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ARTICLE
Animal Ecology

Camera traps reveal cryptic species-specific seed removal preferences in a seasonal small-mammal foraging study

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Abstract

Seasonal changes in plant–animal interactions, such as seed dispersal and predation, remain poorly understood in temperate ecosystems. We examined seed removal of three woody species (*Acer saccharum*, *Tsuga canadensis*, and *Lonicera* spp.) by small mammals (*Peromyscus* spp., *Tamiasciurus hudsonicus*) across fall, winter, and spring using custom camera traps that could record species-specific foraging behavior year-round, including under snow. We predicted that seed removal would decline in the winter and that the assemblage of visiting small-mammal species would vary seasonally due to their differing thermoregulation strategies. We also expected to observe interspecific variation in foraging behavior and seed selection. The overall occurrence of seed removal was lowest in January, the coldest month of our study, driven by reduced foraging by *Peromyscus* spp. Seed removal by *T. hudsonicus* was consistent across months. Our results also revealed clear differences in the identity of seeds removed by the two small-mammal taxa. *Peromyscus* spp. used all three seed species but preferred *Lonicera* spp. and *A. saccharum*, while *T. hudsonicus* only removed *A. saccharum* seeds. These findings underscore the importance of context dependency in seed removal and the important roles of small-mammal community composition and seasonality in shaping plant establishment, including the spread of invasive plants.

KEYWORDS
Acer saccharum, *Lonicera* spp., *Peromyscus* spp., *Tamias striatus*, *Tamiasciurus hudsonicus*, temperate forest, *Tsuga canadensis*

INTRODUCTION

The strength of species interactions has profound effects on species distributions (Brown & Vellend, 2014), diversity (Stephens et al., 2019), ecosystem function (Schmitz, 2008), and evolution (Ford et al., 2014). However, species interactions vary in strength across space and time, and thus, understanding the mechanisms driving this variation remains a major challenge in community ecology (Agrawal et al., 2007; Maron et al., 2014). One underappreciated driver of context dependency in species interactions may be seasonality. A single geographic area may experience highly variable conditions due to seasonal transitions that modify habitat structure (Dalton et al., 2023; Guiden et al., 2023) or produce temporally dynamic food webs in which consumers face fluctuating

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resource availability (McCary et al., 2021; McMeans et al., 2015). Seasonality may also drive coexistence by granting species temporally limited competitive advantages in different seasons (Brown, 1989a, 1989b) or alter the relative importance of different mechanisms governing community assembly (Fitzgerald et al., 2017), resulting in seasonally distinct ecological communities. Many species interactions cannot be divorced from their seasonal context, underscoring the need to explicitly address the role of seasonality in structuring and maintaining ecological communities (White & Hastings, 2020).

One example of a seasonally dependent species interaction is seed removal by small mammals, which can promote plant recruitment through dispersal (Lichti et al., 2014; Vander Wall et al., 2005) or impede recruitment through predation (Bricker et al., 2010; Orrock et al., 2006). Small-mammal foraging behavior and resource selection may be driven by seasonally dependent factors, such as changing habitat structure through leaf senescence (Bartowitz & Orrock, 2016) and snow cover (Guiden & Orrock, 2021), the availability of different food resources (Merritt & Merritt, 1978), shifting population densities (Schnurr et al., 2004), and the physiological or behavioral demands associated with transitions from warm to cold temperatures (Guiden & Orrock, 2020; Landry-Cuerrier et al., 2008). This seasonal context may interact with other factors governing small-mammal foraging decisions, such as seed size (Celis-Diez et al., 2004), handling costs (Lima et al., 1985), nutrient content (Frank, 1988), and the presence of plant secondary metabolites (Windley & Shimada, 2020). The strength of seed removal is often inferred from the disappearance of seeds in foraging depots after a set amount of time—a method which fails to differentiate between seed predation and seed dispersal (Vander Wall et al., 2005) or account for interspecific or intraspecific variation in foraging behavior across small-mammal communities (Brown et al., 2016; Moore et al., 2022). However, studies integrating monitoring systems such as camera traps (Mortelliti et al., 2019) or passive integrated transponder tag antennas (Kotler et al., 2010) with classic seed removal study designs have demonstrated the substantial effects of inter- and intraspecific variation on seed predation and dispersal (Bartel & Orrock, 2020; Brehm & Mortelliti, 2022). By replicating such studies across seasons, we might more precisely understand the drivers underpinning context dependency in this key biotic filter in community assembly (Orrock et al., 2006).

