

Eastern Coyotes (*Canis latrans* var.) consuming large ungulates in a multi-ungulate system

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Abstract

The feeding habits of generalist predators often vary among populations and regions. For example, Coyote (*Canis latrans*), which is a generalist predator distributed across North America, occupies a wide range of habitats and has a highly varied diet. In this observational study, we quantified the presence of mammalian prey items in 50 Eastern Coyote (*Canis latrans* var.) scats collected in late spring and summer in a private game reserve in southwestern Quebec. Nearly all scats contained hair of White-tailed Deer (*Odocoileus virginianus*; 44%), Moose (*Alces americanus*; 38%), or American Beaver (*Castor canadensis*; 38%). Although all three species are known to be consumed by coyotes, such a high proportion of Moose and White-tailed Deer simultaneously occurring in the diet of coyotes has not been previously reported. The uniqueness of the study area, with its relatively high abundance of all three prey species, may account for the uniqueness of the diet of Eastern Coyotes living there.

Key words: *Canis latrans*; Coyote; Eastern Coyote; *Alces americanus*; Moose; diet; feeding ecology; foraging ecology; feeding habits; Quebec

Introduction

Biologists often study animal feeding habits to understand a species' trophic status within its ecological community (Abramsky 1978; Chan *et al.* 2017). The feeding habits of predators are of particular interest because their regulation of prey populations can maintain ecosystem health (Fortin *et al.* 2005), but, depending on prey choice, may also affect livestock populations (Hunter and Price 1992; Reynolds and Tapper 1996; Stahler *et al.* 2006). Coyotes (*Canis latrans*) have become the apex predator in many North American regions following local eradication of Gray Wolf (*Canis lupus*) and Cougar (*Puma concolor*; Goldman 1937; Crooks and Soulé 1999; Laliberte and Ripple 2004; Roemer *et al.* 2009). This generalist predator is highly flexible and adaptable, causing its ecology to vary greatly by region (Gompper 2002). Because of the coyote's vast geographic range, combined with location-specific ecology, regional observational studies often provide new and important information about coyote behaviour and dietary niche that is relevant to our understanding

of coyotes and their role in shaping trophic and community structure.

The forests of rural southern Quebec offer an interesting niche for Eastern Coyotes (*Canis latrans* var.) to exploit because this area includes the northern range of White-tailed Deer (*Odocoileus virginianus*), a common prey item, and the southern range of Moose (*Alces americanus*), which is more often associated with predation by wolves and bears (Ballard and Van Ballenberghe 1998; Snaith and Beazley 2004; Benson and Patterson 2013). Historically, Gray Wolves existed in the area, but they have been extirpated from most of the region (Peterson 1966). At present, Eastern Coyote, which is smaller than wolves but bigger than Western Coyotes (*Canis latrans*; Way 2007; Way and Hirten 2019), are the only extant canid. Eastern Coyotes are generally thought to have arisen from wolf-coyote hybridization, but the species designation of Eastern Coyote and the extent of gene flow among wolves, coyotes, and Domestic Dogs (*Canis familiaris*) remains controversial and actively studied (Way and Lynn 2016).

Studies across eastern North America show coyotes to be dietary generalists, consuming everything from Moose to small rodents, fruits, and plants (Gese and Grothe 1995; Samson and Crete 1997; Crimmins *et al.* 2012; Dowd and Gese 2012; Swingen *et al.* 2015). Using scat analysis, we describe the spring and summer vertebrate diet of Eastern Coyotes in a forested area of southwestern Quebec. We predicted that White-tailed Deer would be the most consumed vertebrate, as they are locally abundant and have been previously documented as key items in coyote diet in other parts of Ontario and Quebec with similarly high densities (Pouille *et al.* 1993; Crete *et al.* 2001; Sears *et al.* 2003).

