

canus), American Goldfinch (*Spinus tristis*), and Northern Cardinal (*Cardinalis cardinalis*). To assess condition, we calculated a species-specific index of energy reserves (i.e., fat and muscle) that adjusted body mass for individual differences in size by regressing mass against tarsus length in SAS Enterprise Guide 4.3 (SAS Institute Inc., Cary, NC). The resulting residuals were used as an index of condition in a linear model with housing density to assess the impact of urbanization on body condition. Species and the interaction of species and housing density were also included in the model to determine if there were species-specific differences in how body condition was impacted by urbanization. A second model was constructed which included year to determine if the different sampling methodologies used in 2010 and 2011 affected the results. Year and its interactions with species and housing density were not significant and did not qualitatively change the results of the first model, so only the findings for species and housing density were reported below.

Results and Discussion

The credit card hypothesis proposes that body condition will decline with increasing urbanization, but we found no evidence to support this prediction. Our index of condition did not differ among species ($F_{3, 790} = 0.08, P = 0.9734$) and was unrelated to housing density ($F_{1, 790} = 0.96, P = 0.3283$). In addition, the interaction between species and housing density was not significant ($F_{3, 790} = 0.85, P = 0.4650$), which suggested that increases in housing density did not lead to any species-specific responses in condition.

A small number of other studies have calculated mass-adjusted indices of condition and compared them between urban and nonurban habitats. Investigations of the Northern Cardinal, Abert's Towhee (*Pipilo*

Table 1. Number of individuals of the focal species captured each year

Species	2010	2011	Total
American Goldfinch	35	80	115
House Finch			
House Sparrow	114	272	386
Northern Cardinal	28	30	58
Total	222	568	790

aberti), and Curve-billed Thrasher (*Toxostoma curvirostre*) have shown little change with urbanization (Fokidis et al. 2008, Rodewald and Shustack 2008), while condition of the Northern Mockingbird (*Mimus polyglottos*) improves with increasing urban development (Fokidis et al. 2008). Results from House Sparrow studies have been mixed, with one study finding no difference in condition relative to the degree of urbanization (Fokidis et al. 2008) while another reported lower-quality adults in cities (Liker et al. 2008). However, after sampling for additional years, adding study sites, and modifying their statistical approach, the authors of the later study concluded body condition did not vary with urbanization (Bokony et al. 2012).

Taken together, our results and those of other researchers do not support the credit card hypothesis. For most species, body condition is unaffected by urbanization rather than declining with increasing development. Therefore, high densities of animals in cities compared to nonurban environments do not result from an increase in the proportion of poor-quality individuals in urban habitats.

Despite the lack of support for the condition prediction made by the credit card hypothesis, the assumptions relating to predation and food availability that are the foundation of the hypothesis suggest two other mechanisms that could drive density

changes in wildlife relative to urbanization (Shochat 2004). The greater availability of food resources in metropolitan areas compared to undeveloped habitats may support larger populations of wildlife (Marzluff 2001), a phenomenon referred to as bottom-up population control. Alternatively, a reduction in predation pressure with increasing urbanization could lead to higher survival rates, producing larger populations due to relaxed top-down population control (Gering and Blair 1999).

In the remaining two years of our study, we will quantify both food availability and survival rates along the gradient of urbanization in Champaign County to assess the influence of bottom-up and top-down control. Through this work, we hope to identify the mechanisms responsible for shaping the community structure of wildlife in urbanizing landscapes.

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