In this study, we examined seasonal variation in small-mammal seed removal of three woody species common to northern temperate forests of North America (sugar maple, *Acer saccharum*; eastern hemlock, *Tsuga canadensis*; and invasive bush honeysuckle, *Lonicera* spp.), using custom camera traps to observe species-specific foraging behavior over fall, winter, and spring. We hypothesized that seed removal would vary seasonally and be lowest in the winter when cold temperatures and deep snow limit foraging (Guiden et al., 2019). We predicted that the assemblage of species visiting the camera traps would also vary by season, with *Tamias striatus* (eastern chipmunks) being less common or absent in the winter due to their use of torpor (Landry-Cuerrier et al., 2008). We also expected that *T. striatus* and *Tamiasciurus hudsonicus* (North American red squirrels) would focus on the larger *A. saccharum* seeds (Ivan & Swihart, 2000) while the more generalist *Peromyscus* spp. (deer mice) would make use of all three seed species.

METHODS

This study was conducted at the Hamilton College Experimental Forest in central New York state, USA (43.059658, −75.403315), which is typically characterized by warm summers and cold, snowy winters. Our 14 long-term monitoring plots consisted of mixed hardwood forest canopies including both hardwood (*A. saccharum*, *Fagus grandifolia*, *Fraxinus americana*) and conifer (*T. canadensis*, *Pinus strobus*, and *Picea glauca*) species. Some plots also had understories dominated by invasive plants, including buckthorn (*Rhamnus cathartica*) and bush honeysuckle (*Lonicera* spp.). Live-trapping in the summers of 2022–2023 revealed that the small-mammal community is mostly composed of deer mice (*Peromyscus* spp.), with similar relative abundances for eastern deer mice (*Peromyscus maniculatus*; 0.514 ± 0.359; mean relative abundance $\pm$ SD) and white-footed mice (*Peromyscus leucopus*; 0.347 ± 0.310). Other species in the community include occasional red squirrels (*T. hudsonicus*; 0.045 ± 0.128), southern flying squirrels (*Glaucomys volans*; 0.034 ± 0.158), eastern chipmunks (*T. striatus*; 0.024 ± 0.081), and southern red-backed voles (*Myodes gapperi*; 0.008 ± 0.041).

We monitored small-mammal foraging activity using custom, all-season camera traps that were composed of white trash cans with motion-activated cameras (Browning Strike Force HD Pro X, Birmingham, AL, USA) facing down from the bottom of the lid to record activity inside the trap (Figure 1a; Guiden & Orrock, 2020; Soininen et al., 2015). One camera trap was placed at each of the 14 plots, which were >40 m apart. Entry holes 5 cm in diameter were drilled on either side of the containers, and at the bottom of each camera trap, we placed a labeled tray with *Lonicera* spp. (*Lonicera*

