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RESEARCH ARTICLE

Emotions as Drivers of Wildlife Stewardship Behavior: Examining Citizen Science Nest Monitors' Responses to Invasive House Sparrows

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ABSTRACT

Growing evidence suggests wildlife stewardship behaviors might be affected by emotional dispositions toward particular species. To test this hypothesis, we studied wildlife management choices made by backyard citizen scientists ($N = 448$) involved in two North American bird nest monitoring projects. Our exploratory study characterized nest monitors' efforts to manage invasive house sparrows, which compete with native songbirds for nesting sites, and examined the relative influence of cognitive and affective factors on management orientations. Results revealed that nearly all respondents engaged in some form of house sparrow management, and most respondents favored a combination of lethal and non-lethal management approaches. Core affect, emotional dispositions, and experiential variables were the primary drivers of citizen scientists' management decisions, with anger toward house sparrows and firsthand contact with house sparrow damage as the strongest positive correlates of lethal management orientations. Findings highlight the potentially powerful influence of affect and emotions on wildlife stewardship actions.

KEYWORDS

Citizen science; core affect; emotional dispositions; human-wildlife conflict; invasive species

Introduction

Millions of people intentionally manage songbirds by providing habitat, food, and nesting sites in their “backyards” (i.e., non-commercial private lands). However, such activities typically occur without any type of formal oversight, and there is a growing need to understand factors affecting ecosystem dynamics in human-dominated landscapes (Alberti et al., 2003). The data gap might be addressed through citizen science, a form of open collaboration where members of the public participate in the scientific process to address real-world problems in ways that include identifying research questions, collecting and analyzing data, conducting experiments, interpreting results, making new discoveries, developing technologies and applications, and solving complex problems (USEPA, 2015). Because of its inherently participatory nature, citizen science presents unique opportunities to study ecological benefits associated with stewardship practices and to identify the diverse cognitive, affective, and experiential factors that influence humans' decision-making with respect to backyard wildlife management (Cooper, Dickinson,

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Phillips, & Bonney, 2007). These insights could enhance general understanding of human activities as drivers of complex social–ecological systems (Crain, Cooper, & Dickinson, 2014).

We studied participants in a citizen science project in which nestbox monitors reported their actions to manage invasive house sparrows (*Passer domesticus*), which aggressively compete with native cavity-nesting North American songbirds, including eastern bluebirds (*Sialia sialis*) for nesting sites. Our citizen science project adopted a neutral stance with respect to prescribing management options, but most participants were likely familiar with the recommendations for managing sparrows and mitigating threats to native nesters that are prominently displayed on the websites of many songbird conservation organizations (e.g., North American Bluebird Society). These recommendations range from removing house sparrow nests to trapping and killing adult sparrows. However, no studies have explored the extent to which these strategies are applied and the array of factors that influence nest monitors' decisions about house sparrow management.

This relatively unexplored system provides an ideal venue for investigating a topic of increasing interest among both natural and social scientists: the dynamic interplay between cognitive and affective drivers of wildlife stewardship behavior. Although rational logic models (e.g., structured decision-making) typically guide professional wildlife management practices, individual decisions about wildlife are not driven solely by conscious, analytical cognitions. Another subconscious processing domain exists within the human psyche (Kahneman, 2011), and generates the core affect and emotional dispositions that may be particularly salient in cases of human–wildlife conflict (Hudenko, 2012; Jacobs, Vaske, & Roemer, 2012). Despite these recent insights, little research has explicitly examined the role that affect and emotions play in citizen-based wildlife management. In this article, we rely on self-reported data from backyard citizen scientists to characterize current house sparrow management practices and explore the relative influence of cognitive and affective dispositions on wildlife stewardship choices.

Emotions and decision-making

For years, efforts to understand people's decisions about natural resource management have focused primarily on cognitive processes and behavioral models (Jacobs et al., 2012a). Cognitive frameworks suggest that decision-making is a deliberative and rational process that requires calculated assessments and conscious control (Hudenko, 2012; Wilson, 2008). Many cognitive approaches to understanding human behavior have focused on motivations and satisfactions as key drivers of decision-making, particularly with respect to wildlife management (Vaske & Manfredi, 2012). Other comprehensive cognitive theories of behavior have emerged from psychology, including the theory of planned behavior (Ajzen, 1991) and value-belief-norm theory (Stern, 2000). Each of these models is based on the general assumption that values, attitudes, norms, and perceived behavioral control influence an individual's behavior.

Building on these theories, researchers studying human dimensions of wildlife have developed frameworks such as the cognitive hierarchy to measure general values and basic belief structures (which are relatively abstract and non-specific) that shape more specific cognitions such as attitudes and norms (which are more specific and object- or situation-based) (Vaske & Manfredi, 2012). Although informative, these cognitive

models typically explain, at best, half of the variability in wildlife-related behavior (Jacobs et al., 2012b). Hence, there is a potential need to explicitly examine and account for affective and emotional drivers of human behavior (Dolan, 2002; Fishbein, 2008; Hudenko, 2012; Lerner & Keltner, 2000; Peters, Västfjäll, Gärling, & Slovic, 2006).

