will simply lead to more rodents replacing them, if the underlying causes of infestation are not addressed).

Given ongoing challenges with rodent pest control at certain facilities in London, AWCAC has identified a need for public information about how to prevent rodent infestations (e.g., storing food and waste, sealing points of entry). The City does not currently offer any printed pamphlets or information on its website about preventing pests.

AWCAC is proposing to create dedicated stickers for high-risk areas for rodent activity (e.g., cafeterias, waste collection points) to be distributed to the public, similar to the following existing stickers. Messaging should focus on cleaning up / storing food correctly to limit pests and referring people to the City's website for more information about dealing with rodent issues.

AWCAC will also create public information content for an information pamphlet and new City webpage about pests, and proactive management strategies. The webpage could adapt content produced from the London Environmental Network / Bird Friendly London Responsible Pest Management program or adapt resources from British Columbia, City of Pickering, City of Waterloo, etc.

In 2025, AWCAC will review the City's next contract for pest management at municipal facilities, and may propose adoption of a Council policy similar to the City of Pickering to reduce or eliminate use of rodenticides as deemed appropriate. In tandem with a new policy, AWCAC could help the City to develop an Integrated Pest Management Plan for its facilities to provide detailed information about preferred proactive strategies, such as implementing infestation reporting tools, inspecting buildings for points of entry and applying exclusion methods.

Agricultural Advisory Committee of Clarington
40 Temperance Street,
Bowmanville, ON L1C 3A6

July 30, 2024

To the Agricultural Advisory Committee of Clarington;

It has come to our attention that on December 14, 2023, the Agricultural Advisory Committee of Clarington was presented with information by Mike Dunn of the Structural Pest Management Association of Ontario concerning rodenticide usage, legislation, and the importance of pest management. Upon review of the meeting minutes outlining the substance of Mr. Dunn's presentation, we are gravely concerned about the extent of misinformation that has been provided to the Committee.

In light of the Committee's mandate[1] to "identify, review, discuss and make recommendations to Council on agricultural and agricultural-related issues," and among other activities, "provide advice, comments and recommendations on alternative solutions, approaches, plans or studies… within the responsibilities and financial capabilities of the Municipality of Clarington," we[2] write to call your attention to hazards associated with rodenticide use in an agricultural setting, the legal and regulatory framework governing these products, and the availability of safer, more economically sustainable solutions.

Please consider the following responses to Mike Dunn's statements as transcribed in Council's December 14, 2023 Draft Meeting Minutes approved January 11, 2024.

[1] Terms of Reference for the Agricultural Advisory Committee of Clarington (2001). https://www.clarington.net/en/town-hall/resources/Advisory-Committees/AACC-Terms-of-Reference-AODA.pdf

[2] Rodenticide Free Ontario (RFO) is a citizen-led initiative dedicated to defending wildlife, pets, and the environment from the risks posed by rodenticides and advancing preventative pest management policies. RFO is supported by Defend Them All.

In particular, we are concerned with the mischaracterization of (I) ecological risks and consequences of rodenticides; (II) law and policy governing these products; and (III) the availability of better alternatives.

I. ECOLOGICAL RISKS AND CONSEQUENCES

"M. Dunn presented about rodenticide usage, regulation, and the importance of managing pests. He described his organization and its role in promoting the benefits and risks of all forms of pest management. He noted that managing pests is important to reduce the health and economic impacts they pose to humans. He reviewed specific health risks associated with rodent infestations, including diseases which can result in serious illness or death. Economic effects including property damage, business closures, and food contamination were also reviewed."

At the outset, and in case it was not disclosed, it is important to note that Mike Dunn is a pesticide industry actor employed by Orkin, one of the largest pest management companies in Canada. As such, Mike Dunn has a fundamental conflict of interest, as his incentives to promote and sell rodenticide products are likely substantial.[3]

We agree that effective rodent management is crucial, particularly in agricultural settings where safeguarding the health and well-being of livestock and humans is paramount. Rodents can carry and transmit pathogens including zoonotic diseases to livestock and subsequent human consumers, and can contaminate grain, feed, and other food sources, posing significant threats to public health and agricultural sustainability. Their presence can disrupt feeding and resting behaviors, leading to decreased productivity and welfare, resulting in higher veterinary costs and reduced profits.[4]

But rodenticides are not an effective or sustainable solution; in fact, they exacerbate the problem over time and increase contamination risks.