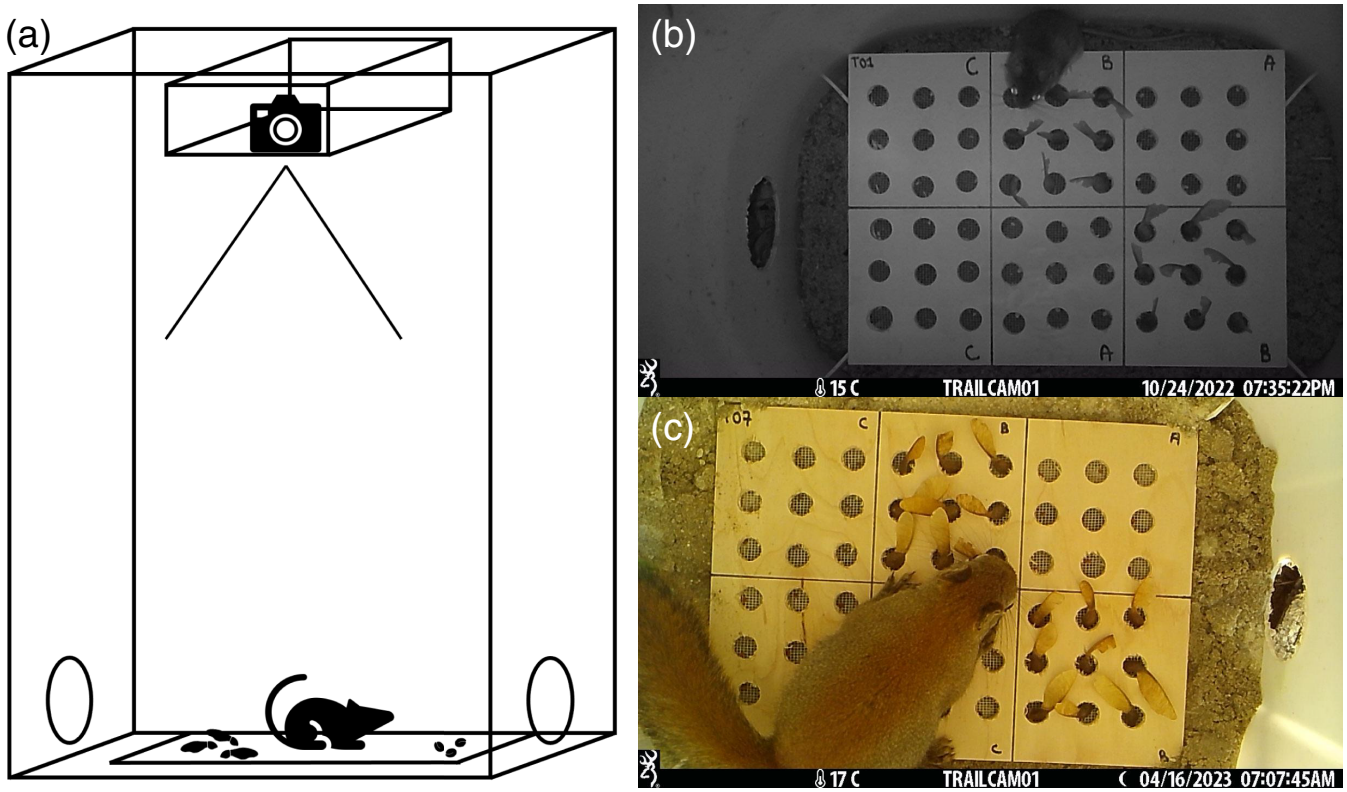


FIGURE 1 (a) Schematic showing the camera trap design, including the container, camera, and seed tray. (b) Still frame from camera footage showing *Peromyscus* spp. foraging on a seed tray. The tray contains 54 seeds, with two labeled 3 × 3 arrays for each of the three species. (c) Still frame from camera footage showing *Tamiasciurus hudsonicus* foraging on a seed tray. Camera traps were set by M. H. Vavra.

maackii and *Lonicera morrowwii*), *A. saccharum*, and *T. canadensis* seeds (Moore et al., 2022). These seeds were selected because they characterize the main cover types in the study area, including dominant hardwood, softwood, and invasive shrub species. They are also commonly found in seed rain traps throughout the forest (P. W. Guiden, unpublished data), indicating that they are prevalent food sources in the area. The three seed species ranged in size, with *A. saccharum* being the largest (0.046 ± 0.023 g), followed by *Lonicera* spp. (0.0025 ± 0.00047 g) and *T. canadensis* (0.0018 ± 0.0016 g). The trays included 54 total seeds, with 18 seeds per species, arranged randomly in 3 × 3 grids (Figure 1b,c; Moore et al., 2022). Cameras and seed trays were deployed for seven nights per session (October 23–30, 2022; November 27/28–December 4/5, 2022; January 22/23–29/30, 2023; and April 15/16–22/23, 2023). At the conclusion of each session, we collected all remaining seeds. We also analyzed video footage to identify foraging small mammals and which seeds they removed. The considerable morphological similarities between *P. maniculatus* and *P. leucopus* prevented reliable differentiation on camera, so we grouped the two species at the genus level. For the larger *A. saccharum* seeds, we also noted whether small mammals processed the seeds in situ or removed them whole from the camera trap (Vander Wall et al., 2005). Supplemental methods can be found in Appendix S1.