Methods

Study area

Our study site was Kenauk Nature, a 265-km² private game reserve (Figure 1), located on the southwest border of Quebec, just north of the Ottawa River between Ottawa and Montréal. The property is crossed

by a network of ~100 km of dirt roads (approximate density 0.4 km/km²). Lying in the transition zone between the St. Lawrence Lowlands and the Laurentian Mountains, the site contains primarily mixed hardwood forest, with many lakes, rivers, and wetlands. The average annual temperature is 4.8°C (SD 1.4), the average winter (November–April) temperature is -4.7°C (SD 2.6), and the average summer (May–October) temperature is 14.2°C (SD 1.2). Average total annual rainfall is 807.4 mm and total annual snowfall is 178.1 cm (Environment Canada 2017).

The reserve has a long history of forestry, and active logging still occurs. In 2012, winter aerial surveys of half the property found Moose densities of ~1.0/km²; 2014 winter surveys of the hunting zone in which the property lies (Zone 10 East) found White-tailed Deer densities of ~2.5/km² (Ministère des Forêts de la Faune et des Parcs unpubl. data). The density of Eastern Coyotes in the area is unquantified, but they are regularly observed and heard on the property. American Black Bears (*Ursus americanus*)

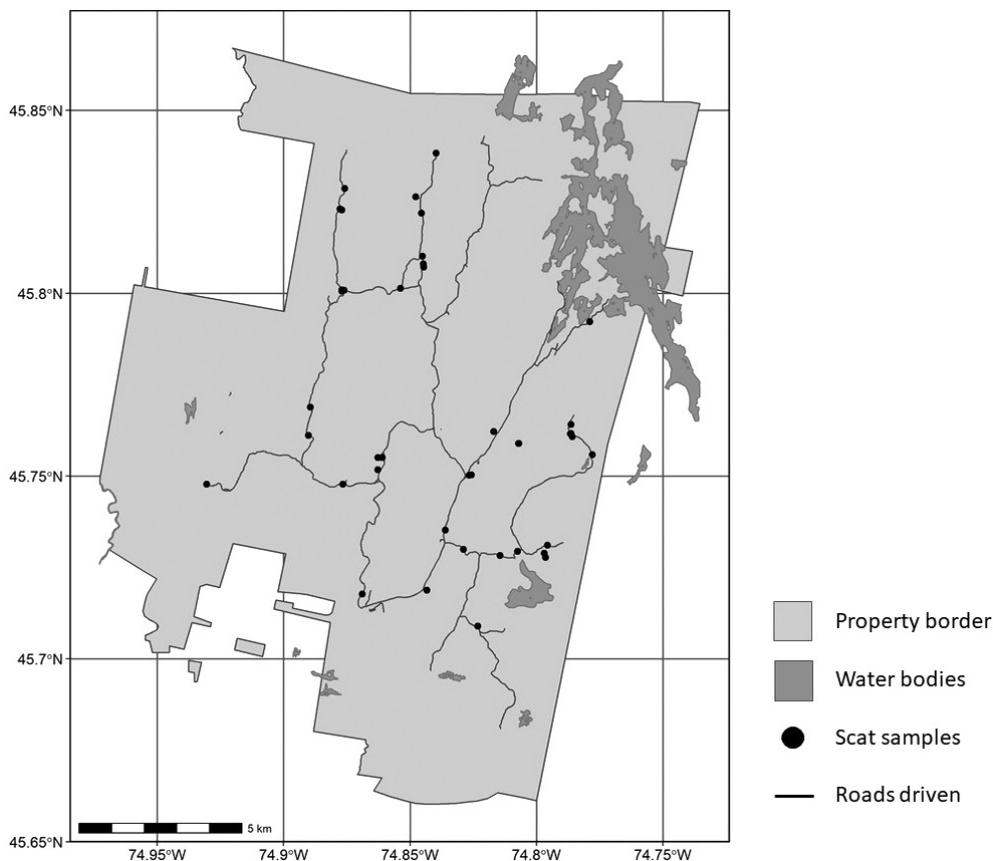


FIGURE 1. Locations of Eastern Coyote (*Canis latrans* var.) scat collected in 2016 at Kenauk Nature, Quebec, Canada, a 265-km² private game reserve just north of the Ottawa River between Ottawa and Montréal.

exist on the property, but their densities are also unknown. Canada Lynx (*Lynx canadensis*) and Bobcat (*Lynx rufus*) have not been observed, but are potential predators. In autumn, Moose are hunted from about 17 September to 20 October (females and males), and deer are hunted from about 4 to 18 November (males with ≥ 6 points), each with an annual limit of 10 animals; success rates are higher for Moose (L.B.N. unpubl. data).