Rodenticides are highly toxic, environmentally persistent, bioaccumulative, and well known to adversely affect a broad range of non-target animals from birds of prey to bears, bats, and even invertebrates.

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[3] According to Glassdoor, average base salary for a Branch Manager at Orkin is $80K/year plus additional pay (average $30k/year) which may include cash bonus, stock, commission, profit sharing or tips.

[4] Schulze Walgern, A., Hecker, O., Walther, B., Boelhauve, M., & Mergenthaler, M. (2023). Farmers' Attitudes in Connection with the Potential for Rodent Prevention in Livestock Farming in a Municipality in North Rhine-Westphalia, Germany. *Animals : an open access journal from MDPI*, *13*(24), 3809. <https://doi.org/10.3390/ani13243809>

Clearing a resident rodent population simply makes space for new groups to move in, creating a perpetual cycle with ever increasing costs to growers, producers, and the environment as rodent populations that have developed resistance can consume even greater amounts of bait with reduced adverse effects posing even greater risks to secondary consumers.

Moreover, poisoned rodents that are left to die within structures or disperse into the surrounding environment become more susceptible to disease.[5] Further exacerbating health risks for both livestock and humans, as the presence of poisoned rodents may increase the transmission of pathogens and contaminants in the food supply and throughout the ecosystem.

Livestock animals exposed to rodenticides pose significant human health risks.

In a recent (2022) publication examining potential risks of rodenticides in animals intended for human consumption, the Food Animal Residue Avoidance and Depletion Program (FARAD)[6] warns that "there is potential for substantial and severe adverse health risks to humans or animals consuming products from food animals exposed to rodenticides, especially in those individuals already on long-term anticoagulant therapy."[7] In light of these risks, FARAD recommends that meat, milk, and eggs of animals exposed to commonly used rodenticides do not enter the food chain. Furthermore, carcasses of animals exposed to these products should be disposed of to prevent ingestion by other animals such as pets or predators.

While primary and secondary exposure to rodenticides in livestock is understudied, it is not an uncommon occurrence. In fact, numerous studies have documented residues of widely used products at significant levels in swine, sheep, cattle, and poultry weeks to months after exposure, raising serious food safety concerns for humans (Mercer et al., 2022). For example, in chickens, liver residues remained constant for 14 days following a single oral dose of brodifacoum (0.5 mg/kg)(pg. 6). Perhaps even more concerning, toxins found in eggs laid by the same hens increased throughout the sampling period with peak brodifacoum concentrations 14 days after dosing (0.035 µg/g) thus requiring "extremely prolonged discard times" to ensure depletion of the toxicant (id at 6).

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[5] Murray, M. H., & Sánchez, C. A. (2021). Urban rat exposure to anticoagulant rodenticides and zoonotic infection risk. Biology Letters, 17(8), 20210311. <https://doi.org/10.1098/rsbl.2021.0311>

[6] "*Farad is a USDA-funded university-based consortium that is overseen and operated by faculty and staff within Kansas State University Olathe, the School of Veterinary Medicine at the University of California-Davis, and the Colleges of Veterinary Medicine at the University of Florida, North Carolina State University, and Virginia-Maryland*." Food Animal Residue Avoidance Databank (FARAD) (2023). <http://www.farad.org/about-farad.html>

[7] Mercer, M. A., Davis, J. L., Riviere, J. E., Baynes, R. E., Tell, L. A., Jaberi-Douraki, M., Maunsell, F. P., & Lin, Z. (2022). Mechanisms of toxicity and residue considerations of rodenticide exposure in food Animals—a FARAD perspective. Journal of the American Veterinary Medical Association, 260(5), 514-523. <https://doi.org/10.2460/javma.21.08.0364>

In a similar study involving swine exposed to bromadiolone, the mean liver concentration was 213 µg/kg after 9 weeks (pg. 6). Likewise, the hepatic elimination half-life (length of time for liver concentrations to decrease by 50% after initial exposure) for orally administered diphacinone (1.5 mg/kg) was 25.2 days for heifers and 35.4 days for steers, with a maximum reported elimination half-life of 49.5 days (pg. 4).

These risks are unacceptable and unnecessary, and should be of great concern to growers, producers, and the public.

"[M. Dunn] noted that there is currently pushback on rodenticides as trace amounts have been found in predators of rodents. He suggests more evidence is needed to confirm rodenticides were a significant cause of death."