We analyzed our data (Vavra & Guiden, 2024) in R version 4.3.0 (R Core Team, 2023). As our data included many zeroes (i.e., cases where no seeds were removed or no small mammals visited seed traps), we used the "glmmTMB" package (Brooks et al., 2017) to create four hurdle models. These models disentangle what factors drove the occurrence (zero-inflation model) and magnitude (conditional model) of seed removal and seed predator activity (Guiden & Orrock, 2020). To understand how seed removal varied over time across different plant species, we first modeled the number of seeds removed as a function of seed species (*Lonicera* spp., *T. canadensis*, and *A. saccharum*) and month (Oct, Dec, Jan, and Apr). We could not include a month × seed species interaction, as it prevented model convergence. We then examined species-specific changes in consumer pressure over time by modeling the number of seed predator visits (defined by observed exits of the camera trap or gaps in recording greater than 1 min) to a camera trap as a function of rodent species (*Peromyscus* spp., *T. hudsonicus*; not enough *T. striatus* were observed to include them in our models), month, and a month × rodent species interaction. The final

two models identified species-specific foraging tendencies by modeling the number of seeds removed as a function of seed species; individual models were used for *Peromyscus* spp. and *T. hudsonicus* because using a single model with an interaction term again prevented model convergence. The fixed effects structures described above were included in both the zero-inflation and conditional models, and each model used a negative-binomial distribution to account for overdispersion. Each model also included plot as a random intercept to account for non-independence, except for the *T. hudsonicus* seed removal model (this species was only observed at four plots, which is insufficient to estimate among-population variance accurately). All models also contained a unique ID random intercept to account for overdispersion. See Appendix S2 for full model structure, including ANOVA results. All results are reported as estimated marginal means using the "emmeans" package (Lenth, 2023) plus or minus one SE. For ease of interpretation, the conditional model results for seed removal are expressed as a proportion (means and SE divided by 18, that is, the number of seeds per species in foraging trays).

RESULTS

Across 56 (14 plots × 4 months) replicates, 34% of seed trays had seeds removed by rodents ($n = 19$), with a total of approximately 8.6% of seeds removed ($n = 259$). The zero-inflation model of seed removal showed that the occurrence of seed removal varied by month ($\chi^2 = 8.40$, df = 3, $p = 0.04$) and was lowest in January (probability of no seed removal: 0.988 ± 0.015), when it was 90% lower than in December (0.859 ± 0.011; $z = 2.74$, $p = 0.03$; Figure 2a). Intermediate seed removal occurred in October (0.886 ± 0.097) and April (0.946 ± 0.052). There was no strong effect of seed species on the occurrence of seed removal ($\chi^2 = 4.73$, df = 2, $p = 0.09$). When seed removal occurred, the conditional model suggested a strong species effect ($\chi^2 = 11.99$, df = 2, $p = 0.002$): *T. canadensis* was six times less likely to be removed (proportion of seeds removed: 0.068 ± 0.037) compared with *A. saccharum* (0.397 ± 0.150; $z = 3.11$, $p = 0.005$) or *Lonicera* spp. (0.397 ± 0.143; $z = 3.26$, $p = 0.003$; Figure 2b). Month had no effect on the number of seeds removed ($\chi^2 = 0.32$, df = 3, $p = 0.96$).

In total, there were 210 visits by small mammals across the 4 months of our study. *Peromyscus* spp. made 125 visits to our camera traps, *T. hudsonicus* made 83 visits, and *T. striatus* made two visits. The zero-inflation model of visits by small mammals showed that the occurrence of visits varied by mammal species ($\chi^2 = 5.12$, df = 1, $p = 0.02$), with *Peromyscus* spp. more likely to visit a plot at least once (probability of no visits: 0.755 ± 0.118) than *T. hudsonicus* (probability of no visits: 0.910 ± 0.058; $z = 1.93$, $p = 0.05$; Figure 2c). Neither month ($\chi^2 = 5.24$, df = 3, $p = 0.16$) nor the mammal species × month interaction ($\chi^2 = 3.59$, df = 3, $p = 0.31$) affected the occurrence of small-mammal visits. When visits occurred, the conditional model indicated a significant mammal × month interaction ($\chi^2 = 9.79$, df = 3, $p = 0.02$). In October, the average number of visits by *T. hudsonicus* at visited plots (13.48 ± 9.24) was almost seven times that of *Peromyscus* spp. in the same month (1.92 ± 1.09; $z = 2.34$, $p = 0.02$). The average number of visits by *T. hudsonicus* at visited plots in October was also over 10 times that of *T. hudsonicus* in December (1.29 ± 1.05; $z = 2.59$, $p = 0.05$). Species ($\chi^2 = 1.30$, df = 1, $p = 0.25$) and month ($\chi^2 = 3.79$, df = 3, $p = 0.29$) alone did not have strong effects.

