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### Title

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### Permalink

<https://escholarship.org/uc/item/0dp7x4vg>

### Journal

Proceedings of the Vertebrate Pest Conference, 25(25)

### ISSN

0507-6773

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### Publication Date

2012

### DOI

10.5070/V425110687

# The Influence of Perceptions, Attitudes, and Experiences on the Perceived Risks and Benefits of Free-Roaming Cats

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**ABSTRACT:** Individual perceptions of free-roaming cats can vary from “voracious predators of small birds and mammals” to “cherished and beloved companion animals.” This paper focused on the influence of situational variables (e.g., experiences with outdoor cats), cognitive variables (e.g., attitudes toward cats and cat management), and demographic variables (e.g., gender, cat ownership) on perceptions of the risks posed by free-roaming cats to the ecosystem and the benefits that cats provide to people. In addition, we analyzed the potential role that risk and benefit perceptions play in mediating the relationship between attitudes toward outdoor cats and tolerance for the future cat population. We conducted an 11-item written survey of 474 undergraduate students enrolled in two introductory ecology courses. There were significant differences in perceived risks and benefits of cats between cat owners and non-owners and cat feeders (people who fed free-roaming cats) and non-feeders. Perceptions of the current cat population, experiences with cats and attitudes toward cats predicted both perceptions of risks to the ecosystem and benefits to people. The relationship between attitudes and tolerance was mediated by individual perceptions of benefits to people from free-roaming cats. Experience with free-roaming cats, attitudes toward cats, affection for cats, and demographic variables predicted individual risk perceptions. These perceptions, in turn, influenced support for future cat population levels and should therefore be addressed in management campaigns aimed at reducing the outdoor population of free-roaming cats.

**KEY WORDS:** attitudes, domestic cats, experiences, *Felis catus*, risk perceptions, stakeholders

Proc. 25<sup>th</sup> Vertebr. Pest Conf. (R. M. Timm, Ed.)  
Published at Univ. of Calif., Davis. 2012. Pp. 67-75.

## INTRODUCTION

Feral cats (*Felis catus*) pose a potential risk to wildlife and people. Incidences of cat predation and competition with wildlife have been widely addressed in the fields of wildlife conservation (Baker et al. 2008, Beckerman et al. 2007, Coleman et al. 1997) and veterinary medicine (Barrows 2004, Jessup 2004, Levy and Crawford 2004). Cats make up the largest source of rabies cases in domestic animals; a total of 303 rabid cats, 71 cattle and 69 dogs were reported in 2010 (CDC 2012b). However, the rate of rabies infection in cats is much lower than that of wildlife (Department of Health and Human Services 2010, Slater 2004). Despite the potential threat from rabies, there have been only 2 cases of rabies to human transmission in the last 50 years (CDC 2012a). In 2010, the majority of reported rabies cases (92%) were associated with wildlife (CDC 2012a). Therefore, the risk of rabies transmission from cats to people is a low probability risk (Levy and Crawford 2004). Rabies transmission is an example of the type of high-consequence low-probability event that is often overestimated by the public and therefore widely discussed in the existing literature about outdoor cats (Slovic 2000a, Zeckhauser and Viscusi 1990).

Indirect effects of cats on wildlife and ecosystems have also been cited. These include temporal or spatial avoidance of cats, including the alteration of foraging patterns, habitat selection, and other behaviors that affect adult and juvenile survival, clutch size, or clutch number (Beckerman et al. 2007, Baker et al. 2003, Sims et al. 2008). Cats also deposit large quantities of fecal matter into the environment, a source of fecal coliform bacteria that can pollute fresh and salt water systems (Dabritz et al. 2006).

Feral cats are also subject to health risks including disease, starvation, collision with vehicles, and attack by

dogs, coyotes, and humans (Slater 2004, HSUS 2009). Numerous examples of people inflicting intentional harm (e.g., shooting, poisoning) on stray or feral cats exist (Jessup 2004). A study of 169 free-roaming kittens found 75% of the newborns died or disappeared within 6 months of birth; the overwhelming majority of the incidents (68%) involved attacks by stray dogs or car collision (Nutter et al. 2004). This has led to speculation that the lifespan for indoor-only cats can be significantly greater than that of feral cats (Jessup 2004).