Decades of research has documented sub-lethal effects[8] of rodenticide exposure in wildlife, including lethargy, shortness of breath, anorexia,[9] bloody diarrhea, changes in behavior, tenderness of the joints and mange,[10] demonstrating that, even at sub-lethal levels, rodenticide products are known to reduce the biological fitness of wildlife (See California Department of Pesticide Regulation, pg. 31). Rodenticides also interfere with reproduction, reduce hunting success, and are associated with an increased likelihood of trauma. For example, even if owls are not directly killed by internal hemorrhaging, those that have ingested rodenticides are more likely to hunt unsuccessfully, become ill, or collide with vehicles or windows.

Many of Ontario's native and at-risk species face high risks of rodenticide poisoning. In addition to mice, small animals including songbirds, shrews, voles, and other non-target mammals and invertebrates are known to access bait boxes containing these poisons. This direct feeding is contaminating the food-chain and wider ecosystem: coyotes, bobcats, foxes, skunks and other mammalian predators that feed on small animals have been found to have rodenticides in their systems. Owls and other raptors are at a particularly high risk of secondary poisoning because of their dependence on rodents as a food source.

What's more, our analysis of necropsies for birds of prey in British Columbia raised serious concerns regarding the application of criteria used to diagnose avian species. Even if the presence of rodenticide(s) is confirmed, trauma, hemorrhage, emaciation, or a combination thereof are often listed in the report with no mention of toxicants. Additionally, many birds that exhibit classic signs and

[8] Salim, Hasber, et al. "Secondary poisoning of captive barn owls, Tyto alba javanica, through feeding with rats poisoned with chlorophacinone and bromadiolone." J Oil Palm Res 26.1 (2014): 62-72 [Salim, Secondary poisoning of barn owls]
[9] Cox & Smith, *supra* note 3.
[10] Serieys, Laurel E.K. et al. 2015. "Anticoagulant rodenticides in urban bobcats: exposure, risk factors and potential effects based on a 16-year study." *Ecotoxicology*, 24(4).

symptoms of rodenticide poisoning with no other identifiable cause are never tested for the presence of rodenticides. Results described in Wiens et. al., 2019 suggest that similarly problematic data collection

and analysis procedures may exist in the United States.[11] If this is the case, the effects of rodenticides on special status species across North America may be grossly underestimated.

The precautionary principle enunciated by the federal PCPA[12] provides that full scientific certainty is not required to amend or cancel the registration of a product where there are reasonable grounds to believe such action is required to deal with a threat to the environment.[13] It follows that rodenticides should cease to be registered. Further, the value of these products is negligible, given their failure to achieve their intended pest management purpose. As such, demanding further study, and in the meantime, business as usual despite widespread health and environmental damage is alarming and severely inconsistent with federal and provincial frameworks that treat protection of the environment as a primary consideration.[14]

"A Member noted that farms located near new subdivisions are often overrun with rodents, requiring them to use more rodenticides, …and noted that if more institutions choose not to use them, it will lead to higher overall populations, and further increased costs to food producers who require them. The Committee also discussed how putting in place bans on rodenticides can lead to increased regulation over time which removes valuable tools from farmers. The comparative importance of protecting the food supply for humans versus the impacts on the environment were discussed. Committee members suggested that the food supply chain is of top importance, and all levels of government should support rodenticide usage that is handled responsibly."

As burrows are often unearthed during demolition and construction, initial rodent dispersals are not uncommon, which could explain periodic increases in rodent activity near new subdivisions. Given this somewhat predictable influx, preventative measures (exclusion) and monitoring on surrounding properties must be prioritized and incorporated into development plans.

No rodenticide is safe, humane, or eco-friendly. The only sure way to mitigate risk to humans, animals, and the environment from the toxic effects of poisons is to discontinue their use. Rodents will always be a part of our ecosystems. As such, there will always be a need for pest management operators willing to

[11] Wiens, J. David et al. 2019. "Anticoagulant rodenticides in *Strix* owls indicate widespread exposure in west coast forests." *Biological Conservation*, 238.
[12] PCPA, s 20(2).
[13] PCPA, s 20(1)(b).
[14] "Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent adverse health impact or environmental degradation." See PCPA, *supra* note 21, s 20(2).

proactively fortify and monitor structures to prevent rodent intrusion and reduce the need for reactionary measures.