Emotions emerged in the course of biological evolution as adaptive physiological responses to environmental stimuli (Bernstein, Penner, Clarke-Stewart, & Roy, 2006; Darwin, 1965; Jacobs et al., 2012b), and emotional states are a common currency universally recognized across multiple human cultures (Ekman, 1993). Despite this commonality, emotions have historically been difficult to conceptualize, define, and interpret (Izard, 2007; Plutchik, 2001; Scherer, 2005). Most definitions agree that emotional responses to stimuli consist of some combination of reactions and impulses (e.g., immediate, innate physiological and psychological changes), behavioral tendencies (e.g., specific, goal-directed actions), and affective experiences (e.g., feelings or valence-based evaluation of an object or situation) (Izard, 2007; Jacobs et al., 2012b). These emotional responses are often driven by two broad attributes of subconscious decision-making pathways: core affect and emotional dispositions.

Core affect, broadly described as a simple, non-reflective state of feeling (positive or negative) is an integral blend of hedonic and arousal values that serves as a key building block for emotions (Russell, 2003). Core affect may exist in free-floating form (e.g., moods), or it may be attached to a particular stimulus (e.g., general feelings about a species), and the basic concept has been used to explain a variety of human judgments and decisions (Peters et al., 2006). In turn, emotional dispositions, which are influenced by core affect, denote criteria against which the emotional relevance of a stimulus is appraised (Jacobs et al., 2012b; Plutchik, 2001). These traits vary among individuals and tend to be relatively stable (e.g., fear of spiders, joy of seeing puppies). Assessments of emotional dispositions can be used to predict emotional reactions to particular objects, events, or situations.

In many cases, core affect and emotional dispositions interact to produce unconscious mental shortcuts, or heuristics, that dictate behavioral responses (Finucane, Alhakami, Slovic, & Johnson, 2000; Kahneman, 2003), but the relative magnitude of their influence on decision-making remains the subject of substantial debate. Some scholars theorize affect and emotions as originating entirely separate from the cognitive path of mental processing. Others advocate a more integrated perspective in which an individual experiences a stimulus and associated physiological arousal, and then the individual conducts a cognitive appraisal (i.e., evaluation or judgment) of the stimulus. It is the combination of arousal and appraisal that generates an affective response (Bernstein et al., 2006; Lazarus, 1982). Similar dual process models account for automatic, unconscious responses based on affective processes (an experiential pathway) as well as controlled, conscious responses based on cognitive processes (an analytical pathway), depicting distinct reasoned and reactive routes to decision-making that often occur at different temporal scales (Hudenko, 2012; Kahneman, 2011; Wilson, 2008). This type of integrated thinking about the independent and interactive roles of cognitive and affective elements (e.g., core affect, emotions) in decision-making have gained traction in the literature (Jacobs et al., 2012b; Lerner & Keltner, 2000). Such insights have even inspired an expanded version of traditional cognitive behavior theory, the reasoned action approach, which explicitly acknowledges emotional dispositions as key antecedent to beliefs, attitudes, and behavior (Fishbein, 2008).

Consequently, many have called for decision-making models that reflect a balance of cognitive and affective processes, particularly with respect to wildlife management (Wilson, 2008).

Emotions and wildlife stewardship behavior

As evolutionary theory suggests, humans have a strong predisposition to react emotionally to animals (Jacobs, 2009; Kellert & Wilson, 1993). For example, many people experience negative reactions to snakes even if they have no logical reasons to fear them based on previous personal encounters (Öhman, Flykt, & Esteves, 2001). Preexisting emotional appraisals are further refined through additional interactions (either direct or indirect) with certain species. These collective physiological and experiential forces create powerful affective triggers that can shape human responses to wildlife (Hudenko, 2012; Jacobs et al., 2012b; Manfredo, 2008; Wilson, 2008). However, existing work explicitly examining the role core affect and emotional dispositions in human–wildlife interactions is rare and primarily theoretical in nature (Hudenko, 2012; Jacobs, Fehres, & Campbell, 2012a; Jacobs et al., 2012b). Some studies have highlighted potentially powerful effects of affect and emotions on wildlife value orientations (Dayer, Stinchfield, & Manfredo, 2007), wildlife tourism experiences (Ballantyne, Packer, & Sutherland, 2011), and environmental stewardship (Vining, 2003). More recent work has examined the influence of emotional dispositions on wildlife management preferences, revealing that certain emotions (e.g., fear, disgust) predict support for control of large carnivores (Frank, Johannson, & Flykt, 2015; Jacobs, Vaske, Dubois, & Fehres, 2014).