Risk/benefits perceptions (whether from technological or natural hazards) play a critical role in individual risk assessments and are therefore as important as determining the true risk of exposure to injury or disease (Gore and Knuth 2009). Perceived risk/benefits can influence stakeholder tolerance of animals (Riley and Decker 2000b), attitudes toward management (Agee and Miller 2009), and support for conservation or eradication (Kellert 1985). There is a strong and direct relationship between perceived risks of outdoor cats on wildlife and the environment and tolerance of outdoor cats, which in turn predicted attitudes toward cat management techniques, such as removal to a long-term no kill shelter, support for Trap-Neuter and Return activities, and the confinement of cats indoors (Wald and Jacobson 2013). Therefore, efforts to manage feral cats will require comprehensive understanding of individual perceptions and tolerance. To date, few studies have addressed public perceptions of ecological risk with regard to an invasive vertebrate species. This study expands the domain of risk perception by exploring individual risk perceptions related to the often-controversial domestic cat. This research is the first to explore both the potential risks of feral cats to wildlife, pets, and people and the risks to feral cats from the outdoor lifestyle. In

addition, it seeks to quantify the positive experiences or perceived benefits cats provide to people, including companionship and the control of pest species (e.g., rodents). These benefits are important to address when measuring risk, due to the inverse and potentially attenuating influence of benefits on individual risk perceptions (McDaniels et al. 1997, Fischhoff et al. 1978).

This study examined the influence of situational variables (e.g., experiences with outdoor cats), cognitive variables (e.g., attitudes toward cats), and demographic variables (e.g., gender, cat ownership) on perceptions of the risks that free-roaming cats pose to the ecosystem and the benefits that cats provide to people. In addition, we analyzed the potential role that perceptions of risks and benefits play in mediating the relationship between attitudes toward outdoor cats and tolerance for the future cat population.

### Theoretical Framework

Risk is the probability that an event will occur and the likelihood that exposure will result in a negative outcome (e.g., injury, damage, or loss) (Breakwell 2007). Perceptions of ecological risks will be defined as threats to the health and productivity of individual species, communities, environmental processes, and the ecosystem (McDaniels et al. 1997). As perceptions of ecological impact increase, perceptions of risk increase and human benefits decrease (McDaniels et al. 1997). Ecological risks have previously been studied with regard to human activities and their negative impact on ecosystem services (e.g., clearcutting in forests, air pollution) (McDaniels et al. 1997, Williamson et al. 2005). Few studies have addressed the risks associated with natural hazards (e.g., floods, earthquakes, volcanoes) (Axelrod et al. 1999, McDaniels et al. 1995). Four factors explain significant variability in lay perceptions of ecological risk ( $R^2=.96$ ), including impact on species (humans and nonhumans), human benefits, perceived control, and knowledge of the impacts (McDaniels et al. 1997). Impact on species was the most important factor predicting ecological risk perceptions (McDaniels et al. 1997). McFarlane and Witson (2008) expanded this theory to include risks associated with a natural disturbance event in protected areas. This study will further expand the concept of ecological risk by treating feral cats as a natural risk event and measuring risk perceptions associated with feral cat predation on wildlife. We focus on risk within the assumptions and limitations of the psychometric paradigm. This paradigm assumes risk is subjective, quantifiable, and predictable, and therefore can be modeled and measured using a variety of survey techniques (Slovic 2000a). This paradigm assumes that individual evaluation of risk is influenced by psychological, social, institutional, and cultural factors (Slovic 2000a).

Results of previous empirical research on wildlife-related risk have provided a basis for expectations about the explanatory relationship between risk perceptions and several cognitive, situational, and demographic variables (Sjoberg 1998). Familiarity with a risk should increase knowledge and therefore lower risk perceptions (Slovic 2000a). Negative experiences with feral and free-range cats influenced respondent perceptions of cats as nuisance animals (Ash and Adams 2003) and support for lethal

management (Loyd and Miller 2010). People in rural Wisconsin were more likely to attempt cat population control if they perceived a higher density of cats in their area (Coleman and Temple 1993). In addition, a number of studies have explored human perceptions of risk from carnivores. In these cases, experience with a carnivore reduced risk perceptions (Bjurlin and Cypher 2005, Røskaft et al. 2003). Seeing the endangered San Joaquin kit fox (*Vulpes macrotis mutica*) (Bjurlin and Cypher 2005), black bears, or a sign about black bears reduced concern (Siemer et al. 2009). In Norway, fear of carnivores declined as experience increased (Røskaft et al. 2003). Additionally, first-hand experience was not necessary, as negative media coverage amplified residents' concerns over the risk of negative interactions with black bears (Siemer et al. 2009, Gore et al. 2009) and the risk of chronic wasting disease in deer herds (Heberlein and Stedman 2009).