II. INADEQUATE LAW AND POLICY

"M. Dunn explained that pest management companies are regulated in Ontario by the Ministry of the Environment, Parks, and Conservation. The PMRA's main responsibilities include registering pest control products for manufacture, sale and use in Canada, re-evaluating pesticides currently on the market, and promoting sustainable pest management strategies. Rodenticides are regulated by the Pest Management Regulatory Agency, which regularly reviews pesticides for their efficacy and safety. The next rodenticide review is expected to be released in 2024."

It is common for pest management industry actors to cite regulatory frameworks and Health Canada's involvement in the registration and review of rodenticides in an effort to imply that these products are safe, and need not be questioned by the public. Unfortunately, this system has proven to inadequately protect Canadians and the environment from the risks of pesticide products, including rodenticides.

Federal approval of a pesticide reflects a determination of "acceptable risk," not safety. Pre-market risk assessments and regulatory decisions for new products are based on studies conducted by the registrant, not the Pest Management Regulatory Agency (PMRA), which has raised serious concerns around potential biases, transparency, and the integrity of data.[15] Moreover, cyclical (every 15 years), point-in-time re-evaluations challenge the agency's ability to keep pace with evolving scientific knowledge and emerging concerns, hindering its capacity to ensure the ongoing safety and efficacy of pesticides (including rodenticides).[16] The PMRA itself has acknowledged these shortcomings, and in doing so, initiated a targeted review of the Pest Control Products Act (PCPA) in 2022 (Discussion Document DIS2022-01).[17] This "Transformation Agenda" aims to modernize the pesticide review process, increase transparency, and enhance decision-making by incorporating real-world data and independent advice to better protect human and environmental health.[18]

Reiterating its transformation goals, Health Canada established a Science Advisory Committee on Pest Control Products to "...support evidenced-based decision-making on pesticide health and environmental risk and value assessments, as well as development of risk management options (Terms of Reference)."[19]

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[15] Standing Committee on Environment and Sustainable Development. (2000). Pesticides: Making the right choice for the protection of health and the environment (Chapter 8). <https://www.canada.ca/en/health-canada/services/consumer-product-safety/pesticides-pest-management/public/consultations/discussion-documents/targeted-review-pest-control-products-act/document.html>

[16] Pest Management Regulatory Agency. (2022). Further Strengthening Protection of Health and the Environment: Targeted Review of the Pest Control Products Act (PDF).

[17] Pest Control Products Regulations, SOR/2006-124 ["PCPR"].

[18] *Ibid*, s 2.0.

[19] Health Canada. (2023). Science Advisory Committee on Pest Control Products: Terms of Reference.

Unfortunately, any expectations of substantive reform were summarily quashed by the public resignation of Dr. Bruce P. Lanphear, MD, MPH,[20] former co-chair of the PMRA's new Scientific Advisory Committee. Citing concerns over the role that the pesticide industry plays in the regulatory process, as well as lack of transparency and scientific oversight, Dr. Lanphear called for a an "overhaul" and questioned whether Canadian Environmental Protection Act (CEPA) amendments currently underway will dictate the changes necessary to protect Canadians from toxic pesticides;

> "*...I worry that the Scientific Advisory Committee – and my role as a co chair – provides a false sense of security that the PMRA is protecting Canadians from toxic pesticides. Based on my experience over the past year, I cannot provide that assurance*."(Dr. Lanphear Resignation, pg. 1)

> "*...we can no longer continue to rely on an obsolete regulatory system that protects the pesticide industry more than it protects Canadians*." (Dr. Lanphear Resignation, pg. 3)

The PMRA's mandate is to protect the health of Canadians and the environment against unacceptable risks from the use of pesticides.[21] In furtherance of this objective, the PMRA is obligated to afford consideration and protection to future generations, and encourage the development of sustainable pest management strategies[22] in a manner consistent with the precautionary principle. It follows that if they exist, alternative methods of controlling rodent infestations that minimize risks of harm to human health and the environment must be exhausted before turning to potentially harmful chemical products. That is, toxic chemicals must be treated as a last resort, and used in a manner that minimizes hazards to the environment.

Recognizing the risks rodenticides pose to human health and the environment, in 2013 Health Canada enacted risk mitigation measures for several commercial class rodenticides. However, recent research in Ontario, and across Canada, demonstrates that these measures are ineffective and merely symbolic. Restricting the most toxic rodenticides to indoor use and requiring these products to be kept in tamper-proof bait boxes fails to consider the documented fact that rodents do not die inside these boxes, but rather disperse into the surrounding natural habitats.