Scat collection and predator species confirmation

Between 23 May and 27 August 2016, we collected coyote scat opportunistically on the property's unpaved road network and occasionally by hiking away from the road network (Figure 1). Coyotes have been found to use tertiary (unpaved) roads all year long, thus supporting our assumption that scat found on the road network would be relatively representative of the property's population (Bensen *et al.* 2015). We collected scats with a diameter of ≥ 18 mm to reduce the likelihood of collecting those of foxes or other smaller carnivores (Dumond *et al.* 2001). We sampled roads daily to once a week during the entire collection period. During roughly the first week of sampling (23–31 May), we cleared the roads of scat, retaining those that appeared fresh (digestive matrix present) and discarding those that consisted of hairs and other hard parts only, with no digestive matrix. Although the age of the first week's collected scats was unknown, we assumed they were from mid to late spring. Subsequently, collected scats were all less than one week old. We placed scats in sealable plastic bags and stored them at -20°C until processing as described in MacCracken and Hansen (1982) and Swingen *et al.* (2015).

We carried out DNA analysis on a subsample of 28 of the freshest scat (highest moisture content when collected) to confirm they were from coyotes. We thawed the scats and collected ~ 0.4 mL of digestive matrix into 1.5-mL microfuge tubes containing 95% ethanol. Digestive matrix subsamples were stored at -20°C until they were sent to the Canadian Centre for DNA Barcoding in Guelph, Ontario, Canada, for DNA preparation and analysis.

Similar to methods described in Moran *et al.* (2019), DNA was extracted at the Canadian Centre for DNA Barcoding directly from the homogenate we sent and amplified using vertebrate-specific primers which targetted a 185-base-pair fragment of the cytochrome c oxidase I (COI) barcode region of mtDNA. DNA was sequenced with an Ion Torrent PGM high-throughput sequencer (Thermo Fisher, Waltham, Massachusetts, USA). The raw sequence reads were demultiplexed into 30 datasets that included the 28 faecal samples and two negative controls, filtered to remove low-quality reads,

and trimmed to remove primer sequences. The reads were then clustered into operational taxonomic units (OTUs) based on 98% identity and a minimum of 10 reads per OTU. Although the COI barcode region for wolves and coyotes is 95.8% identical, six diagnostic nucleotides can be used to distinguish them and confirm maternal heritage. These methods also amplified some prey DNA, but we did not use such DNA for our dietary analysis.

Dietary analysis

Scats were individually thawed, dried, and cleaned until only hard parts remained. We selected up to 10 guard hairs from across each cleaned scat for identification (Forbes and Theberge 1996 found that three hairs per scat accounted for 98.8% of prey items in wolf scat). We assessed each hair's macro-qualities (colour, length, width, texture, and shape), medulla patterns, and scale patterns of the guard hairs and compared these against known hair samples and guides (Moore *et al.* 1974). We identified Cervidae to species level (i.e., White-tailed Deer or Moose) and other prey to the family level. We distinguished among larger Rodentia species, American Beaver (*Castor canadensis*) and North American Porcupine (*Erethizon dorsatum*), but grouped small rodents into one prey group. We also recorded the presence of avian feathers found in the scats.