It is important to note that the type of experience, the type of animal, and the frequency of the interactions matter. Perceived risk increased as the severity of the experience with cougars increased (e.g., observing the animal in the wild vs. attack or threat to pet, livestock or self) (Riley and Decker 2000b). People were less tolerant of wolves and bears in close proximity to people than of lynx and wolverines (Kleiven et al. 2004). Moreover, negative experiences (e.g., damage to property) with beavers, white-tailed deer, and geese (Loker et al. 1999), black bears (Siemer et al. 2009), and prairie dogs (Zinn et al. 2000) amplified concerns. Risk, in the latter instance, referred to more than just the probability or perception of risk from injury or death to the individual; it also included concerns about zoonotic diseases, economic damage, and damage to property (e.g., destroying gardens, fouling yards).

Affect is an involuntary, immediate emotional response to an external event (Slovic 2000a, Zajonc 1980). Affect can be positive (like) or negative (dislike); it can influence decision-making and action (Zajonc 1980). Affection is among the first and most important human feelings guiding cognition and behavior, including perceived risks and benefits (Zajonc 1980, Finucane et al. 2000). Affect predicts individual attitudes and perceived benefits of a risk object (Finucane et al. 2000, Slovic 2000b, Slovic et al. 1991). There is a strong correlation between affection, attitudes, and risk perceptions; if an activity is liked, it is valued as highly beneficial and perceived as a low-risk event (Slovic 2000a, Finucane et al. 2000).

People are more willing to accept the costs of living with a risk if they perceive immediate benefits from the object (Fischhoff et al. 1978). Cat owners in Australia reported lower levels of concern about free-ranging cats than non-owners (Dabritz et al. 2006). There are a number of potential physical and psychological benefits of pet ownership that may reduce risk perceptions and support for lethal management (Friedmann 1995, Poresky and Hendrix 1990, Zasloff and Kidd 1994, Vining 2003). In California and Ohio, cat owners were more likely to oppose government initiatives to control cats (Dabritz et al. 2006, Lord 2008), and in Australia cat owners were generally less supportive of cat control initiatives than non-owners (Grayson et al. 2002).

Previous researchers have reported dramatic differences in attitudes and perceptions based on gender; others

**Table 1. Factor analysis results of “Belief about Cats” and “Cat Impact” scales.**  
(modified from Wald and Jacobson 2013)

	$\bar{X}$	SD	Factor Loadings		Cronbach's $\alpha$
			Factor 1	Factor 2	
<b>Belief About Cats</b>					0.71
Cats deserve to be outdoors like other animals	3.29	0.96	0.67	--	
Outdoor cats live happy healthy lives, comparable to indoor cats	3.05	1.0	0.60	--	
Most outdoor cats can find their way home on their own	3.51	1.0	0.57	--	
Wildlife and cats should have equal access to outdoors	3.39	1.0	0.50	--	
Outdoor cats do not pose a significant threat to wildlife	3.20	0.91	0.44	--	
Most outdoor cats are able to survive without human help	3.40	0.98	0.43	--	
<b>Cat Impacts</b>					0.61
Outdoor cats kill wildlife	3.44	0.92	--	0.68	
Outdoor cats compete with wildlife species for food	3.49	0.94	--	0.67	
Outdoor cats transfer diseases to wildlife	3.35	0.88	--	0.51	
I am willing to reduce outdoor cats to benefit wildlife	3.13	0.98	--	0.30	

<sup>a</sup> Scores were estimated from a 5-point progressive scale, with 1 indicating strong disagreement, 5 strong agreement, and 3 neither.

Note: KMO = 0.71

have suggested that “gender is among the most important demographic influences on attitudes toward animals in our society” (Kellert and Berry 1987:365). Men are generally less concerned about hazards and risk than are women (Slovic et al. 1991). Women reported higher levels of personal risk from mountain lions (Thornton and Quinn 2010, Zinn and Pierce 2002). However, there were also cases where gender did not result in significant difference in concern over mountain lions (Riley and Decker 2000a), wolves (Peyton et al. 2007), and bears (Siemer et al. 2009).

Identifying the perceived risk/benefits from outdoor cats will help predict individual tolerance, attitudes toward management, and support for eradication or education programs. To explore these issues, we address the following questions: Which individual characteristics, such as cat ownership, cat feeding, affection for cats, and gender, will predict risk perceptions/benefits of outdoor cats? How do situational and cognitive variables influence risk/benefits perceptions? Do perceived risks/benefits mediate the relationship between attitudes toward outdoor cats and tolerance for the future cat population?

