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FACTORS INFLUENCING FIDELITY OF HOUSE FINCHES TO A FEEDING STATION

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ABSTRACT.—House Finches (*Carpodacus mexicanus*) in North America are a commonly-studied species, but basic aspects of their life history remain poorly understood. I banded and observed marked House Finches at a backyard feeding site in a suburban neighborhood in Atlanta, Georgia from August 2002 through July 2004 to address how age, gender, mycoplasmal conjunctivitis, and time of year affected fidelity of individual House Finches to this site. Of 386 House Finches banded, I recaptured 77 and recorded 1,210 reobservations. More than half (55%) of all birds banded were not seen again and, of those that were, almost half (44%) were seen for less than 2 months. A House Finch's age, gender, and month of capture significantly affected how many times it was subsequently encountered (recaptured or reobserved), but not the duration of time it spent at the site of banding. Young birds (HYs) were encountered more often than adults (AHYs), and females more than males. Young birds with mycoplasmal conjunctivitis were encountered less often than those without, but this was not true for adults. These data indicate high site fidelity of adults during the breeding season and low site fidelity of juveniles early in the summer that becomes higher in late summer. Most birds captured in fall were encountered for up to 3 months. These results are discussed in relation to previous studies and their implications for transmission of *Mycoplasma gallisepticum* among House Finches. *Received 1 February 2007. Accepted 8 September 2007.*

House Finches (*Carpodacus mexicanus*) in North America have become the subject of intense study in the past decade. This species has become susceptible to a newly emerged disease, mycoplasmal conjunctivitis (e.g., Hartup et al. 2001, Roberts et al. 2001a, Farmer et al. 2002, Altizer et al. 2004a, Faustino et al. 2004). This disease, caused by the bacterium *Mycoplasma gallisepticum* (MG), can cause infected House Finches to develop easily recognizable swellings around their eyes (mycoplasmal conjunctivitis) with outbreaks occurring annually during fall and winter (Altizer et al. 2004a, 2004b). House Finches are also studied because of natural variation in male plumage color and, thus, have become a focal species for study of sexual selection and male quality (e.g., Hill 1992b, 1998; Hill et al. 1999; Hill 2002). Finally, House Finches in eastern North America originated from the southwestern United States where they are non-migratory, and there is now interest in development of migratory tendencies in the expanding eastern population (Able and Belthoff 1998, Egbert and Belthoff 2003).

Ironically, despite the large number of studies involving this species, basic aspects of their life history remain poorly understood. For example, few studies have examined movements of birds at a single site, such as at a backyard feeding station. Thus, little is known of their daily activity patterns at feeding stations, and how this changes throughout the year. What little is known comes from summaries and reports from long-term banding stations (McClure 1989, Hamilton 1992, Hilton 1994). These studies have shown that House Finches can be characterized by large-scale movements and seasonal turnover (Hamilton 1991, 1992; Hilton 1994). Previous studies contain important information, but most involved comparing rates of recapture, which may not accurately estimate fidelity to a feeding station (Hamilton 1992), and most did not examine factors affecting site fidelity, such as demographic aspects. Given that transmission of MG is likely to occur where birds gather in large numbers, such as at bird feeders, learning how feeders are used by House Finches is important. Further, since mycoplasmal conjunctivitis is a newly emerged disease, the effect of this disease on feeder use and local movements has yet to be clarified.

I report results of a 2-year study in which House Finches were trapped, uniquely banded, and reobserved at a single suburban backyard bird feeding station in an effort to elucidate the factors influencing their site fidelity.

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My specific objectives were to learn: (1) if the number of times individual House Finches captured or reobserved ('encountered') varied with time of year, age or gender, or whether or not they had conjunctivitis; and (2) if these same factors influence the duration of each individual's presence at the trap site (as measured by the time between initial capture and last encounter).

METHODS

Site Description.—The study site was the backyard of the author's house in a suburb of Atlanta, Georgia (33° 39′ N, 84° 26′ W). The yard was approximately 30 × 40 m, and contained three tube-style bird feeders on metal poles in the middle of the yard. All feeders were filled with black-oil sunflower seed, the preferred food of House Finches (Hill 1993).