The interaction of cognitive, affective, and experiential factors may be particularly powerful among citizen scientists, who are often intellectually and emotionally invested in the conservation of particular taxa or systems (Bonney et al., 2009). Typical citizen scientists may be simultaneously driven by a desire to build knowledge and awareness for personal or scientific gain (cognitive variables) and strengthen affective bonds to species or ecosystems of interest (affective variables), all the while interacting with the system itself (experiential variables). Citizen science therefore provides an ideal context through which to examine the dynamic interplay between cognitive and affective dimensions in citizen-based wildlife management decisions. In this exploratory article, we examined the role of core affect and emotional dispositions on management preferences for the invasive house sparrow. Using data from a sample of citizen science nest monitors, we identified house sparrow management practices and orientations and examined the factors that influenced those management orientations. Our specific objectives were to (a) characterize nest monitors' current house sparrow management practices and general management orientations; and (b) explore the relative influence of cognitive, affective, and experiential factors on house sparrow management orientations.

Methods

Study population

We collected data through Web-based surveys of two groups engaged in citizen science songbird nest monitoring efforts. The first survey population consisted of individuals who enrolled in the Cornell Lab of Ornithology and Hunter College's House Sparrow Project, an

endeavor conducted in 2013 to fill data gaps surrounding backyard management practices and assess the decision-making process of citizen scientists who specialize in nest monitoring. We recruited House Sparrow Project participants through the North American Bluebird Society and the Cornell Lab of Ornithology's NestWatch Project, a nationwide citizen science monitoring program designed to track status and trends in the reproductive biology and nesting behavior of birds (<http://nestwatch.org/>). Of the 242 people who registered to participate in the House Sparrow Project, 144 completed a pre-program survey (response rate = 60%). Participants lived throughout the United States and Canada.

To augment the smaller House Sparrow Project sample and create an opportunity for comparisons and contrasts with other nest monitors, we conducted an additional identical survey with a random sample of the approximately 7,000 participants in the NestWatch Project who did not register for the House Sparrow Project. Of the 619 NestWatchers who received the survey, 304 responded (response rate = 49%). Although some participants in the NestWatch sample (45%) had heard of the House Sparrow Project, they had elected not to participate for a variety of reasons (e.g., insufficient time, lack of interest).

Survey instrument and implementation

We created survey items to address key constructs of interest. For our first objective, we asked respondents to indicate whether or not they had taken action to manage house sparrows. If an individual had engaged in sparrow management, he/she was asked about the specific actions taken and their preferences for various management approaches. All participants (including those who did not actively manage sparrows) were asked to rate the overall acceptability of specific management actions on an 8-item scale ranging from $-3 = \textit{extremely unacceptable}$ to $+3 = \textit{extremely acceptable}$. Items on this scale mirrored the list of potential management actions and were grouped into three major categories in the exploratory factor analysis of management orientations: no management, non-lethal or passive management, and lethal or active management.

To address our second objective, we developed survey items that would assess a variety of potential behavioral predictors. In addition to basic demographic variables (e.g., age, gender), these predictors were grouped into three major categories:

Cognitive Factors

Multiple scales were used to measure cognitive aspects of human-sparrow interactions. These factors included scales designed to measure nest monitoring motivations and beliefs about the human-nature relationship. Items were adapted from existing instruments measuring motivations (e.g., Manfredi, Driver, & Tarrant, 1996) and value orientations (e.g., Teel & Manfredi, 2010) and reworded to match our research context. The eight motivation items (rated from $1 = \textit{not at all important}$ to $7 = \textit{extremely important}$) revealed two different motivational constructs: appreciation-oriented motivations focused on aesthetic enjoyment of and personal connections with birds and conservation-oriented motivations that focused on contributions to bird management and conservation.¹ A separate 6-item scale (rated from $-3 = \textit{strongly disagree}$ to $+3 = \textit{strongly agree}$) revealed two different perspectives regarding the human nature relationship: the eco-responsibility orientation explicitly acknowledged humans' obligation to act as ecological stewards; the eco-isolation orientation recognized a clear distinction between humans and nature and encourages minimal levels

of interaction between the two. We created the final cognitive scale in an attempt to assess participants' beliefs about the role of science in wildlife management, a concept that has been frequently discussed as an important outcome in the field of citizen science, yet one that has rarely been measured (Jordan, Crall, Gray, Phillips, & Mellor, 2015). Our scale used six items (rated from $-3 = \textit{strongly disagree}$ to $+3 = \textit{strongly agree}$): half of the items emphasized a "science is beneficial and necessary" approach (hereafter referred to as science-based management), and half of the items emphasized the value of "experience, intuition, and feelings" in addition to science when it comes to wildlife decision-making (hereafter referred to as experience-based management).