## METHODS

### Survey Design

Survey research was conducted from December 2010 to May 2011. Survey questions were pilot tested in focus

group discussions with stakeholders. The survey used the term “outdoor cats” to describe free-roaming cats, both friendly strays and unapproachable feral cats. The written questionnaire contained 11 primary items focused on 1) experiences with outdoor cats, 2) attitudes toward cats and cat management, 3) perceptions of current cat population and tolerance of future cat populations, and 4) perceptions of risk/benefits. *Experiences* included positive items (i.e., enjoyed watching cats, fed cats, pet cats, and adopting a cat) and negative items (i.e., observed a cat scaring birds, had a pet attacked, personally injured by a cat, heard about problems with cats, observed a cat hunting). We created two summative scales of both positive and negative experiences. We measured participants’ perceptions of cat *frequency* on a 4-point progressive scale (1 = never see cats to 4 = daily sightings). *Current population* measured participant perceptions of current cat population levels as 1 (= too many cats), or 0 (= the right number or too

few cats). *Attitudes toward cats* was coded on a 5-point scale (1 = hates cats, 5 = loves cats). *Beliefs about cats* were measured using a list of 12 statements about outdoor cats (Table 1). Respondents were asked to indicate the extent to which they agreed with the statements on a 5-point, bipolar scale that ranged from 1 (= strongly disagree) to 5 (= strongly agree). To measure *perceptions of risks/benefits*, we used a reduced set (10 items) of the aforementioned risk dimensions related to the impact, acceptability, and emotionality of the impact of cats on a) ecosystems, b) wildlife, and c) people on a 5-point progressive scale (Table 2). In discussing these measures below, we will refer to two composite scales, “risks to the environment” and “benefits to people.” *Tolerance* for future cat populations was treated as a dichotomous variable in which 1 = decrease and 0 = all other responses.

The survey concluded with general questions regarding cat ownership, cat feeding, gender, and years in school. Cat owners also were asked about the number of owned cats, their ability to control outdoor access, and the vaccination and sterilization status of their cats. Participants included 474 undergraduate students (191 males, 259 females) enrolled in two different general education ecology courses at the University of Florida. Course credit was given for participation. These students were selected because course assignments addressed the issue of outdoor cats, and therefore we assumed respondents would

**Table 2. Perceptions of ecological risks and perceived benefits to people.**  
(modified from Wald and Jacobson 2013)

	Scale Endpoints	M	SD
<b>Ecological Risks</b>			
To what extent do you believe outdoor cats have an impact on the environment	1 = very negative impact 5 = very positive impact	2.81	0.67
To what extent are the effects of outdoor cats on natural ecosystems acceptable to you	1 = very unacceptable 5 = very acceptable	3.06	0.80
What level of emotion do you feel when you think about outdoor cats and their effect on natural ecosystems	1 = very negative emotion 5 = very positive emotion	2.90	0.72
To what extent do you believe outdoor cats have an impact on native wildlife	1 = very negative impact 5 = very positive impact	2.70	0.72
To what extent are the effects of outdoor cats on native wildlife acceptable to you	1 = very unacceptable 5 = very acceptable	2.84	0.85
What level of emotion you feel when you think about outdoor cats and their effect on native wildlife	1 = very negative emotion 5 = very positive emotion	2.83	0.71
What threat do outdoor cats pose to wildlife	1 = very serious 5 = none	2.94	0.72
<b>Benefits to people</b>			
Please rate the extent to which you believe outdoor cats have an impact on you	1 = very negative impact 5 = very positive impact	2.97	0.84
Please rate the extent to which the presence of outdoor cats in your community is acceptable	1 = very unacceptable 5 = very acceptable	2.98	0.93
Please rate the level of emotion you feel when you think about outdoor cats and their effect on your community	1 = very negative emotion 5 = very positive emotion	2.89	0.77

have some prior knowledge about cat-related risks and the animal welfare concerns. All scales included a “do not know” or “neutral” response option. A subsample of these data was used to examine factors influencing tolerance for outdoor cats and reported elsewhere (Wald and Jacobson 2013).