In 2022, Health Canada initiated a re-evaluation of eight rodenticides (brodifacoum, bromadiolone, bromethalin, chlorophacinone, diphacinone (present in free form or as sodium salt), warfarin (present in free form or as sodium salt), Zinc phosphide, and Difethialone) as required under the PCPA. More than two years later, this "rodenticide cluster" has not progressed beyond the scoping stage of the

re-evaluation process, i.e., it is still in the early part of the re-evaluation process with a target for

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<https://www.canada.ca/en/health-canada/corporate/about-health-canada/public-engagement/external-advisory-bodies/science-advisory-committee-pest-control-products/terms-reference.html>

[20] Dr. Bruce P. Lanphear, MD, MPH is a Clinician Scientist at the BC Children's Research Institute and a Professor in the Faculty of Health Sciences at Simon Fraser University. Dr. Lanphear has numerous peer reviewed publications and is highly regarded for his research in early childhood health, environmental neurotoxins, lead poisoning, and epidemiology of asthma.

[21] PCPA *supra* note 17, s 4(1).

[22] *Ibid*, s 4(2).

consultation and final decision anticipated in Q2 (July–September) 2026-27.[23] Meanwhile, products containing these compounds are used across Canada, magnifying threats to biodiversity and the well being of Canadians.

Ontario

The Ministry of the Environment, Parks, and Conservation (MEPC) maintains the power to establish and enforce pesticide regulations related to sale, use, and education, licensing and/or permit requirements in Ontario under the Pesticides Act and Regulation 63/09.

In the early 2000's, municipalities across Ontario pioneered policies drastically restricting cosmetic pesticides in the interest of protecting health and the environment. Such leadership prompted significant provincial reform, and a legal and regulatory framework once considered model legislation for Canadian provinces seeking to further reduce pesticide use in their jurisdiction.

Sadly, this progress was rolled back in 2020 when Ontario's Ministry of the Environment, Conservation and Parks (OMECP) adopted amendments to its Pesticides Act and Regulations. In addition to expanding the number, conditions, and allowable uses of some products, these changes (1) eliminated Ontario's Pesticides Advisory Committee (OPAC) previously mandated to provide important nonpartisan scientific guidance functions related to health and environmental risk, and (2) reduced Ontario's 12-tiered classification system to align with the more simplistic federal regime prescribed by Health Canada's PMRA. As a result, pesticides (including rodenticides) are now immediately available for use upon federal registration with no further research or review at the provincial level.

Abolition of the OPAC was championed by business interests including the Structural Pest Management Association of Ontario (SPMAO) which promoted Health Canada's evaluation process as being "stringent").[24] Environmental and human health advocates warned that relying on the PMRA's review process would compromise the health of Ontario's ecosystems including human and animal health, and ultimately increase the prophylactic use of harmful chemicals.[25]

Considering the dysfunction that has emerged at the federal level, OMECP's uniquely unfortunate decision to defer to the PMRA's oversight has exposed Ontarians to unacceptable risks posed by rodenticide products, consequently obligating urgent action by the provincial and municipal governments to protect public health and the environment. Without decisive intervention, the ongoing proliferation of these toxic compounds will continue to degrade ecosystems, jeopardize biodiversity, and endanger the well-being of wildlife, companion animals, and humans. Thus, all levels of government must prioritize precautionary policies that privilege the environment over industry interests to fulfill their

[23] Health Canada. (2024). Pest Management Regulatory Agency Re-evaluation and Special Review Work Plan 2024-2029 (PDF)
[24] Public Comment submitted by SPMAO, 2019 <https://ero.ontario.ca/comment/37878>
[25] See for example Public Comments submitted in response to Amendments to the Pesticide Regulation (63/09 General), December 12, 2019, by Ontario Council of the Canadian Federation of University Women (CFUW Ontario Council)(PDF), Canadian Partnership for Children's Health and Environment (CPCHE)(PDF).

duty, as the law requires, of protecting Ontarians from the documented dangers of rodenticides. Such reform is vital if Canada is to honor its commitments on biodiversity conservation and global climate action under the Kunming-Montreal Global Biodiversity Framework (KMGBF)(COP15) and the United Nations Climate Change Conference (CCC)(COP-28).