Throughout the study, *Peromyscus* spp. removed 108 *Lonicera* spp. seeds, 70 *A. saccharum* seeds, and 18 *T. canadensis* seeds ($n = 196$ seeds total). The zero-inflation model of seed removal by *Peromyscus* spp. suggested that the occurrence of seed removal was driven by month ($\chi^2 = 8.17$, df = 3, $p = 0.04$) rather than seed species ($\chi^2 = 3.66$, df = 2, $p = 0.16$; Figure 2d). In January (probability of no seed removal: 0.999 ± 0.003), the occurrence of seed removal by *Peromyscus* spp. was only 2% of what it was in December (0.957 ± 0.067; ratio of Dec to Jan: $z = 2.72$, $p = 0.03$). October (0.970 ± 0.049) and April (0.992 ± 0.015) had intermediate levels of seed removal occurrence. When *Peromyscus* spp. did remove seeds, the conditional model revealed that the number of seeds removed varied by seed species ($\chi^2 = 16.06$, df = 2, $p = 0.0003$) but not by month ($\chi^2 = 5.08$, df = 3, $p = 0.17$). *T. canadensis* was removed by *Peromyscus* spp. about 4.5 times less (proportion of seeds removed: 0.055 ± 0.032) than *A. saccharum* (0.254 ± 0.131; $z = 3.28$, $p = 0.003$) and about 5.6 times less than *Lonicera* spp. (0.310 ± 0.133; $z = 3.97$, $p = 0.0002$). *T. hudsonicus* almost exclusively removed *A. saccharum* seeds ($n = 61$ seeds removed), and neither the occurrence ($\chi^2 = 0.08$, df = 3, $p = 0.99$) nor the quantity ($\chi^2 = 4.49$, df = 3, $p = 0.21$) of seed removal varied by month.

DISCUSSION

Our data identify small-mammal community composition and seasonal variation as key influences on small-mammal seed removal (Figure 2). This study builds on classic seed removal experiments by using motion-activated cameras to track species-specific foraging preferences across multiple seasons, when it is typically intractable to monitor small-mammal foraging under snow. We explore two