Trapping and Banding.—I trapped House Finches from the beginning of August 2002 through the end of July 2004 (24 months). I conducted trapping sessions at least once a week for a minimum of 3 hrs each morning. I used a combination of mist nets (9 m long, with 30 mm mesh) placed around the feeders and two walk-in cage traps following Hill (2002). The cage traps were cylindrical and made of hardware mesh; each contained a standard bird feeder filled with sunflower seed. Two entrances in the hardware mesh near the bottom of the trap allowed birds to walk in (via a wooden perch placed outside each entrance). House Finches were readily captured by setting this trap in place of the lure feeders on trapping days.

I banded each bird upon capture with a numbered USGS metal band and three color bands in a unique color-metal band combination for later reobservation (Hill 1992a). I recorded each bird's age as either after-hatch year (AHY) or hatch-year (HY) based on skull ossification, plumage, or retrix fault bars (Pyle 1997). Similarly, I assigned gender of each bird based on the dimorphic adult plumage of the species (Hill 1993). Most HY birds were still in juvenile plumage and gender could not be assigned. I recorded the presence or absence of conjunctivitis in all birds based on outward signs of conjunctival swelling and/or ocular discharge following Altizer et al. (2004b). This same procedure was performed for all newly captured as well as recaptured birds.

Reobservations.—I watched for banded individuals at the feeding station, usually in the mornings, when activity at the feeders was high. I recorded the band combination, gender, date and time of observation, and the presence or absence of conjunctivitis whenever a banded House Finch was reobserved at or near the feeders. House Finches often visit feeders in large flocks, especially during winter (Hill 1993) and I recorded the number of other finches in the flock with the reobserved individual. Every effort was made to watch for banded individuals on most days each month.

Data Analyses.—I used the pooled trapping and reobservation data from the 24-month period for this study. I first ensured the reobservation data contained no erroneous band combinations (Milligan et al. 2003) and created two variables for testing site fidelity of House Finches. I summed all of the encounters (first capture + any subsequent recaptures or reobservations) for every bird. If the bird was not encountered after initial capture, it was assigned a '1'. I assumed this value represented the approximate frequency at which the individual used the feeding station. Second, I calculated the time in days between the first (initial capture) and last (recapture or reobservation) encounter for each individual, using only those individuals that were encountered two or more times. This value was assumed to represent the time span over which the individual visited the feeding station. I used univariate analyses of variance, using either of the above variables as dependents (after log-transformation) with age (AHY or HY), gender, conjunctivitis status (with, without), month (of initial capture), and all two-way interactions between age, gender, and conjunctivitis as independent variables. Significance was accepted when $P < 0.05$ but results were considered nearly significant when $P < 0.1$.

RESULTS

I banded 386 separate individuals over the 24-month study period (Table 1), and later made 77 recaptures and 1,210 reobservations of these individuals for a total of 1,673 encounters. Overall, 55.7% of all House Finches banded were not recaptured or reobserved after initial capture (Fig. 1A). Another 24.7%

TABLE 1. Trapping totals (new captures only) and age ratios of House Finches by month at a feeding station in Atlanta, Georgia (trapping data pooled over 2 years). House Finches could not be reliably assigned to age classes in December.

Month	% AHY	% HY	Total banded
Jan	100.0	0.0	21
Feb	100.0	0.0	16
Mar	100.0	0.0	8
Apr	100.0	0.0	10
May	16.3	83.7	43
Jun	8.3	91.7	36
Jul	6.1	93.9	49
Aug	18.2	81.8	40
Sep	33.3	66.7	62
Oct	48.1	51.9	34
Nov	38.9	61.1	35
Dec	N/A	N/A	32
Totals	34.9	65.1	386

were recorded up to five times. Combined, 80.4% of all House Finches banded were encountered between one and five times at the feeding station, and 19.6% of all House Finches were encountered more than five times. Only 6.7% of all birds were encountered 20 or more times (Fig. 1A). Examination of the time period between first and last encounter for all individuals encountered two or more times indicated 44% of the House Finches were present less than 50 days (Fig. 1B), while only 14 % were encountered over a span longer than 1 year.