## RESULTS

### Data Reduction and Scale Reliability

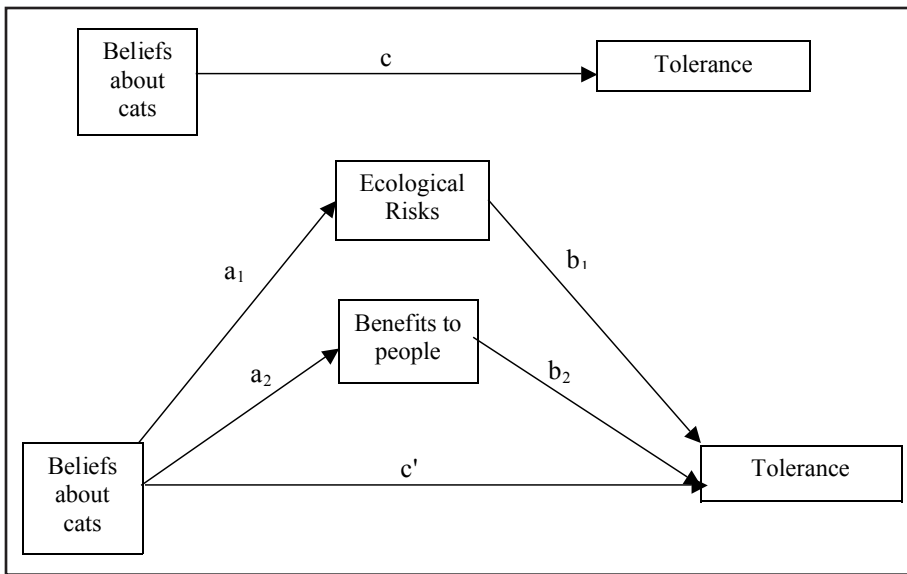
To interpret our results, we reported factor loadings  $>.30$ , factors that accounted for at least 5% of the total variance, and Eigenvalues greater than 1. Kaiser-Meyer-Olkin (KMO) results examine the appropriateness of factor analysis for this data and values  $> 0.7$  and are acceptable (Hutcheson and Sofroniou 1999). For all tests, Chronbach’s  $\alpha$  values  $>.60$  were considered acceptable (Nunnally 1978, Vaske 2008) and items were removed if they detracted significantly from scale reliability. The positive experiences scale had a potential range of 0 - 1; the negative experiences scale had a potential range of 0 - 0.80. An exploratory factor analysis with orthogonal rotation confirmed previous findings (Wald and Jacobson 2013). Therefore, we removed two items, including “this issue is important to me” and “cats should be kept indoors at all times”, resulting in a 10-item measure with two factors, “beliefs about cats” and “cat impacts.” These factors explained 32% of the total variance and had potential ranges of 1 - 5 (Table 1). The risk perceptions items comprised two separate scales, one addressing the perceived impact

and acceptability of the risks cats pose to wildlife and the environment (7 items) Chronbach’s  $\alpha = 0.84$ , and a scale measuring perceived benefits to people from cats (3 items) Chronbach’s  $\alpha = 0.79$  (Table 2).

To evaluate demographic differences in risk perceptions and benefits, which were measured using a single scale, we ran a series of repeated measures analysis of variance (ANOVA) with between-subject factors of cat ownership and gender to analyze demographic differences in perceptions of risks and benefits. Partial eta squared,  $\eta^2$ , is reported as a measure of effect size. Post-hoc independent t-tests were used to further evaluate significant results. Due to small cell sizes, differences between feeders and non-feeders on perceived risks were analyzed separately from gender and cat ownership. In addition, we conducted a repeated measures ANOVA test comparing the influence

of cat feeding on risk perceptions and benefits.

We used ordinary least squares (OLS) regression to determine the variables predicting our risk scales, “ecological risks” and “benefits to people.” The independent variables tested included perceptions of current cat populations, affection for cats, perceived frequency of outdoor cats, experiences with cats, and attitudes toward outdoor cats. Previous research suggested that strong support for cat rights and positive perceptions of cat benefits increased individual tolerance for outdoor cats, while risk perceptions decreased tolerance (Wald and Jacobson 2013). To further explore this relationship, we examined whether perceived risks and benefits mediated the relationship between attitudes toward outdoor cats and tolerance. A mediating variable is one that influences, partially or completely, the relationship between a predictor and outcome variable (Baron and Kenny 1986). To determine a mediating relationship, we first established a causal relationship between the independent variable “beliefs about cats” and the dependent variable tolerance (Figure 1, path c). Next, we established a causal relationship between “beliefs about cats” and both potential mediators “ecological risks” (Figure 1, path a1) and “benefits to people” (Figure 1, path a2). We then tested the predictive relationship between both of the risk scales as potential mediators of tolerance (Figure 1, path b1 and b2). Finally, mediation was confirmed by establishing that the difference between the total effect (c path) and the direct effect (c’), also known as the total indirect effect ( $f = a1b1 + a2b2$ ), was significantly differ-



**Figure 1. Illustration of the potential mediation of risks and benefits between “cat rights” attitudes and tolerance. Cat rights attitudes are hypothesized to exert an indirect effect on tolerance through perceived risks and benefits.**

ent from zero. To test mediation we used bootstrapping, a nonparametric sampling procedure (Preacher and Hayes 2008). Bootstrapping is an improvement over the causal-steps model, proposed by Barron and Kenny (1986), and the Sobel test (Sobel 1986) because it does not assume normality and can be used to estimate models where the outcome variable, in this case tolerance, is dichotomous (Preacher and Hayes 2008, Hayes and Preacher 2010). This approach requires responses with complete data on the variables of interest, so for this test we used a subsample of 333 individuals with complete data on the variables of interest.