Affective factors

Multiple scales were used to measure affective elements of human-sparrow interactions. These questions included items designed to measure core affect (i.e., general feelings) and emotional dispositions toward native songbirds and house sparrows. The four core affect items (rated from $-3 = \textit{very negative feelings}$ to $+3 = \textit{very positive feelings}$) asked participants how they would feel about each experience (e.g., "Seeing a bluebird/house sparrow flying/nesting on your property"). The eight emotional disposition items (rated from $-3 = \textit{strongly disagree}$ to $+3 = \textit{strongly agree}$) measured discrete groups of emotional dispositions based on Plutchik's (2001) model of emotional concepts. These emotions included feelings such as happiness or excitement to see native songbirds, sympathy or sadness for native songbirds displaced or injured by sparrows, empathy for house sparrows engaging in nesting behavior, and disgust and anger toward house sparrows. Items ultimately grouped into three major categories of emotions that could influence management orientations: "joy seeing bluebirds," "pity for bluebirds," and "anger toward house sparrows."

Experiential factors

Because the cognitive and affective antecedents of behavior and decision-making are shaped by previous experience (Hudenko, 2012), we also included multiple dichotomous items that assessed individuals' monitoring experience: years monitoring (5 or fewer vs. more than 5), number of nests monitored (fewer than 10 vs. 10 or more), and direct observation of damage caused by house sparrows (damage observed vs. damage not directly observed).

The survey instrument was designed and implemented using the Qualtrics Web-based survey software tool. We used a multiple-contacts survey approach (a primary email with three separate reminders sent to non-respondents at weekly intervals) to reach both the House Sparrow Project and the NestWatch populations. Implementation for the House Sparrow Project participants was initiated in April 2013, early in the breeding season and prior to any project-related activities. Implementation for the NestWatch participants was initiated in July 2013, during the breeding season. All data were collected by August 2013. Because nearly all of the participants had some previous experience with nest monitoring (generally) and house sparrows (specifically), the timing of survey implementation for the different samples was presumed to exert minimal influence on the results.

Data analysis

For scales with multiple items we assessed reliability of latent constructs using Cronbach's alpha (three or more items) or Spearman's rho (two items) and discriminant validity using

Principal Axis Factoring (PAF). We conducted oblique rotation of factor loadings to simplify the data structure and account for correlations among the latent components of each scale (Costello & Osborne, 2005). We retained all factors that explained at least 10% of the overall variance and items with pattern and structure matrix factor loadings $\geq .400$. In rare cases, items with cross-loadings $\leq .400$ were retained when their content was integral to the construct. We verified content validity of latent constructs by ensuring that items within each factor were meaningful, logical, and interpretable. These construct means were then used in conjunction with other variables to address the second research objective.

We used Two Step Cluster Analysis, a method that has been previously used to identify distinct groups of stakeholders based on attitudes toward invasive species (Sharp, Larson, & Green, 2011), to characterize house sparrow management orientations based on the 8-item management preference scale. Cluster number was optimized by simultaneously considering the lowest values of Schwarz's Bayesian Information Criterion (BIC) and the highest values for ratio of distance measures. We used distribution frequency tests (e.g., χ^2 tests) to compare characteristics of the two management orientation groups.

We then developed a hierarchical logistic regression model to evaluate the relative influence of various factors on house sparrow management orientations. The dependent variable was membership in one of two clusters: advocates of "non-lethal management only" and advocates of "lethal or non-lethal management." Individuals with missing data ($n = 10$) for any of the predictor variables were excluded from the analysis. Independent variables were added sequentially to the model in blocks, beginning with demographics, and followed by experience, cognitive factors, and affective factors. The contributions of each block to overall predictive power of the model was assessed using changes in log likelihood, block chi-square, model classification accuracy, and Nagelkerke R^2 . After comparing the effects of each variable block, we assessed the significance of specific predictor variables in the full model using likelihood ratio tests (where each term was sequentially removed and compared to the full model), parameter estimates (B), and odds ratios.

Results

Respondents in both the House Sparrow Project and Nestwatch samples included more females (60%), and had an average age of 56.5 years. Their citizen science experience was substantial, with 50% of respondents reporting more than 5 years of nest monitoring, 41% monitoring 10 or more nests, and 61% witnessing firsthand nest damage caused by house sparrows. Compared to NestWatch participants, House Sparrow Project participants tended to have more nest monitoring experience [$\chi^2(1,448) = 22.9$, $p < .001$] and more previous contact with house sparrows [$\chi^2(2,444) = 18.7$, $p < .001$]. However, their scores did not differ on the cognitive and affective constructs of interest. Furthermore, over 65% of respondents in both samples reported some previous effort to manage house sparrows. In our analysis, we therefore pooled the two samples of nest monitors and statistically controlled for both demographics and experiential factors when evaluating the relative influence of cognitive and affective constructs on management orientations.