Results

We collected 50 scats from 23 May to 27 August, the first five of which we assumed to have been deposited in spring (April), but we do not know the precise date. Only one sample was found off roads. Although scats were never found in some sections of road, scats were distributed fairly evenly across the monitored area (Figure 1). All 28 samples sent for DNA analysis confirmed coyote maternal origin. On six occasions, we collected multiple scats at a single location and time, but in only one of these cases did scats collected together have identical dietary findings (samples 48 and 49; Table S1). The three most commonly found diet items, based on simple occurrence rate, were White-tailed Deer (0.44), Moose (0.38), and beaver (0.38; Table 1). We also observed mustelids (0.10), non-beaver rodents (0.04), and bird and feline species, which we categorized as "other" (0.04; Table 1). We did not find any lagomorph or porcupine remains in any of the scats. Although we did not distinguish between juvenile and adult ungulates, Moose hair was often thin and weak in structure, which, we speculate, could indicate that most consumed Moose were calves (Adorjan and Kolenosky 1969).

Most scats ($n = 32$) contained only a single type of hair, while the remainder had either two ($n = 16$) or three hair types ($n = 2$; Table S1). Samples never con-

TABLE 1. Diet items detected in 50 Eastern Coyote (*Canis latrans* var.) scat samples collected in 2016 at Kenauk Nature, Quebec, Canada.

| Species/taxa | | Samples in which diet item found ($n = 50$) | |
|-------------------|-------------------------------|---|----|
| Common name | Scientific name | No. | % |
| White-tailed Deer | <i>Odocoileus virginianus</i> | 22 | 44 |
| Moose | <i>Alces americanus</i> | 19 | 38 |
| American Beaver | <i>Castor canadensis</i> | 19 | 38 |
| Mustelid | Mustelidae | 5 | 10 |
| Non-beaver rodent | Rodentia | 2 | 4 |
| Other | — | 2 | 4 |

tained both Moose and White-tailed Deer, and beaver hair was found both alone and paired with ungulate hair (Figure 2). Of scats containing two hair types, most consisted of beaver and an ungulate.

Discussion

White-tailed Deer, beaver, and Moose were all detected in coyote scats at similar rates, and each was detected throughout the study period from May to August (Table S1). In addition, although individual scats often contained both beaver and Moose or beaver and deer, we did not find any scats that contained both species of ungulates. A Moose or deer could feed multiple coyotes or a few coyotes over multiple days, whereas beavers are smaller and likely cannot; thus, a specific Moose or deer may be represented in

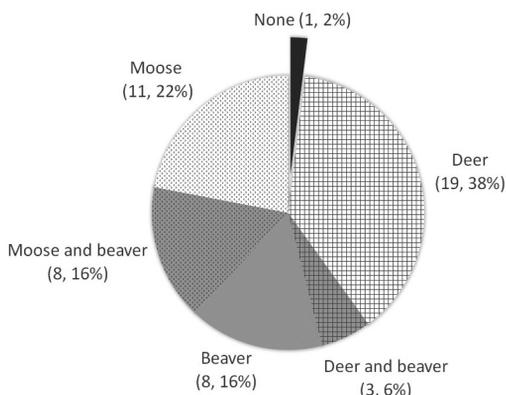


FIGURE 2. Detection rates for each hair type (number, %) in 50 analyzed Eastern Coyote (*Canis latrans* var.) scats, including the three most common items: Moose (*Alces americanus*), White-tailed Deer (*Odocoileus virginianus*), and American Beaver (*Castor canadensis*), and their combined detections. One detection equals one scat and, hence, reflects prey importance; no sample is represented by multiple categories. The category “None” represents the only sample that did not contain Moose, White-tailed Deer, or beaver, but remains of small rodents only.

multiple samples. Our results, therefore, suggest that deer, Moose, and beaver are the primary diet items of Eastern Coyotes in this reserve during the spring and summer. A study from a neighbouring area in south-eastern Ontario also found deer and beaver to be common summer diet items (Sears *et al.* 2003). Although our results were in line with our prediction that White-tailed Deer would be the most common diet item, we did not expect such a high occurrence of Moose.