III. ALTERNATIVE RODENT MANAGEMENT METHODS

"M. Dunn described the role of rodenticides, which is mainly as a first line of defense to reduce the amount of rodents that may attempt to enter a building. He noted that structural improvements are the most important measures to prevent a rodent infestation, but that there will always be vulnerabilities to structural measures, resulting in the need for rodenticides. "

Asserting that rodenticides should serve as a first line of defense demonstrates a reckless disregard for wildlife, environmental health, and food safety. The notion that there will always be vulnerabilities to structural measures, *necessitating* the use of rodenticides reflects an outdated understanding of science, Canadian law and policy, and ethical values held by most Ontarians.

An integrated Pest Management (IPM) program that emphasizes a proactive approach to managing rodents is well known to be the most effective and economical solution.[26] While definitions of the term vary and continue to evolve as new science and management techniques emerge, IPM refers to a strategic approach that aims to reduce risks to humans and the environment by only using pesticides (including rodenticides) as a temporary, last resort.[27] More specifically, IPM advocates for exclusion, prevention, attractant reduction, habitat modification, non-chemical control methods such as snap-traps, and biological controls whenever possible. Of course, it is in the economic interest of pest control companies that use poisons to ignore these steps, as permitting such conditions to persist invites new populations of rodents to invade, thus giving rise to continued business.

Rodenticides do not address the root of a rodent infestation problem, rather, relying solely on methods of killing facilitates the rebound of populations.[28] By eliminating a resident colony, rodenticides only temporarily clear the way for a new population to move in.[29] Rodents are drawn to areas where they

[26] Government of British Columbia. (n.d.). Integrated Pest Management for Rodents: Agricultural Operations [PDF]. <https://www2.gov.bc.ca/assets/gov/environment/pestnutrients-management/integrated-pestmanagement/rovipm_final_june_2022.pdf>

[27] Ehi-Eromosele, C. O., Nwinyi, O. C., & Ajani, O. O. (2013). Integrated Pest Management. In book: *Weed and Pest Control - Conventional and New Challenge*s. DOI: 10.5772/54476

[28] Andrews, Richard V., "Should We Kill The Rats Or Is Biological Control Preferable?" (1977). Transactions of the Nebraska Academy of Sciences and Affiliated Societies, 448.

[29] Pest Control Products Act, SC 2002, c 28, s. 2(1) definition of "value" [PCPA]; Canada, Health Canada, Information Note: The New Pest Control Products Act (Ottawa: Health Canada, 28 June 2006), online: <canada.ca/en/health-canada/services/consumer-product-safety/reports-publications/pesticides-pest-management/fact-sheets-other-resources/new-pest-control-products-act.html>

have access to food and shelter, and baits–flavoured and coloured to attract–are recognized as a food source to revisit. For these reasons, structural rodent problems will be never-ending until access points to these resources are sealed or eliminated.[30]

Raptors and other predators that feed primarily on rodents serve as a natural and chemical-free method of pest control. For example, a nesting barn owl pair and their chicks will consume an average of 1,000 rodents per year.[31] By poisoning rodent predators, rodenticides are reducing the effectiveness of alternative means of controlling rodent populations, thereby unsustainably increasing reliance on poisons.

Further compounding sustainability concerns, it is important to understand that "second generation" anticoagulant rodenticides (SGARs) were introduced to replace "first-generation" anticoagulant rodenticides, as populations had developed a resistance to the latter.[32] However, signs of resistance to SGARs are emerging in Europe,[33] suggesting that increasing the toxicity of rodenticides is a dangerous and unsustainable solution. Consistent with these findings, a majority of surveyed pest control professionals agree that while poisoning is the easiest and cheapest method of controlling rodents, this strategy fails to provide a long-term solution because it fails to deal with the factors promoting and sustaining an unwelcome colony.

The federal Pest Control Products Act (PCPA) and Ontario's Pesticides Act and Regulations require a proactive and preventative approach that minimizes hazards to the environment by only using rodenticides as a temporary last resort.

The mandate of the federal Pest Control Products Act (PCPA) is to protect the health of Canadians and the environment against unacceptable risks from the use of pesticides including rodenticides. Ontario's Pesticides Act and Regulations build on this mandate by administering education, licencing, and/or

[30] An article on Humane Solutions' (a Vancouver-based humane and eco-friendly pest control company) blog, pest control companies may overlook these structural access-points in the interest of having to provide continued services to clients. See Joe Abercrombie, "*Ultimate guide to home rat control: Eco-friendly & humane*" (25 July 2019). <https://humanesolutions.ca/2019/07/25/ultimate-rat-removal-guide/#Lastly_forget_rat_poison>

[31] Salim, Hasber, et al. "Secondary poisoning of captive barn owls, Tyto alba javanica, through feeding with rats poisoned with chlorophacinone and bromadiolone." *Journal Oil Palm Research* 26.1 (2014): 62-72

[32] Hindmarch, S., Elliott, J. E., & Morzillo, A. (2018). Rats! What triggers us to control for rodents? Rodenticide user survey in British Columbia, Canada. *International Journal of Environmental Studies*, 75(6), 1011-1030.