House sparrow management actions and orientations

Of the 448 people who responded to the house sparrow management question, 69% reported past attempts to control house sparrows. Removing nests being built was the most commonly used management strategy (86% of respondents), followed by destroying house sparrow eggs (69%). Other non-lethal (i.e., passive) approaches included changing nestbox location or type (46%), sparrow repelling devices (36%), and nestbox hole size restrictors (34%), while other lethal (i.e., active) management strategies included trapping and destroying sparrows (46%) and shooting sparrows (21%).

The PAF of acceptability ranking items revealed three major categories of potential management actions: no management, non-lethal or passive management, and lethal or active management (Table 1). Scores on the non-lethal and lethal management scales were positively correlated ($r = .487, p < .001$), and both scales were negatively associated with scores for the no management scale ($r = -.273, p < .001; r = -.535, p < .001$; respectively). Overall, nest monitors viewed non-lethal management as the most acceptable approach and no management as the least acceptable approach. The Two Step Cluster analysis identified two general groups of nest monitors based on these management orientations. Advocates of “lethal or non-lethal management” ($n = 318$) were significantly more likely to have taken actions to control house sparrows than advocates of minimal or “non-lethal management only” ($n = 120$) (Table 2), suggesting that management orientations were closely linked to reported management behavior.

Factors influencing house sparrow management orientations

Results of the full hierarchical logistic regression supported the existence of a strong relationship between the predictors and the management orientation outcome variables [Model $\chi^2(df = 16) = 267.4, p < .001$; Nagelkerke Pseudo $R^2 = .683$]. The classification accuracy rate based on the model (91%) was 18% higher than the proportional by chance accuracy rate. Iterative incorporation of blocks in the model showed that, when considering

Table 1. Principal axis factor analysis of nest monitors' acceptability ratings^a for various house sparrow management practices ($n = 438$).

Construct/Item	M	SD	Pattern matrix ^b			Structure matrix ^c		
			A	B	C	A	B	C
<i>A. No Management (Spearman's $\rho = .828$)</i>	-1.57	1.45						
Leave sparrows alone	-1.61	1.51	0.746	0.036	-0.018	0.750	-0.177	-0.499
Do nothing to alter sparrow nesting behavior	-1.53	1.62	0.984	0.013	0.056	0.945	-0.181	-0.587
<i>B. Non-lethal Management (Cronbach's $\alpha = .694$)</i>	1.81	1.19						
Change nestbox location or alter nestbox design	1.98	1.39	0.117	0.713	-0.119	-0.043	0.656	-0.006
Remove sparrow nests	1.82	1.62	-0.269	0.551	0.235	-0.540	0.671	0.558
Use devices to repel sparrows	1.63	1.51	-0.038	0.690	0.062	-0.225	0.715	0.271
<i>C. Lethal Management (Cronbach's $\alpha = .634$)</i>	0.47	1.47						
Destroy eggs	1.49	1.93	-0.296	0.368	0.442	-0.665	0.549	0.735
Trap and destroy sparrows	0.76	2.29	-0.004	-0.029	0.976	-0.639	0.232	0.971
Shoot sparrows	0.08	2.30	0.042	-0.029	0.866	-0.520	0.192	0.830

^aScale: -3 = *extremely unacceptable* to 3 = *extremely acceptable*.

^bIn an oblique rotation, numbers in the pattern matrix represent the factor loadings.

^cIn an oblique rotation, numbers in the structure matrix represent correlations between the variables and the factors. Statistics for PAF (with Direct Oblimin rotation): KMO = .77; Bartlett's Test of Sphericity: $\chi^2(28) = 2099.5, p < .001$; 3 factors explain 79.8% of variance (Eigenvalues = 4.00, 1.56, 0.82); rotations converged in four iterations.

Table 2. Comparison of house sparrow management orientation clusters identified in two step cluster analysis.

Variable	Cluster		Diff. tests
	Non-lethal management only advocates (<i>n</i> = 120)	Lethal or non-lethal management advocates (<i>n</i> = 318)	
Acceptability Rating ^a —No Management	0.07 (1.23)	-2.19 (0.97)	$F(1,436) = 407.3 p < .001$
Acceptability Rating ^a —Passive Management	0.89 (1.28)	2.16 (0.94)	$F(1,436) = 128.3 p < .001$
Acceptability Rating ^a —Active Management	-1.40 (0.95)	1.18 (0.91)	$F(1,436) = 681.7 p < .001$
Behavior—Attempt to Control HOSP	30.0%	84.3%	$\chi^2(1,438) = 120.7 p < .001$
Behavior—HOSP Management Actions Taken	Do nothing: 70% Passive only: 18%	Do nothing: 16% Passive only: 11%	$\chi^2(2,438) = 144.3 p < .001$

^aAcceptability Rating Scales: -3 = *extremely unacceptable* to 3 = *extremely acceptable*.

the relative influence of distinct groups of variables on house sparrow management orientations, affective and experiential factors had the most significant effects on nest monitors' likelihood to support "lethal or non-lethal management" (Table 3). Inclusion of affective factors (i.e., core affect and emotional dispositions) led to a .324 increase in Nagelkerke Pseudo R^2 and a 12% increase in model classification accuracy. Inclusion of experiential factors led to .275 increase in Nagelkerke Pseudo R^2 and a 4% increase in model classification accuracy. The influence of cognitive factors, though statistically significant, was substantially weaker (Δ Nagelkerke $R^2 = .070$, Model classification accuracy +2%).