Many other studies from Quebec and surrounding areas have found Moose to be absent or rare in coyote diets (Richens and Hugie 1974; Messier *et al.* 1986; Poulle *et al.* 1993; Patterson *et al.* 1998; Crete *et al.* 2001; Sears *et al.* 2003). Although there are also reports of high Moose consumption and low deer consumption in Quebec and New Brunswick (Samson and Crete 1997; Dumond *et al.* 2001; Boisjoly *et al.* 2010; Power *et al.* 2019), these studies have been carried out in areas with reported high Moose densities compared with deer. A dramatic change in coyote summer diet, from White-tailed Deer as the primary ungulate consumed in 1988 to Moose by 1991, was observed in Gaspésie, Quebec (Samson and Crete 1997). During that time, deer numbers decreased greatly (based on a 76.9% decline in harvest rate), while Moose densities increased (based on a 15.1% increase in harvest rate), which the authors hypothesized as the reason for the change in diet. None of these studies show a similar occurrence rate for both Moose and deer in the diet over the same period of time, which makes our observation, even with a small sample size, notable.

Our unique observation of similarly high rates of Moose and deer consumption by Eastern Coyotes could be explained by the relatively high densities of both ungulates in our study area. Moose and White-tailed Deer ranges overlap at their southern and northern extents. The eastern area of their sympatric range grew to its current size only after land clearing in the 20th century, when deer extended their range north, causing Moose densities to decline, likely in part because of the spread of meningeal worm, *Parelaphostrongylus tenuis* (Boer 1998). Given that White-tailed Deer carry, but are not affected by this parasite, which kills Moose, it is often assumed and frequently reported that densities of these two ungulates are inversely related in eastern regions (Whitlaw and Lankester 1994). Hence, few if any coyote feeding studies have been conducted where Moose and deer are present at high abundances. We do not know the reason for our study area’s high densities of both Moose and deer, but one explanation could be that the historical strip cuts and current logging practices have created ample forage. We have yet to learn the current status of *P. tenuis* in our study area.

We speculate that most of the Moose consumed were calves, based on other literature and characteristics of both Moose and White-tailed Deer, although we cannot distinguish between predation and scavenging. The vast majority of the scats collected (Table S1) were deposited during or after the window of Moose parturition in this region (Musante *et al.* 2010). Juvenile Moose are also smaller and less coordinated than adult White-tailed Deer, which Eastern Coyotes are known to predate (Pouille *et al.* 1993; Chitwood *et al.* 2014). It is commonly believed that coyotes are incapable of predating healthy, adult Moose, except during the winter months when snow can severely limit ungulate movement (Benson and Patterson 2013). We speculate that the Moose found in the first week's samples were scavenged or predated adult/yearling Moose from the spring (before the window of parturition) when the body condition of Moose is poor (Musante *et al.* 2010).

Having a better understanding of Eastern Coyote dietary patterns in the region, in particular what age classes and conditions of ungulates they consume, would help wildlife managers to quantify the influence of Eastern Coyotes on the local ungulate populations. Future work on coyote feeding habits in this reserve should include collecting more scats across multiple seasons and an age-class analysis of hairs in scats. It is possible that coyotes consume newborn Moose calves in the summer (a pulsed resource) and adults in the winter when they are made more vulnerable by snow and poor body condition (Benson and Patterson 2013). Kill site investigations, best located with global positioning system units on predators (Franke *et al.* 2006), would also help identify the species, age, and condition of larger prey and better determine whether hairs in the diet were from predation or scavenging events. In addition, sampling for *P. tenuis* should occur to learn whether a lack of *P. tenuis* promotes the high densities of Moose and White-tailed Deer or if they co-occur despite the parasite.

Author Contributions

Writing – Original draft: J.B.; Writing – Review & Editing: J.B., L.B.N., and M.M.H.; Conceptualization: J.B., L.B.N., and M.M.H.; Investigation: J.B.; Methodology: J.B.; Formal Analysis: J.B.; Funding Acquisition: L.B.N.; Resources: M.M.H.; Project Administration: L.B.N.; Supervision: M.M.H. and L.B.N.; Visualization: J.B.