### Risk Perceptions

A total of 827 students received a copy of the survey; 474 completed it, for a response rate of 57%. On average, participants perceived more benefits from outdoor cats to people ( $M=3.01$ ,  $SE=.04$ ) than risks to the environment ( $M=2.89$ ,  $SE=.03$ )  $F(1,433)=22.0$ ,  $p<.001$ ,  $\eta^2=.05$ . There were no significant gender differences in risk perceptions. There were significant differences across both risk scales between owners ( $M=3.04$ ,  $SE=.06$ ) and non-owners ( $M=2.87$ ,  $SE=.03$ ),  $F(1,433)=7.00$ ,  $p<.01$ ,  $\eta^2=.02$ . There was a significant interaction between cat ownership and risk perceptions  $F(1,433)=4.60$ ,  $p<.05$ ,  $\eta^2=.01$ . Owners perceived fewer serious risks from cats to the environment ( $M=2.95$ ,  $SE=.05$ ) than non-owners ( $M=2.83$ ,  $SE=.03$ ) and this difference approached significance  $t(445)=1.91$ ,  $p=.057$ ,  $r=.09$ . Owners perceived cats as more beneficial to people ( $M=3.13$ ,  $SE=.07$ ) than non-owners ( $M=2.90$ ,  $SE=.04$ ),  $t(445)=3.26$ ,  $p<.001$ ,  $r=.15$ .

We compared the influence of feeding on participant perceptions of the “ecological risks” and “benefits to people.” Feeders and non-feeders differed in their overall perception of risks  $F(1,445)=8.33$ ,  $p<.01$ ,  $\eta^2=.02$ . Feeders scores on both risk scales were higher ( $M=3.04$ ,  $SE=.06$ ) than non-feeders ( $M=2.86$ ,  $SE=.03$ ). In addition, there was a significant interaction between feeding and risk percep-

tions  $F(1,445)=8.26$ ,  $p<.01$ ,  $\eta^2=.02$ . Overall, feeders viewed fewer risks to the ecosystem ( $M=2.94$ ,  $SE=.05$ ) than non-feeders ( $M=2.85$ ,  $SE=.03$ ), but this difference was not significant  $t(445) = 1.76$ ,  $p=.08$ . Feeders perceived a significantly greater benefit from outdoor cats to people ( $M=3.14$ ,  $SE=.07$ ) than non-feeders ( $M=2.88$ ,  $SE=.04$ ),  $t(158.3) = 2.95$ ,  $p<.01$ ,  $r=.23$ .

### Situational and Cognitive Variables and Risk

Negative experiences with cats, perception of “too many cats”, and agreement with “cat impacts” statements increased ecological risk perceptions, whereas positive experiences with cats and strong beliefs about cats reduced ecological risk perceptions (Table 3). Positive attitudes toward cats and perceived frequency of seeing cats, while not

significant predictors of perceived risks, had signs in the expected direction. Positive attitudes toward cats, positive experiences with cats, and positive beliefs about cats predicted positive benefits from cats to people. Negative experiences, perceptions of “too many cats,” and agreement with “cat impact” beliefs predicted negative perceptions of the benefits to people.

### Mediation

Mediation results indicated that “beliefs about cats” was a significant predictor of tolerance  $\beta=-1.167$ ,  $Wald=34.51$ ,  $p<.001$  (Figure 1, path c) and of both of the potential mediators, “benefits to people”  $\beta=.275$ ,  $t=4.35$ ,  $p<.001$  and “ecological risks”  $\beta=.202$ ,  $t=4.12$ ,  $p<.001$  (Figure 1, path a<sub>1</sub> and a<sub>2</sub>). “Benefits to people” was a significant predictor of tolerance for outdoor cats  $\beta=-1.16$ ,  $Wald=20.00$ ,  $p<.001$  (path b<sub>2</sub>). “Ecological risks” was not significantly related to tolerance  $\beta=-.289$ ,  $Wald=.86$ ,  $p=.35$  (path b<sub>1</sub>). The total effect of “beliefs about cats” on tolerance was  $\beta=-1.17$ ,  $Wald=34.51$ ,  $p<.001$  (path c). The direct effect of “beliefs about cats” on tolerance through both risk scales was  $\beta=-1.14$ ,  $Wald=25.82$ ,  $p<.001$  (path c'). The difference between the total and direct effects (path c and c') or the total indirect effects had a point estimate of  $-.3762$  and was significant (Table 4). “Benefits to people” mediated the relationship between “beliefs about cats” and tolerance, while “ecological risks” was not a significant mediator.