Examination of parameter estimates and odds ratios associated with variables in the full model provided a more in-depth look at specific factors that may be driving the system (Table 4). Among the variables in the affective block, negative feelings about house sparrows ($B = -.908, p < .001, OR = .40$) and anger toward house sparrows ($B = .967, p < .001, OR = 2.63$) were the best predictors of management orientations. Nest monitors who expressed negative feelings about and anger toward sparrows were more likely to be in the "lethal or non-lethal management" cluster. Parameter estimates for positive feelings about bluebirds and other native species, joy seeing bluebirds and other natives, and pity for bluebirds and other natives were not statistically significant. Among the variables in the experience block, firsthand experience witnessing damage caused by house sparrows ($B = 1.276, p = .001, OR = 3.58$) was the best predictor of the "lethal or non-lethal management" orientation. Only one cognitive factor was significantly associated with house sparrow management orientations. Nest monitors who favored experience-based management (instead of science-based

Table 3. Relative predictive power of distinct variable blocks in hierarchical logistic regression model predicting "lethal or non-lethal" house sparrow management orientations of nest monitors (*n* = 422).

Logistic regression block	No. of items	-2LL	Δ Nagel. R^2	Class. accuracy	Test of model coefficients		
					χ^2	<i>df</i>	Sig.
1. Demographics	2	486.3	.014	73%	4.07	2	.130
2. Experiential Factors	3	396.9	.275	77%	89.45	3	<.001
3. Cognitive Factors	6	370.7	.070	79%	26.14	6	<.001
4. Affective Factors	5	223.0	.324	91%	147.71	5	<.001
FULL MODEL ^a	16	223.0	.683	91%	267.37	16	<.001

^aHosmer-Lemeshow Goodness of Fit Test: $\chi^2(8) = 14.36, p = .073$.

Table 4. Parameter estimation from the full hierarchical logistic regression model predicting “lethal or non-lethal” house sparrow management orientations of nest monitors ($n = 422$).

Variable	Mean	SD	B	SE	OR
Constant			-3.204	2.006	
Gender (male)	0.39	0.49	-0.246	0.431	0.78
Age (years)	56.29	14.37	-0.029	0.014	0.97*
Years Monitoring (>5)	0.50	0.50	0.214	0.415	1.24
Nests Monitored (10+)	0.41	0.49	0.684	0.425	1.98
HOSP Contact	0.62	0.49	1.276	0.377	3.58**
Motivations—Appreciative ^a	5.37	1.33	-0.001	0.161	1.00
Motivations—Conservation ^a	6.32	0.83	0.137	0.255	1.15
Humans & Nature—Eco-responsibility ^b	2.37	0.71	0.248	0.294	1.28
Humans & Nature—Eco-isolation ^b	-0.81	1.28	-0.203	0.155	0.82
Management Perspectives—Science-based ^b	1.77	0.82	-0.385	0.294	0.68
Management Perspectives—Experience-based ^b	-0.71	1.11	-0.436	0.197	0.65*
Core Affect—Bluebirds ^c	2.86	0.34	0.699	0.579	2.01
Core Affect—HOSP ^c	-1.86	1.23	-0.908	0.232	0.40**
Emotions—Joy seeing Bluebirds ^b	2.84	0.53	0.059	0.377	1.06
Emotions—Pity for Bluebirds ^b	2.45	1.03	-0.370	0.213	0.69
Emotions—Anger toward HOSP ^b	1.47	1.50	0.967	0.201	2.63**

* and ** denote statistical significance at $\alpha = .05$ and $.001$, respectively.

^aScale: 1 = *not at all important* to 7 = *extremely important*.

^bScale: -3 = *strongly disagree* to 3 = *strongly agree*.

^cScale: -3 = *extremely negative* to 3 = *extremely positive*.

management) were more likely to be in the “non-lethal management only” cluster ($B = -.436$, $p = .027$, $OR = .65$). Age was also related to management orientations, with younger nest monitors more likely to support “lethal or non-lethal management” than their older counterparts ($B = -.029$, $p = .035$, $OR = .97$).

Discussion

Results of our exploratory study support two major conclusions. First, some level of house sparrow management was common among citizen science nest watchers. Advocates of both the lethal and non-lethal management approaches were more abundant than those who only supported non-lethal management. Second, affective and experiential variables were the strongest correlates of house sparrow management orientations. This finding highlights the powerful role that core affect and emotional dispositions played with respect to wildlife management decisions, particularly among citizen science nest monitors with little formal knowledge or training to inform actions.