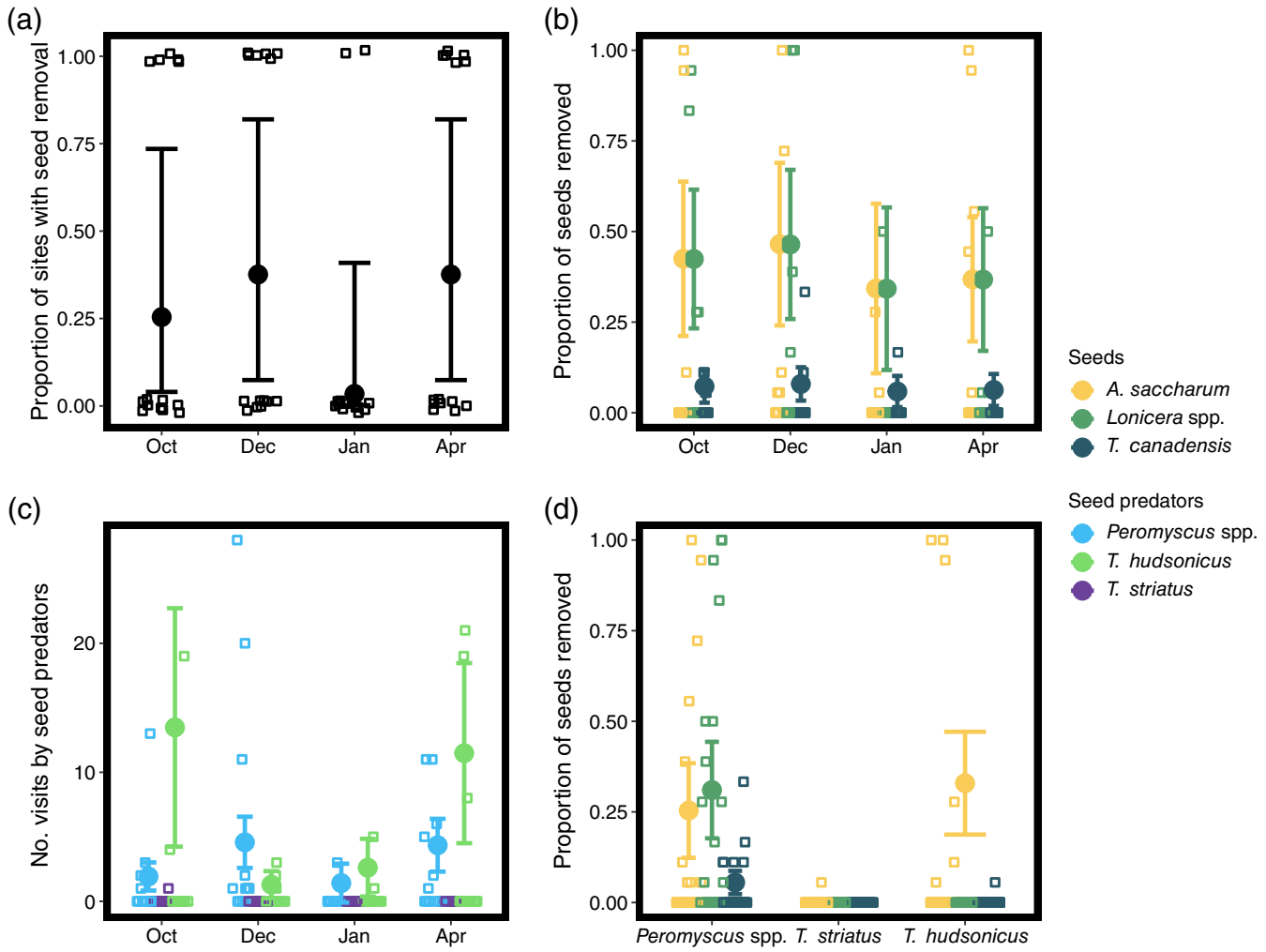


FIGURE 2 (a) The proportion of plots that experienced any seed removal by small mammals across months. The raw data, indicated by empty squares, demonstrate the number of plots where seed removal occurred (1) or was absent (0). (b) The proportion of different seed species removed at each plot across months. (c) The number of times different species of small mammals visited each plot across months. *Tamias striatus* were not included in the model due to insufficient data. (d) The proportion of different seeds removed from each plot by species of small mammal. All seeds for *T. striatus* and *Tsuga canadensis* and *Lonicera* spp. for *Tamiasciurus hudsonicus* were not included due to insufficient data. Data were modeled using a negative binomial distribution but are presented as proportions for ease of interpretation. Empty squares represent raw data, and solid circles represent estimated marginal means. Error bars are SE, except for panel (a), where they represent the upper and lower CLs.

implications of our findings below. First, as generalist small mammals exhibited species-specific foraging preferences, shifts in small-mammal community composition may influence larger-scale plant population processes, such as range shifts (Brown & Vellend, 2014) or species invasions (Bartowitz & Orrock, 2016). Second, the seasonal variation in seed removal recorded here shows how climate change might indirectly affect ecosystems by reshaping seed predation (McMeans et al., 2015). Here, we contribute to a line of research working toward identifying the roles of different consumer species in food webs and their responses to seasonal cycles, which will allow ecologists to better predict trophic interactions as species ranges shift in the Anthropocene (Mortelliti et al., 2019).