Next, we looked at the potential mediation of “ecological risks” and “benefits to people” on the relationship between “cat impact” beliefs and tolerance for outdoor cats (Figure 2). “Cat impact” beliefs significantly predicted tolerance  $\beta=.472$ ,  $Wald=7.92$ ,  $p<.005$  (Figure 2, path c) and both of the potential mediators “benefits to people”  $\beta=-.418$ ,  $t=-7.09$ ,  $p<.001$  and “ecological risks”  $\beta=-.370$ ,  $t=-8.21$ ,  $p<.001$  (Figure 2, path a<sub>1</sub> and a<sub>2</sub>). “Benefits to people” was a significant predictor of tolerance for outdoor cats  $\beta=-1.16$ ,  $Wald=21.25$ ,  $p<.001$  (path b<sub>2</sub>). “Ecological risks” was not a significant predictor of tolerance

**Table 3. OLS regression estimates of variables associate with ecological risks and perceptions of benefits to people.**

	Risk to the Ecosystem <sup>c</sup>			Benefits to Humans		
	b	SEB	b	b	SEB	b
<sup>a</sup> CurrentPOP	.272	.055	.229**	-.407	.067	-.266**
Affection	-.014	.023	-.030	.077	.028	.130*
Frequency	.032	.031	.046	.004	.038	.004
Positive Exp	-.352	.096	-.194**	.641	.118	.275**
Negative Exp	.489	.137	.172**	-.840	.168	-.230**
<sup>b</sup> Belief about cats	-.153	.041	-.170**	.160	.050	.138*
<sup>b</sup> Cat impacts	.301	.055	.229**	-.320	.048	-.266**

R<sup>2</sup> = .30 "Risk to Ecosystems" and R<sup>2</sup> = .36 "Benefits to Humans"

\*p<.01, \*\*p<.001

<sup>a</sup> CurrentPOP represents a measure of participant perceptions of the current cat population.

<sup>b</sup> Represent our two composite belief scales.

<sup>c</sup> In this table, signs for risk were reversed for ease of interpretation, so the .272 on Current Population means that perceived increases to the population are associated with higher perceptions of risk.

$\beta = -.363$ , Wald=1.30,  $p = .25$  (path  $b_2$ ). The total effect of "cat impact" beliefs on tolerance was  $\beta = .472$ , Wald=7.92,  $p < .005$  (path c). The direct effect of "cat impact" beliefs on tolerance through both risk scales was  $\beta = .019$ , Wald=.008,  $p = .927$  (path c'). Lastly, the total indirect effects had a point estimate of .6200 and were significant (Table 5). These results confirm that "benefits to people", not "ecological risks", mediated the relationship between "cat impact" beliefs and tolerance.

## DISCUSSION

This study provides insight into the influence of situational, demographic, and cognitive variables on the perceived risks and benefits related to outdoor cats. Our results confirmed an inverse relationship between risks and benefits related to cats and provided insight into the role that experiences, beliefs, and socio-demographic variables play in influencing risks and benefits. However, this study also suggested that when separated into two scales, perceived benefits to people are more important than ecological risk perceptions in predicting individual tolerance for outdoor cats. Campaigns, such as those sponsored by the American Bird Conservancy, are aimed at reducing the outdoor cat population and encourage cat owners to "keep cats indoors." As motivation, they provide numerous examples of the ecological risks cats pose to wildlife. Given

the non-significant mediation of risk perceptions on the relationship between beliefs and tolerance, which is a known predictor of support for cat management (Wald and Jacobson 2013), this research suggests that providing evidence of ecological risks from cats may not directly decrease tolerance or increase support for active cat management or efforts to keep cats indoors.