Over 80% of respondents reported “removing nests being built,” by far the most common method of controlling house sparrows competing with native passerines for nest sites. However, the next two methods most frequently employed, “destroying eggs” and “trapping and destroying [adult] sparrows,” were both lethal in nature. “No management” was consistently rated as the least acceptable option. Cluster analysis revealed that, based on self-reported management preferences, about 73% of respondents identified more strongly with the “lethal or non-lethal management” orientation compared to “non-lethal management only.” Although perceptions of volunteer nest monitors are informative and likely indicative of the current state of backyard house sparrow management, this self-reported information only reveals part of the story. There remains a need for ecological research that explicitly

examines the effects of house sparrow competition with native songbirds for nest sites and the actual efficacy of various management strategies on house sparrow populations.

This citizen science nest monitoring and management system also allowed us to address a larger question within the wildlife management community: to what extent do affect and emotion influence wildlife-related decision-making? Results showed that two of the strongest predictors of house sparrow management orientations were negative core affect (general negative feelings) and discrete emotional dispositions (specifically, anger) toward house sparrows. In fact, anger toward sparrows, which also incorporated an element of “disgust,” seemed to be more powerful than joy or pity for bluebirds themselves, the species that many nest monitors were trying to protect. The power of “hate” as a driver of human behavior is well documented, and most typologies of moral emotions include the “other”-condemning emotions of anger, disgust, and contempt (Haidt, 2003; Russell & Giner-Sorolla, 2013). Other research suggests that anger has a particularly strong influence on decision-making processes and outcomes, and may even impact cognitive appraisals of stimuli (Lerner & Tiedens, 2006), including support for lethal management of wolves in Europe and North America (Jacobs et al., 2014). Along with the work of Jacobs and colleagues (2012a, 2012b, 2014), this study is among the first to document the effects of such powerfully antagonistic emotional dispositions on human–wildlife interactions. An obvious question, then, is how did such a profoundly negative affective response to house sparrows emerge?

Jacobs (2009) described how emotions originate through innate biological or evolutionary reactions as well as experience and conditioning. In the case of house sparrows, preexisting or innate fear or disgust is unlikely because the birds have co-existed with humans for centuries without incident and are even a species of conservation concern in portions of their native range (Shaw, Chamberlain, & Evans, 2008). Human’s inherent compassion for all living things, or biophilia (Vining, 2003), could explain why nest monitors were motivated to protect bluebirds, but biophilic tendencies do not explain why lethal management of sparrows (another living thing) was often the preferred mechanism of control. Additional research could examine this paradox, perhaps accounting for emotional dispositions that extend beyond the target species (e.g., house sparrows) and consider broader situational influences that affect decision-making (Ellsworth & Scherer, 2003; Jacobs et al., 2012b). For example, emotional reactions to house sparrows may be fueled by concerns and antagonism regarding invasive species in general (Larson, 2007). As Dawson (1903) wrote over a century ago, “without question the most deplorable event in the history of American ornithology was the introduction of the English Sparrow.” Such words likely elicit strong affective responses among contemporary nest monitors, particularly when they are prominently displayed on conservation organizations’ websites (e.g., <http://www.sialis.org/hosp.htm>). Our data suggest the origin of anti-sparrow sentiment may stem from personal experience, or—more specifically—previous contact with house sparrows. For citizen science nest monitors, most of whom have little formal training or knowledge regarding wildlife management, affective responses to negative encounters with house sparrows may represent the most accessible and influential decision-making heuristic available.

Substantial evidence shows that experiences with wildlife foster links between cognitive memories of events and affective and emotional responses to those stimuli (Hudenko, 2012; Jacobs, 2009). For example, direct observations of house sparrow predation of native songbirds and their nests may generate powerful emotional memories and elicit

intense behavioral responses. This might explain why the odds for inclusion in the “lethal or non-lethal management” orientation cluster for individuals who had previous contact with house sparrows were nearly four times higher than the odds of those who had not interacted with house sparrows. The hypothesis is also supported by the strong observed correlations between previous contact with house sparrows, feelings about sparrows ($r = -.45, p < .001$) and anger toward sparrows ($r = .37, p < .001$). Although the link between experience and affective responses could not be directly tested using the self-reported data in our study, this relationship represents a fruitful ground for future research on emotions and wildlife.

For many respondents, it was not simply the experience of nest monitoring, but the feelings generated by negative sparrow encounters that appeared to translate into support for lethal management. These encounters likely include both direct observations of sparrow-induced damage as well as indirect exposure to sparrow impacts through conversations with peers or internet searches. Similar patterns have been observed in other decision-making contexts, where fuzzy mental representations that capture the essence of a past experience are used to quickly respond to present stimuli (Reyna & Brainerd, 1995). Because nest monitoring is an intense experience involving multiple outcomes (e.g., birth, growth, life, death) that can trigger a range of affective and visceral reactions, emotion-based decision-making heuristics may be particularly salient in this context (Hudenko, 2012). While the prevalence of negative emotions toward house sparrows was overwhelming, it should be noted that some respondents actually viewed house sparrow encounters, as they viewed interactions with all songbird species, in a positive light. Because the valence and intensity of emotional responses differ significantly from one individual to another based on different cognitive appraisals or contextual cues (Keltner & Haidt, 2001), such variations might be expected.