There were significant or nearly significant effects of age, gender, month, and an age*conjunctivitis interaction effect on number of times an individual was encountered (Table 2). There were no significant effects or significant interaction effects in the second ANOVA using time span between first and last encounter as the dependent variable. Birds captured in April, August, September, October, November, and December were all encountered more than the mean of 4.15 encounters (Fig. 2A). Birds captured in March, April, August, October, and December were subsequently encountered for longer time spans than the mean of 79.5 days (Fig. 2B). Birds captured in May, June, and July (mostly HYs; Table 1) were encountered less than 50 days. Birds captured in June were encountered only 1.5 times on average, for fewer than 50 days, but yet in June there were large flocks

TABLE 2 ANOVA examining factors influencing number of times House Finches were encountered at a feeding station in Atlanta, Georgia. The nonsignificant interaction of Gender*Conjunctivitis is not shown. Only birds of known age and gender were used in the analysis.

Variable	df	Mean square	*F*	*P*
Age	1	0.784	3.513	0.063
Gender	1	0.969	4.345	0.039
Conjunctivitis	1	0.427	1.912	0.168
Month	11	0.408	1.828	0.052
Age * Conjunctivitis	1	0.998	4.474	0.036
Gender * Age	1	0.273	1.223	0.270
Error	176	0.223		

at the feeding station (Fig. 2C). Conversely, in April, there were few House Finches observed at the feeders, but those that were captured in this month (all adults; Table 1) were later frequently encountered (~5 times) for ~5 months later (150 days).

The effects of age and gender on number of encounters per individual varied (Fig 3A). Young House Finches were encountered more often on average than adults, and females were encountered more often than males. Overall, young females were encountered most often. Birds initially captured with conjunctivitis were not subsequently encountered differently than those without (Table 2, Fig. 3B). However, there was a significant interaction of age and conjunctivitis (Table 2, Fig. 3B); adults with conjunctivitis had a slightly higher encounter rate than those without, but young birds with conjunctivitis had a lower rate than those without.

DISCUSSION

There was high seasonal turnover of House Finches at this suburban site in Georgia. High turnover rates of this species have been documented in a number of studies in eastern (Hamilton 1992) and western North America (McClure 1989). Only a small percentage of House Finches at my site frequented the feeding station over 20 times (6.7%) and for longer than 1 year (14%). These numbers indicate that only a small fraction of the House Finches observed at backyard bird feeders in suburban Atlanta, Georgia remain at individual sites year-round. Thus, most House Finches at this (and perhaps other) feeder sites must

