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Influence of indirect cues and vegetation density on foraging behavior in snowshoe hares (Lepus americanus)

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Snowshoe hares (*Lepus americanus*) alter feeding behavior in response to coyote (*Canis latrans*) and moose (*Alces* alces) cues at diverse vegetation densities

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Introduction

- Interspecific competition can change the community structure of an ecosystem (Capitan et al. 2017), and it can manifest itself as direct interactions, e.g., physical combat, or indirect interactions, e.g., avoidance of a cue (Durant 2000; Soderback 1991).
- Snowshoe hares (*Lepus americanus*) rely on vegetation density and knowledge of their surroundings to survive (Litvaitis et al. 1985; Sullivan et al. 1985). They attend to predator cues, but we do not know how they respond to competitor cues (Sullivan et al. 1985).
- Snowshoe hares and moose (*Alces alces*) show similarities in resource consumption and habitat distribution, and their ranges overlap (Dodd 1960). Thus, snowshoe hares and moose may compete for resources, with moose acting as the dominant competitor (Belovsky 1984; Dodd 1960).
- The purpose of this experiment was to determine if chemical cues from a competitor (moose) and a predator (coyote, *Canis latrans*) alter snowshoe hare feeding behavior across a spectrum of vegetation densities.

Predictions

1. Decreased number of visits to areas marked with moose and coyote urine.
2. Decreased number of visits to, and time spent in, plots with less dense vegetation.
3. Increased percentage of time spent vigilant in plots marked with coyote urine and in plots with less dense vegetation.

Methods

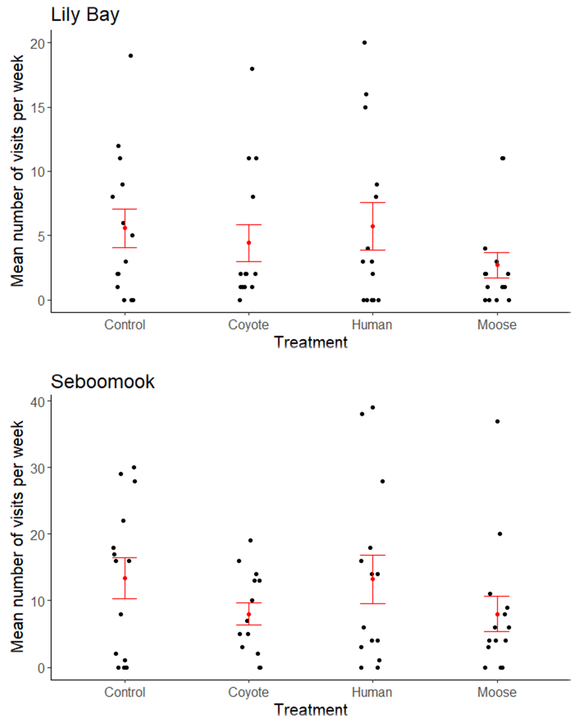
Study sites
We conducted this study at 2 sites bordering Moosehead Lake in Piscataquis County, ME: Lily Bay State Park (LBSP) and Seboomook Public Reserved Land (SPRL), June-October 2018. Both moose and snowshoe hares commonly occur in these areas throughout the year (Bowyer et al. 2003; Murray 2003).

Data collection
At each study site, we established a set of plots containing 4 treatments in vials attached to wooden stakes: coyote urine, moose urine, human urine, and water. We separated plots by 100 m and baited them with bananas, apples, timothy hay, and rabbit food. We attached game cameras to trees adjacent to plots to record number of snowshoe hare visits, time spent in plot, and vigilance.