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Literature Cited

- Abramsky, Z.** 1978. Small mammal community ecology. *Oecologia* 34: 113–123. <https://doi.org/10.1007/bf00345160>
- Adorjan, A.S., and G.B. Kolenosky.** 1969. A Manual for the Identification of Hairs of Selected Ontario Mammals. Ontario Department of Lands and Forests, Toronto, Ontario, Canada.
- Ballard, W.B., and V. Van Ballenberghe.** 1998. Predator/prey relationships. Pages 247–273 in *Ecology and Management of the North American Moose*. Edited by A.W. Franzmann and C.C. Schwartz. Wildlife Management Institute, Washington, DC, USA.
- Benson, J.F., P.J. Mahoney, and B.R. Patterson.** 2015. Spatiotemporal variation in selection of roads influences mortality risk for canids in an unprotected landscape. *Oikos* 124: 1664–1673. <https://doi.org/10.1111/oik.01883>
- Benson, J.F., and B.R. Patterson.** 2013. Moose (*Alces alces*) predation by eastern coyotes (*Canis latrans*) and eastern coyote × eastern wolf (*Canis latrans* × *Canis lycaon*) hybrids. *Canadian Journal of Zoology* 91: 837–841. <https://doi.org/10.1139/cjz-2013-0160>
- Boer, A.H.** 1998. Interspecific relationships. Pages 337–350 in *Ecology and Management of the North American Moose*. Edited by A.W. Franzmann and C.C. Schwartz. Wildlife Management Institute, Washington, DC, USA.
- Boisjoly, D., J.P. Ouellet, and R. Courtois.** 2010. Coyote habitat selection and management implications for the Gaspésie Caribou. *Journal of Wildlife Management* 74: 3–11. <https://doi.org/10.2193/2008-149>
- Chan, K., S. Boutin, T.J. Hossie, C.J. Krebs, M. O'Donoghue, and D.L. Murray.** 2017. Improving the assessment of predator functional responses by considering alternate prey and predator interactions. *Ecology* 98: 1787–1796. <https://doi.org/10.1002/ecy.1828>
- Chitwood, M.C., M.A. Lashley, C.E. Moorman, and C.S. DePerno.** 2014. Confirmation of coyote predation on adult female white-tailed deer in the southeastern United States. *Southeastern Naturalist* 13: N30–N32. <https://doi.org/10.1656/058.013.0316>
- Crête, M., J.P. Ouellet, J.P. Tremblay, and R. Arsenault.** 2001. Suitability of the forest landscape for coyotes in northeastern North America and its implications for co-