[33] Buckle, A.P., Prescott, C. and Ward, K.J., 1994, Resistance to the first and second generation anticoagulant rodenticides: a new perspective. *Proceedings of the 16th Vertebrate Pest Conference,* 7; Pelz, H. J. (2007). Spread of resistance to anticoagulant rodenticides in Germany. *International Journal of Pest Management,* 53(4), 299-302; Meerburg, B. G., van Gent-Pelzer, M. P., Schoelitsz, B., & van der Lee, T. A. (2014). Distribution of anticoagulant rodenticide resistance in *Rattus norvegicus* in the Netherlands according to Vkorc1 mutations. Pest management science, 70(11), 1761-1766.

permit requirements in accordance with federal and provincial law, and in furtherance of its own aim "to protect human health and the environment," as well as the MEPC's responsibility to "...monitor[ing] and protect[ing] our air, land and water, species at risk and their habitat and address[ing] climate change while helping communities prepare for its impacts, reducing] litter and waste …for future generations of Ontarians."[34]

MEPC's Core Manual[35] and Structural Pest Management Module[36]–required reading for pesticide exterminator licensing in Ontario–further emphasize the importance of proactive pest management measures and explicitly instruct trainees to use pesticides "only when necessary."[37]

The prophylactic use of highly and acutely toxic rodenticide compounds where other measures are available clearly and directly conflict with these proactive and preventative principles.

"He noted that [rodenticide] bans lead to more reliance on other measures such as snap traps, which lead to increased costs, more pest management servicing to maintain the traps, and potentially decaying rodents if traps aren't properly monitored. He noted that since British Columbia's ban, they have seen a substantial increase in rodents and large cost increases for pest management services."

First and foremost, the updates to the BC Integrated Pest Management Regulations enacted in January 2023 are not a rodenticide ban. The regulations only partially restrict just 3 of many rodenticides registered for use in BC. Most rodenticides are still legal, and even restricted products are permitted for use across 9 broadly defined exemption categories.[38] Thus, rodenticide use is still prevalent and continues to perpetuate rodent populations at the consumer and environment's expense.

M. Dunn's statements appear to echo narratives perpetuated by the pest control industry in a self-serving effort to attract business. In truth, many factors contribute to fluctuations in rodent activity, but deceptive business practices and fear based marketing has been a go-to strategy in the pest control industry for decades. Orkin's annual "rattiest" city lists are a primary example. These broadly marketed "studies" imply dramatic rodent problems by ranking cities based on the number of rodent services provided. If the company provides effective services why do the same cities consistently top the list?

[34] Ontario Ministry of the Environment, Conservation and Parks. (2023). Published plans and annual reports 2022-2023. <https://www.ontario.ca/page/published-plans-and-annual-reports-2022-2023-ministry-environment-conservation-and-parks>

[35] Ontario Ministry of the Environment, Conservation and Parks. Ontario Pesticide Training and Certification Core Manual. *Queen's Printer for Ontario*, 2017. [Core Manual]

[36] Ontario Ministry of the Environment, Conservation and Parks. Ontario Pesticide Training and Certification: Structural Module. *Queen's Printer for Ontario*, 2011.

[37] Core Manual, s 2-11.

[38] Integrated Pest Management Regulation (B.C. Reg. 604/2004, consolidated February 27, 2024). <https://www.bclaws.gov.bc.ca/civix/document/id/loo91/loo91/604_2004>

Perhaps the “cost increases for pest management services,” referenced by M. Dunn, reflects a rising demand for preventative rodent-proofing services driven by a greater public awareness thanks to recent advocacy campaigns sweeping British Columbia. Promoting permanent solutions would disrupt the company’s current subscription service business model and growth initiative.

It’s possible the purported increase could also be explained by the dramatic increase in advertising expenditures by Orkin’s parent company (Rollins Inc.):

Reported Advertising Expenses - Rollins Inc.