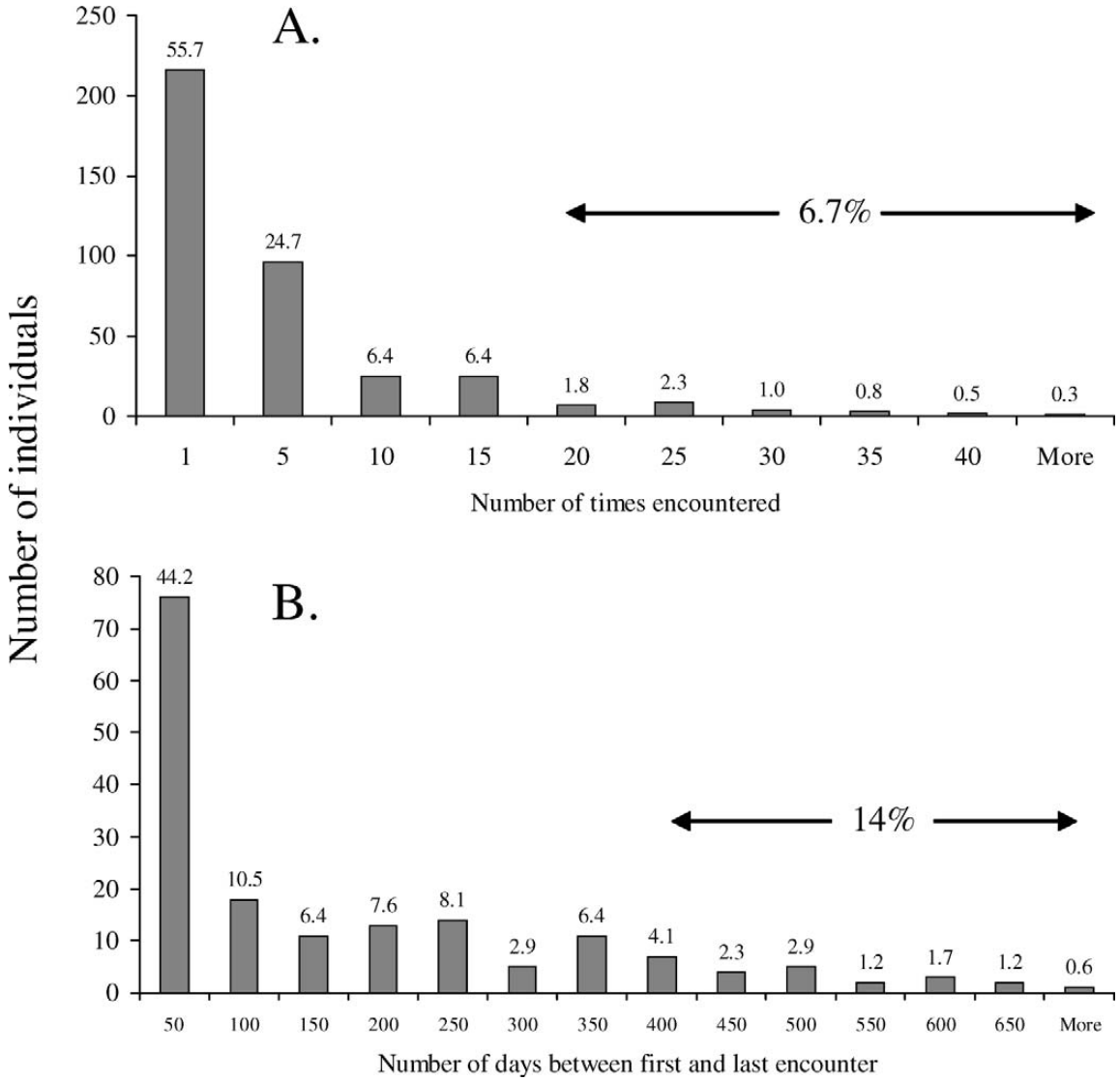

FIG. 1. A. Distribution of all House Finch encounters over 24 months. Values above bars show percentages of the total number of banded individuals (n = 386). B. Number of days between first (initial capture) and last encounters (final recapture or reobservation) of House Finches over 24 months. Only individuals with two or more encounters are included. Values above bars show percentages of the total number of banded individuals with two or more encounters (n = 172).

have been either transient individuals or young of the year that rarely remained at the site. I trapped 386 separate House Finches at this one site over the 2-year period and many new birds were trapped each month, even though the average number of birds seen at the site was <6 (Fig. 2C). Thus, it is likely that most House Finches observed at backyard feeders are infrequently the same individuals.

My data provide additional information on factors influencing feeder fidelity in House Finches. For example, there was a seasonal component to the turnover rate at this site. House Finches trapped in April, which were invariably adults (Table 1), tended to frequent the site throughout the summer, but not much longer. These probably represented adults nesting in the area throughout the summer. Flock sizes increased in May and June, which could be explained as adults and their fledglings frequenting the feeding station. Birds trapped in these months (mostly young; Table 1) were rarely seen after their initial trapping. Encounter rates increased in August and remained high through the fall. Most of the birds trapped during these months were HYs,