- existence with other carnivores. *Écoscience* 8: 311–319. <https://doi.org/10.1080/11956860.2001.11682658>
- Crimmins, S.M., J.W. Edwards, and J.M. Houben.** 2012. *Canis latrans* (Coyote) habitat use and feeding habits in central West Virginia. *Northeastern Naturalist* 19: 411–420. <https://doi.org/10.1656/045.019.0304>
- Crooks, K.R., and M.E. Soulé.** 1999. Mesopredator release and avifaunal extinctions in a fragmented system. *Nature* 400: 563–566. <https://doi.org/10.1038/23028>
- Dowd, J.L.B., and E.M. Gese.** 2012. Seasonal variation of coyote diet in northwestern Wyoming: implications for dietary overlap with Canada lynx? *Northwest Science* 86: 289–299. <https://doi.org/10.3955/046.086.0405>
- Dumond, M., M.A. Villard, and E. Tremblay.** 2001. Does coyote diet vary seasonally between a protected and unprotected forest landscape? *Écoscience* 8: 301–310. <https://doi.org/10.1080/11956860.2001.11682657>
- Environment Canada.** 2017. National climate data and information archive. Environment Canada, Ottawa, Ontario, Canada. Accessed December 2017. https://climate.weather.gc.ca/climate_normals/results_1981_2010_e.html?stnID=5612&autofwd=1
- Forbes, G.J., and J.B. Theberge.** 1996. Response by wolves to prey variation in central Ontario. *Canadian Journal of Zoology* 74: 1511–1520. <https://doi.org/10.1139/z96-165>
- Fortin, D., H.L. Beyer, M.S. Boyce, D.W. Smith, T. Duchesne, and J.S. Mao.** 2005. Wolves influence elk movements: behavior shapes a trophic cascade in Yellowstone National Park. *Ecology* 86: 1320–1330. <https://doi.org/10.1890/04-0953>
- Franke, A., T. Caelli, G. Kuzyk, and R.J. Hudson.** 2006. Prediction of wolf (*Canis lupus*) kill-sites using hidden Markov models. *Ecological Modelling* 197: 237–246. <https://doi.org/10.1016/j.ecolmodel.2006.02.043>
- Gese, E.M., and S. Grothe.** 1995. Analysis of coyote predation on deer and elk during winter in Yellowstone National Park, Wyoming. *American Midland Naturalist* 133: 36–43. <https://doi.org/10.2307/2426345>
- Goldman, E.A.** 1937. The wolves of North America. *Journal of Mammalogy* 18: 37–45. <https://doi.org/10.2307/1374306>
- Gompper, M.E.** 2002. Top carnivores in the suburbs? Ecological and conservation issues raised by colonization of northeastern North America by coyotes. *Bioscience* 52: 185–190. [https://doi.org/10.1641/0006-3568\(2002\)052\[0185:tcitise\]2.0.co;2](https://doi.org/10.1641/0006-3568(2002)052[0185:tcitise]2.0.co;2)
- Hunter, M.D., and P.W. Price.** 1992. Playing chutes and ladders: heterogeneity and the relative roles of bottom-up and top-down forces in natural communities. *Ecology* 73: 724–732. <https://doi.org/10.2307/1940152>
- Laliberte, A.S., and W.J. Ripple.** 2004. Range contractions of North American carnivores and ungulates. *AIBS Bulletin* 54: 123–138. [https://doi.org/10.1641/0006-3568\(2004\)054\[0123:rconac\]2.0.co;2](https://doi.org/10.1641/0006-3568(2004)054[0123:rconac]2.0.co;2)
- MacCracken, J.G., and R.M. Hansen.** 1982. Seasonal foods of coyotes in southeastern Idaho: a multivariate analysis. *Great Basin Naturalist* 42: 45–49.
- Messier, F., C. Barrette, and J. Huot.** 1986. Coyote predation on a white-tailed deer population in southern Quebec. *Canadian Journal of Zoology* 64: 1134–1136. <https://doi.org/10.1139/z86-170>
- Moore, T.D., L.E. Spence, and C.E. Dugnolle.** 1974. Identification of the dorsal guard hairs of some mammals of Wyoming. *Bulletin* 14. Wyoming Game and Fish Department, Cheyenne, Wyoming, USA.
- Moran, A.J., S.W. Prosser, and J.A. Moran.** 2019. DNA metabarcoding allows non-invasive identification of arthropod prey provisioned to nestling Rufous hummingbirds (*Selasphorus rufus*). *PeerJ* 7: e6596. <https://doi.org/10.7717/peerj.6596>
- Musante, A.R., P.J. Pekins, and D.L. Scarpitti.** 2010. Characteristics and dynamics of a regional moose *Alces alces* population in the northeastern United States. *Wildlife Biology* 16: 185–204. <https://doi.org/10.2981/09-014>
- Patterson, B.R., L.K. Benjamin, and F. Messier.** 1998. Prey switching and feeding habits of eastern coyotes in relation to snowshoe hare and white-tailed deer densities. *Canadian Journal of Zoology* 76: 1885–1897. <https://doi.org/10.1139/z98-135>
- Peterson, R.L.** 1966. *The Mammals of Eastern Canada*. Oxford University Press, Toronto, Ontario, Canada.
- Poulle, M., M. Crête, J. Huot, et R. Lemieux.** 1993. Prédation exercée par le Coyote, *Canis latrans*, sur le Cerf de Virginie, *Odocoileus virginianus*, dans un ravage en déclin de l'Est du Québec. *Canadian Field-Naturalist* 107: 177–185. Accessed 24 April 2020. <https://www.biodiversitylibrary.org/page/34810311>
- Power, J.W.B., M.J. Boudreau, E.M. Muntz, and S. Bondrup-Nielsen.** 2019. High reliance on a diet of Moose (*Alces americanus*) by Eastern Coyotes (*Canis latrans* var.) in Cape Breton Highlands National Park, Nova Scotia, Canada. *Canadian Field-Naturalist* 133: 329–331. <https://doi.org/10.22621/cfn.v133i4.2138>
- Reynolds, J.C., and S.C. Tapper.** 1996. Control of mammalian predators in game management and conservation. *Mammal Review* 26: 127–155. <https://doi.org/10.1111/j.1365-2907.1996.tb00150.x>
- Richens, V.B., and R.D. Hugie.** 1974. Distribution, taxonomic status, and characteristics of coyotes in Maine. *Journal of Wildlife Management* 38: 447–454. <https://doi.org/10.2307/3800875>
- Roemer, G.W., M.E. Gompper, and B. Van Valkenburgh.** 2009. The ecological role of the mammalian mesocarnivore. *BioScience* 59: 165–173. <https://doi.org/10.1525/bio.2009.59.2.9>
- Samson, C., and M. Crête.** 1997. Summer food habits and population density of coyotes, *Canis latrans*, in boreal forests of southeastern Quebec. *Canadian Field-Naturalist* 111: 227–233. Accessed 24 April 2020. <https://www.biodiversitylibrary.org/page/35481769>
- Sears, H.J., J.B. Theberge, M.T. Theberge, I. Thornton, and G.D. Campbell.** 2003. Landscape influence on *Canis* morphological and ecological variation in a coyote-wolf *C. lupus* × *latrans* hybrid zone, Southeastern Ontario. *Canadian Field-Naturalist* 117: 591–600. <https://doi.org/10.22621/cfn.v117i4.828>
- Snaith, T.V., and K.F. Beazley.** 2004. The distribution, status and habitat associations of moose in mainland Nova Scotia. *Proceedings of the Nova Scotian Institute of Science* 42: 263–317.
- Stahler, D.R., D.W. Smith, and D.S. Guernsey.** 2006.