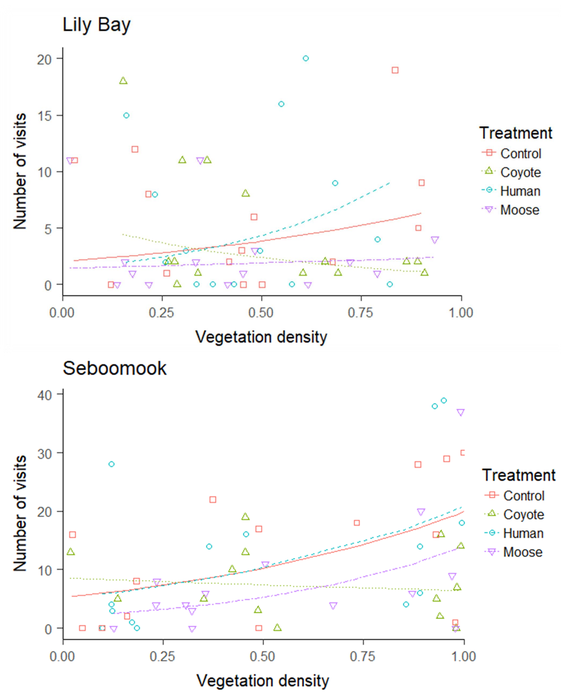
Measuring vegetation density
We employed the method used by Wolff (1980) to measure vegetation density. We used a placard consisting of 64 squares to acquire a simple ratio of squares that were covered vs. uncovered by vegetation. We took measurements from the north, south, east, and west at ground level and at 4 m above ground.

Measuring vigilance
We defined vigilance as an erect head with ears pointing forward. Other behaviors included feeding (food in mouth), grooming, and running.

Results



Mean number of visits to coyote plots was 21% and 40% lower than the water-treated control at LBSP (z = -1.36, p = 0.173, n = 14 weeks) and SPRL (z = -4.31, p < 0.001, n = 14 weeks), respectively. Mean number of visits to moose plots was 40% and 49% lower than the water-treated control at LBSP (z = -3.67, p < 0.001, n = 14 weeks) and SPRL (z = -4.31, p < 0.001, n = 14 weeks), respectively.



At both sites, mean weekly visits to plots treated with water (control) increased as vegetation density increased. Mean weekly visits to moose and coyote plots did not differ significantly from this trend. Conversely, number of visits to coyote plots decreased as vegetation density increased at LBSP (z = -3.67, p < 0.001, n = 14 weeks) and SPRL (z = -4.40, p < 0.001, n = 14 weeks).

Neither time spent in plots nor percent time spent vigilant differed among treatments or vegetation densities.

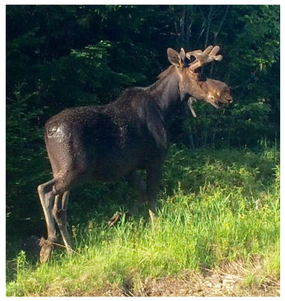
Conclusions

✓ Decreased number of visits to areas marked with moose and coyote urine.

⊕ Decreased number of visits to, and time spent in, plots with less dense vegetation.

⊗ Increased percentage of time spent vigilant in plots marked with coyote urine and in plots with less dense vegetation.

- Perhaps hares responded to a generalized meat-eater cue that exists in urine of predators, due, in part, to high sulfur content and that acts as a warning to prey species (Nolte et al. 1994). Similarly, snowshoe hares may have evolved to avoid a certain factor in moose urine to reduce competition.
- Overall, snowshoe hares tended to visit plots with denser vegetation, as seen in other species (Lee et al. 1999; Savino and Stein 1982). However, number of visits to coyote plots decreased as vegetation density increased. Ambush predators, such as coyotes, can use the concealing properties of dense vegetation to their advantage (Moreno et al. 1996). Thus, snowshoe hares may avoid densely vegetated areas containing coyote urine because the dual effects of coyote scent and inability to scan surroundings indicate a dangerous feeding area.
- Although detection of predators may increase when prey devote all of their energy to vigilance, they can be aware of their surroundings while performing other behaviors (Lima and Bednekoff 1999). Thus, in experimental plots with seemingly greater risk of predation (coyote urine/less dense), snowshoe hares might be more attuned to their surroundings even if this behavior is undetectable.



Acknowledgements

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