Although affect and experience were the strongest correlates in our model, the cognitive block of variables was also a statistically significant, though weak, predictor of management orientations. Surprisingly, respondents who did not possess a concrete cognitive rationale for wildlife management (based on either scientific evidence or personal experience) tended to align more strongly with lethal management orientations than those who did. This observation seems to provide additional evidence that—in the absence of firm beliefs—other factors (perhaps emotional responses) were driving management decisions. General beliefs about humans’ role in nature were not statistically significant in the model, but their influence matched expectations. Respondents who believed that humans were responsible for maintaining natural ecological processes were generally more likely to support lethal or non-lethal management. Motivations for managing house sparrows, either conservation-oriented or appreciation-oriented, did not appear to have a strong influence on management orientations. It should be noted, however, that the cognitive constructs (e.g., motivations, basic value orientations) incorporated in our exploratory models did not effectively integrate all of the key variables (e.g., object-specific attitudes, norms, perceived behavioral control) depicted in many established rational-based behavior theories (e.g., Fishbein, 2008; Stern, 2000). Future attempts to quantify the relative influence of cognitive and affective drivers of wildlife stewardship behavior could explicitly account for these additional factors.

Despite these limitations, our results suggest that an enhanced understanding of emotional connections between people and animals could lead to improved communication regarding wildlife management. From an educational standpoint, a purely “cognitive fix” is likely to be

insufficient (Heberlein, 2012). Efforts to influence human behavior must account for affective and emotional factors. Research has already revealed the potential power of emotional appeals (positive or negative) for influencing an individual's expression of and commitment to particular conservation behaviors (Ballantyne et al., 2011; Buijs & Lawrence, 2013; Kals, Schumacher, & Montada, 1999; Kaplan, 1987; Vining, 2003). A similar approach could be applied to “backyard” wildlife management of songbirds and other species. As citizen science project managers begin to track the transfer of participants' project-specific scientific knowledge gains to other decision-making contexts (Jordan et al., 2015), the role of core affect and emotional dispositions should be a key consideration. Overt attention to affect in teaching and learning has already gained traction in the science education literature (Fortus, 2014), where emotional appeals often facilitate achievement of educational goals. The transition to conservation decision-making (and citizen science programs, specifically) represents a natural progression. By acknowledging that wildlife-related decisions are a result of two systems—an analytical, cognitive pathway and an experiential, affective pathway—working in unison (Wilson, 2008), wildlife managers of the professional and “backyard” variety will both be better equipped to address conservation challenges.

Future research on emotions in wildlife management

Although our exploratory study attempted to account for the relative influence of both cognitive and affective variables on wildlife management orientations, improved integration of the two domains might yield a more powerful dual process model of behavior. We measured broader motivational constructs and basic beliefs about science and human–nature interactions, but not specific attitudes or normative beliefs centered on focal species. Research suggests that although general beliefs and value orientations are often linked to broader conservation perspectives (e.g., wildlife use vs. wildlife protection), attitudinal and normative variables tend to be better predictors of individual actions in specific human–wildlife interactions (Teel & Manfredi, 2010; Whittaker, Vaske, & Manfredi, 2006). Perhaps the predictive power of our cognitive variables would have increased if they were constructed to match the species-specific items measuring core affect and emotional dispositions. Nevertheless, our study provides additional support for studies beginning to emphasize the integration of cognitive and affective domains such as “caring beliefs” into conventional scales for assessing concepts such as wildlife value orientations (Dayer et al., 2007; Skibins, Powell, & Hallo, 2013; Teel & Manfredi, 2010).

Investigations examining the role of emotions in wildlife management could also be expanded beyond a self-selected sample of nest monitors who presumably held strong preexisting biases (according to the data, typically love of bluebirds and hatred of sparrows). Would the influence of core affect and emotional dispositions on human–wildlife interactions differ in other management contexts? For example, would affect-based decision-making supersede cognitive reasoning when management targets hold special personal or cultural significance (e.g., feral cats) or pose significant threats to human health and livelihoods (e.g., large carnivores)? Might involvement in citizen science projects help individuals balance affective and cognitive inputs into wildlife-related decisions? What are the implications of these results for communication and education efforts focused on backyard wildlife managers? All of these questions could be addressed by future research that explicitly considers the necessary and functional influence of core affect and emotional dispositions on wildlife stewardship actions.

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Note

- ¹ Please contact authors for additional details about development of the scales used to measure all constructs.

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