Year	Amount	Percentage Change
2023	$115,987,000	+12.7%
2022	$102,959,000	+12.0%
2021	$91,879,000	+6.5%
2020	$86,314 ,000	+6.3%
2019	$81,174,000	N/A (base year)

Source: Rollins Inc. Form 10-K Annual Reports for 2023, 2022.

Regarding reliance on other measures, if comprehensive rodenticide bans were enacted, it would logically necessitate alternatives that would require more diligence than simply deploying poisons. M. Dunn seems to imply that snap traps are the newly desired, go-to approach to rodent management. To the contrary, campaigns calling for reform are demanding better solutions and adherence to properly preventative IPM principles, not just substitution of similarly unproductive tools. We are confident that the pest control industry will evolve to satisfy these expectations. Such transformation is already underway, as companies dedicated to providing humane, chemical-free rodent management services have opportunistically emerged in Ontario to fill rapidly increasing demand (See Appendix).

“Old buildings can be very difficult and expensive to secure. Exterior snap traps are helpful for monitoring ongoing rodent populations, but solely relying on snap traps in lieu of rodenticides is often prohibitively expensive.”

We agree that snap traps are not a viable long-term solution. In some cases, snap traps may be temporarily necessary if mice have made it indoors and present an immediate threat. However, as rodents are known to not stay indoors, companies that provide humane solutions use one-way doors to clear and permanently seal structures. As outlined above, reducing attractants and "rodent-proofing" the premises of buildings by addressing active and potential access-points in structures and monitoring these measures are critical measures to successfully addressing a rodent problem.[39]

The claim that preventative strategies are "prohibitively expensive" compared to rodenticides reflects an outdated mindset focused on short-term costs over long-term value and public wellbeing. While rodent exclusion may require some upfront costs, it pays dividends by eliminating the need for cyclical poison subscriptions that perpetually expose communities to toxic chemicals. Environmental justice demands equitable access to safe, non-toxic pest control methods to protect all communities, particularly those already overburdened by environmental hazards, including farmworkers and their families. As such, governments must create policies that correct these inequities and incentivize the widespread adoption of sustainable, non-chemical pest management practices. By investing in preventative measures and promoting ecologically sound solutions, we can safeguard public health, preserve the environment, and build more resilient communities in the long run.

As an advisory body tasked with providing informed counsel on agricultural matters, we hope that the Committee will continue its discussion on effective pest management strategies and share the information we have provided with growers and producers.

More specifically, we recommend that the Committee take the following actions:

- Remove all versions of its December 14, 2023 Meeting Minutes containing Mike Dunn's transcribed presentation from the public domain, and replace with redacted or corrected versions.
- Issue a Public Notice regarding publication of corrected Meeting Minutes due to misinformation therein.
- Send a Letter of Support to the Municipal Council of Clarington urging the adoption of chemical free, precautionary pest management policies that prioritize protection of the environment and human health as the law requires.
- Engage a professional with expertise in chemical-free pest management strategies to provide a presentation to the Committee and/or to assist in compiling educational materials and resources for growers and producers.

[39] Ebner, M., & Brown, A. (2022). How to eliminate rodenticide usage at a pharmaceutical facility using IoT rodent control devices: An example of a successful deployment of the VLINK pest network. Woodstream Corporation. <https://vlink.victorpest.com/media/wysiwyg/vlink/pdf/Eliminate_Rodenticide_Usage_Pharmaceutical_Facility_Using_IoT_Rodent_Control_Devices.pdf>

We appreciate your time and attention to this important issue and sincerely hope the materials we have provided are helpful. Please feel free to reach out with questions that arise as you review. We would be pleased to serve as a resource as you consider next steps forward.

Sincerely,

Lindsey Zehel, J.D., LL.M.
Executive Director | Defend Them All

Allison Hansen
Campaign Director|Rodenticide Free Ontario

APPENDIX

Ontario Wildlife Removal - https://www.ontariowildliferemoval.ca/
Service area: Brantford, Kitchener-Waterloo, London, Cambridge and Guelph Ontario

Proven Wildlife Removal - https://provenwildliferemoval.com/
Service area: GTA, Muskoka, Haliburton and Southern Ontario

Simcoe Muskoka Wildlife Removal - https://simcoemuskokawildliferemoval.ca/
Service area: Muskoka, Collingwood, Orillia, Barrie

Natura Wildlife Services - https://www.naturawildlifeservices.com/
Service area: Ottawa and surrounding region

Urban Wildlife Control - https://urbanwildlifecontrol.ca/
Service area: Waterloo