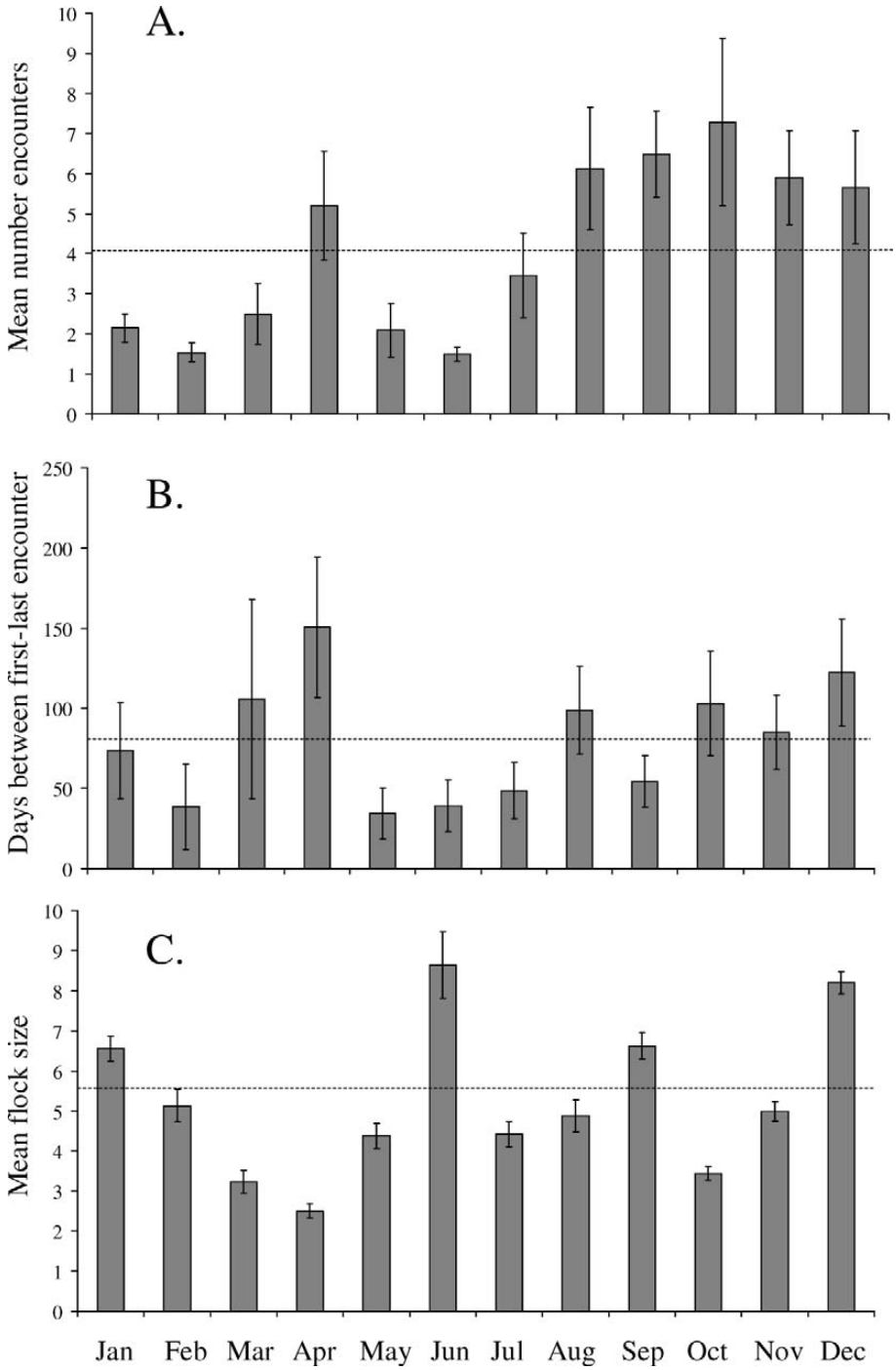

FIG. 2. A. Mean number of encounters of normal House Finches per month. B. Mean length of time between first and last encounter of normal House Finches per month. C. Monthly variation in flock sizes of House Finches observed at feeders over 24 months. Dashed lines indicate 24-month averages.

although they would have been independent of their parents and perhaps traveling in loose flocks (Hill 1993).

Seasonal turnover and fidelity to this site were characterized by high fidelity of adults during the breeding season, low fidelity of juveniles early in the summer, but becoming higher in late summer. Most birds captured in fall were encountered for up to 3 months. These might represent wintering individuals. Fidelity to this site declined in late winter and, by February, most birds captured were rarely