- Foraging and feeding ecology of the gray wolf (*Canis lupus*): lessons from Yellowstone National Park, Wyoming, USA. *Journal of Nutrition* 136: 1923S–1926S. <https://doi.org/10.1093/jn/136.7.1923S>
- Swingen, M.B., C.S. DePerno, and C.E. Moorman.** 2015. Seasonal coyote diet composition at a low-productivity site. *Southeastern Naturalist* 14: 397–404. <https://doi.org/10.1656/058.014.0219>
- Way, J.G.** 2007. A comparison of body mass of *Canis latrans* (coyotes) between eastern and western North America. *Northeastern Naturalist* 14: 111–124. [https://doi.org/10.1656/1092-6194\(2007\)14\[111:acobmo\]2.0.co;2](https://doi.org/10.1656/1092-6194(2007)14[111:acobmo]2.0.co;2)
- Way, J.G., and J.L. Hirten.** 2019. Wild *Canis* spp. of North America: a pictorial representation. *Canadian Field-Naturalist* 133: 295–296. <https://doi.org/10.22621/cfn.v133i3.2473>
- Way, J.G., and W.S. Lynn.** 2016. Northeastern coyote/coywolf taxonomy and admixture: a meta-analysis. *Canid Biology & Conservation* 19: 1–7.
- Whitlaw, H.A., and M.W. Lankester.** 1994. The co-occurrence of moose, white-tailed deer, and *Parelaphostrongylus tenuis* in Ontario. *Canadian Journal of Zoology* 72: 819–825. <https://doi.org/10.1139/z94-111>

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SUPPLEMENTARY MATERIAL:

Table S1. Location and prey content of 50 Eastern Coyote (*Canis latrans* var.) scat samples collected in 2016 at Kenauk Nature, Quebec, Canada.