Generalist small mammals have subtle foraging preferences

Many small mammals are nocturnal foragers that exploit a wide variety of food resources (Landry, 1970). Because direct observations of rodent foraging are rare (Verde Arregoitia & D'Elía, 2021), it is assumed that many generalist small-mammal species play redundant functional roles. Our data add to a growing body of research that fails to support this assumption (Cramer, 2014; Moore et al., 2022): We identified subtle, but consistent differences in foraging behavior between two common generalist small mammals. *T. hudsonicus* removed only *A. saccharum* seeds, while *Peromyscus* spp. removed all

species in our study, but especially *Lonicera* spp. and *A. saccharum* (Figure 2d). The exclusive use of *A. saccharum* seeds by *T. hudsonicus* in our study may be driven by seed size, as the greater handling costs associated with processing the larger *A. saccharum* seeds may be less significant for the larger-bodied *T. hudsonicus* than for the smaller *Peromyscus* spp. (Ivan & Swihart, 2000; Muñoz & Bonal, 2008), which may be able compensate for the lower caloric content of smaller seeds by consuming them in greater volume (Boone & Mortelliti, 2019). Such unappreciated interspecific variation in resource use is analogous to nuanced partitioning of time among small-mammal species (Guiden et al., 2023; Guiden & Orrock, 2020; Levy et al., 2019). Identifying cryptic differences in the niches of seemingly similar rodents species can reveal one mechanism of species coexistence (Rowe & Terry, 2014; Stephens et al., 2017) that will be key to understanding new species assemblages under climate change, including the northward expansion of *P. leucopus* further into the range of *P. maniculatus* (Long, 1996; Myers et al., 2009).

One surprising result of this study was the extensive use of *Lonicera* spp. seeds by *Peromyscus* spp. (Figure 2d). While *Peromyscus* spp. consume seeds of invasive shrubs such as *Lonicera* spp., these seeds are often thought to be less preferred than native species (Bartowitz & Orrock, 2016; Bierker et al., 2023; Rose et al., 2014; Shahid et al., 2009), suggesting that apparent competition plays a strong role in the spread of invasive shrubs (Orrock et al., 2015). On the contrary, our results suggest that *Peromyscus* spp. in our study area have equal preference between a common invasive and native woody species (Mattos et al., 2013). Whether extensive use of invasive seeds by a ubiquitous seed predator is driven by time since invasion (Harvey et al., 2013), mast cycle dynamics (Moore et al., 2022) or small-mammal community composition (Schnurr et al., 2004) remains unknown. However, discovering the context under which apparent competition between invasive and native woody species is likely to occur, as well as the demographic consequences of widespread seed removal of invasive species (Dangremond et al., 2010; Vander Wall et al., 2005) will likely aid both ecological science and invasive species management.

The high rate of removal of *Lonicera* spp. seeds by *Peromyscus* spp. in our study is particularly interesting when compared with the low removal of the similarly sized *T. canadensis* seeds. Previous studies have demonstrated intermediate to low removal of *T. canadensis* seeds by small mammals, but they primarily attribute this pattern to the seeds' small size, which makes consuming the seeds energetically inefficient despite their high nutrient content (Boone & Mortelliti, 2019) and low levels of unpalatable phenolic compounds (Moore et al., 2022). The significant difference in removal between *Lonicera* spp. and *T. canadensis* seeds in our study suggests that factors other than seed size, such as relative energy density or the presence of secondary defense compounds (Lobo, 2014), are likely at play. These patterns of seed removal may be complicated by our inability to differentiate *P. leucopus* and *P. maniculatus*, which have distinct seed preferences (Cramer, 2014; Moore et al., 2022; Stephens et al., 2019), underscoring the need to further study the functional differences in resource use between these two species. Future research may also examine the implications of this lowered predation of *T. canadensis* seeds within the context of *T. canadensis* declines due to infestation by the hemlock woolly adelgid (*Adelges tsugae*) (Orwig & Foster, 1998).