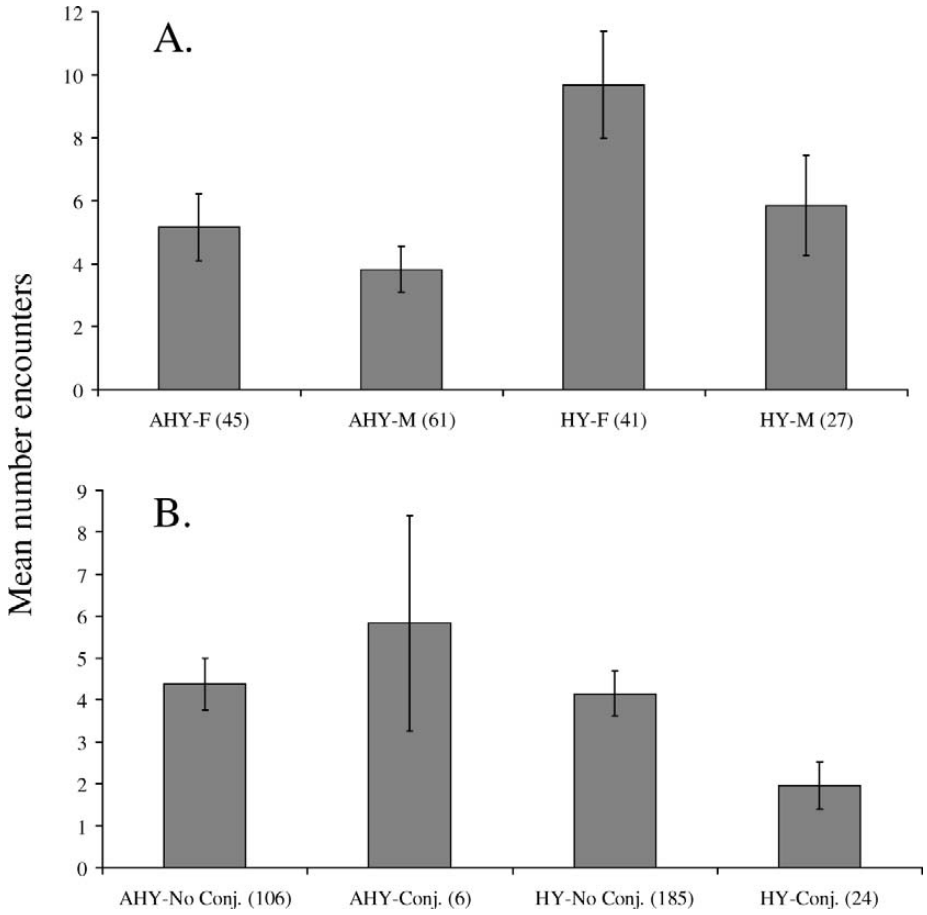

FIG. 3. A. Mean number of encounters of normal House Finches in all age and gender classes. B. Mean number of encounters of House Finches in each age/conjunctivitis category. Sample sizes for each class shown in parentheses in both charts.

seen again. Adult breeders arrived in April and remained throughout the summer.

Direct comparisons of encounter rates by age and gender classes indicated young House Finches were encountered more frequently than adults and females were encountered more than males (Fig. 3A). If the number of encounters represents relative feeder use, this result has important implications for transmission of MG. Roberts et al. (2001b) found that young birds were more likely to be clinically infected than adults. Moreover, young female House Finches were found to have conjunctivitis more than any other age and gender class (Altizer et al. 2004b). My results indicate that young females are encountered most often at a feeding station. Therefore it may be possible that younger individuals, especially females, contract this disease more often because they visit bird feeders more than other individuals, thereby coming in contact with any infected individuals or contaminated surfaces more frequently.

Also of importance to MG dynamics is the extremely high turnover of individuals I observed as 386 separate birds were trapped at a single feeding station during this 2-year study. If this feeder site typifies the use of other feeders in this geographic region, this turnover rate is likely a factor in the transmission of MG among House Finches. Moreover, increased feeder use by individuals during fall compared to other seasons (Fig. 2A) occurs in the same time period as annual outbreaks of MG in this area (Altizer et al. 2004b), thereby increasing the likelihood of transmission between individuals through contact at feeders.

The results of this study serve as an example of how the practice of bird feeding can influence the life history of a bird species. House Finches clearly have adapted to using

feeders in eastern North America (Dhondt et al. 1998) and this study shows they vary in their fidelity to these feeders by age, gender, and time of year. Increased feeder use during certain time periods or by select age/gender classes could be an important driver of the spread of *Mycoplasma gallisepticum*.

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