Generalist small mammals differ in their responses to seasonal habitat changes

Temperate forests undergo dramatic seasonal fluctuations in habitat structure and resource availability as the growing season transitions into winter (Guiden et al., 2019; Stephens et al., 2019). As small homeotherms, small mammals have developed several distinct adaptations to winter, including torpor (Landry-Cuerrier et al., 2008) and use of the subnivium (Pauli et al., 2013). Because small-mammal species with different cold tolerance strategies respond idiosyncratically to winter conditions (Guiden & Orrock, 2020), winter habitat and temperature (e.g., snow accumulation or extreme cold) likely dictates small-mammal exposure to seeds and other food resources. Our results, which demonstrate much lower rates of seed removal than some other similar studies conducted during the summer or fall (e.g., Schnurr et al., 2002), may reflect these variable small-mammal responses to winter conditions. Our data showed that the occurrence of seed removal by *Peromyscus* spp. was lowest in January, while the occurrence of seed removal by *T. hudsonicus* was constant over time. January 2023 represented the coldest month in our study area (average air temperature: $-1.22 \pm 0.07^{\circ}C$; Appendix S3: Table S1) which may have prompted *Peromyscus* spp. to enter torpor or to rely primarily on cached seeds (Pierce & Vogt, 1993). Thus, seeds preyed on primarily by *Peromyscus* spp., such as *Lonicera* spp. (Figure 2d), may face elevated predation in years when either warmer winter weather or deeper snow provide thermal refuge for *Peromyscus* spp. to maintain higher activity levels (Petty et al., 2015; Scott et al., 2022). Conversely, *T. hudsonicus* do not typically enter torpor in cold weather (Brigham & Geiser, 2012) and instead adjust their activity to forage during the warmest parts of the day (Humphries et al., 2005). This may suggest that

consumption of food resources used by *T. hudsonicus*, such as *A. saccharum* seeds (Figure 2d), are less sensitive to winter conditions, though further research is needed to rigorously assess establish this pattern.

Winter climate change is already reshaping small mammals' distribution (Myers et al., 2009) and foraging behavior (Guiden & Orrock, 2021). Even small increases in winter temperatures can profoundly reshape temperate forest food webs by eliminating the subnivium as a critical seasonal refuge that many rodent species rely on (Penczykowski et al., 2017). While both *T. hudsonicus* and *Peromyscus* spp. are thought to use subnivean tunnels to forage in winter (Guiden & Orrock, 2020; Steele, 1998), understanding the relative importance of snow for these two species might help anticipate changes in resource competition or food web structures resulting from climate change. Furthermore, winter climate change might also influence the timing or duration of torpor (Inouye et al., 2000). In our study, *T. striatus* was present in the small-mammal community, but rarely observed during the winter (Figure 2c), likely reflecting prolonged use of torpor. Torpor use can vary substantially in *T. striatus* due to interactions between food availability and winter microclimate (Landry-Cuerrier et al., 2008). Should seasonal torpor use by *T. striatus* be reduced or delayed by climate change, temperate woody species may face increased seed predation.

CONCLUSION

These data demonstrate the power of experimental designs that can identify species-specific trophic interactions and suggest several promising future research questions. For example, seed removal by small mammals is a conditional mutualism, as seeds can be either consumed or dispersed by small mammals. While not a focal point of our study, *T. hudsonicus* and *Peromyscus* spp. differed in their handling of *A. saccharum* seeds: *T. hudsonicus* consumed *A. saccharum* seeds on the tray 18% of the time, while the remainder of seeds were likely cached (Lichti et al., 2014; Steele et al., 2015). On the other hand, *Peromyscus* spp. consumed 83% of removed *A. saccharum* seeds in situ (Appendix S3: Table S2). Studies that track the fate of cached seeds over winter will help link data on small-mammal foraging behavior to population-scale changes in plant recruitment. In addition, pairing camera footage with other technology that can identify individual animals, such as RFID antennas (Brehm et al., 2019), will provide several additional benefits. First, this may allow ecologists to disentangle the roles of *P. maniculatus* and *P. leucopus* in seed removal and assess the proportion of the small-mammal community using foraging depots. Furthermore, identifying personality traits that are more likely to risk exposure to cold, similar to predation risk, could further clarify our understanding of seed removal given the important effects of personality on seed fate (Brehm & Mortelliti, 2022). By studying how different consumer species adjust their activity and foraging behavior to changes in habitat, we will continue to develop predictions of how food webs are reshaped by climate change and the spread of invasive species.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

Data (Vavra & Guiden, 2024) are available from Figshare: https://doi.org/10.6084/m9.figshare.25620519.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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