In general, perceived risk scores were moderate ( $2.70 > M < 3.06$ ), suggesting that most participants found the risks of cats to wildlife and the environment acceptable. There are a number of possible explanations for this finding. It is possible that the risks associated with outdoor cats are perceived as a natural hazard rather than an anthropogenic one. Natural risk items, such as disease or wildfire, are generally perceived as less harmful to the environment, wildlife, and people than man-made events, such as

pollution or urbanization (McFarlane and Witson 2008). Secondly, the killing of birds by cats often takes place outdoors in wooded areas not visible to most people. Perceived risks often increase as the severity of the experience with wildlife increase; therefore, individuals perceive greater risks when they have been threatened or attacked themselves than if they have passively observed the animal in the wild (Riley and Decker 2000a). It is possible that the hunting behavior of outdoor cats, taking place away from human habitation, has contributed to reduced perceptions of risk. It is possible that students living on campus had few experiences with outdoor cats, which contributed to the reduced perceptions of ecological risk.

Americans own approximately 86.4 million cats (APPA 2012). The majority of pet owners view their animals as a significant member of the family (McNicholas et al. 2005). Across all "attitudinal alignments", people favor pets above all other animals (Kellert and Berry 1987). The human-cat bond appears to exist even in cases where cats are so "wild" that caregivers are unable to pet or even approach these animals. Many caretakers report feeling a strong bond with feral animals and voluntarily spend significant amounts of time, effort, and money (ranging from \$260 to \$2,400 annually) caring for them (Centonze and Levy 2002). In a study of attitudes toward free-roaming cats in Ohio, 48.7% of the participants cited positive feel-

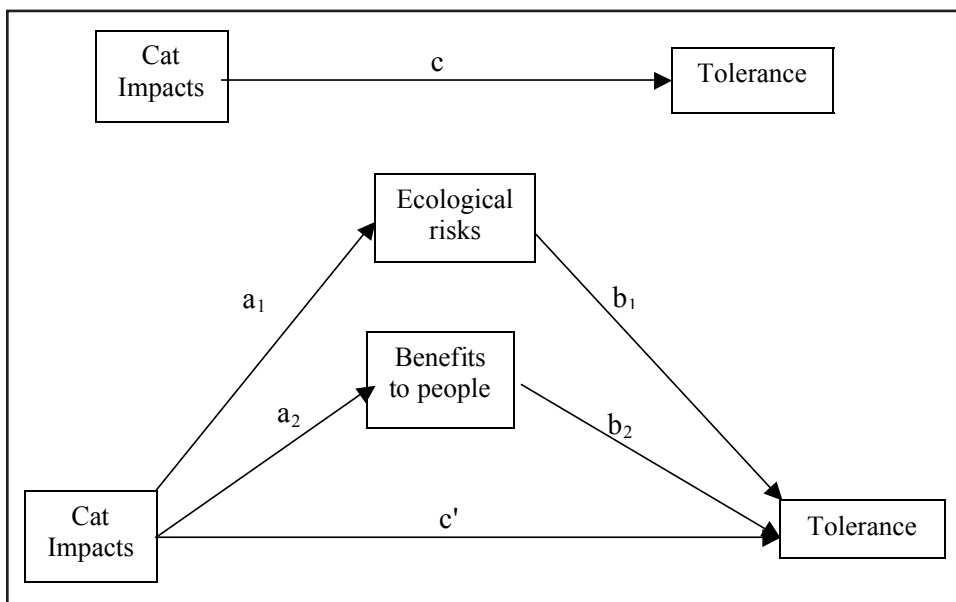
**Table 4. Mediation of the effect of "Belief about Cats" on tolerance for cat populations through perceptions of risks to ecosystems and benefits to people.**

	Point Estimate	SE	Bootstrapping					
			Percentile 95% CI		BC 95% CI		Bca 95% CI	
			Lower	Upper	Lower	Upper	Lower	Upper
Benefits to People	-0.3176	0.1391	-0.6374	-0.1030	-0.6284	-0.1000	-0.6196	-0.0937
Risks to Ecosystems	-0.0586	0.0757	-0.2225	0.0865	-0.2405	0.0664	-0.2321	0.0685
<b>TOTAL</b>	<b>-0.3762</b>	<b>0.1411</b>	<b>-0.6868</b>	<b>-0.1372</b>	<b>-0.6676</b>	<b>-0.1165</b>	<b>-0.6603</b>	<b>-0.1071</b>

BC - bias corrected

Bca - bias corrected and accelerated

1000 bootstrap samples



**Figure 2.** Illustration of the potential mediation of risks and benefits between “wildlife rights” attitudes and tolerance. Wildlife rights attitudes are hypothesized to exert an indirect effect on tolerance through perceived risks and benefits.

ings, while 14.3% expressed negative or angry feelings (Lord 2008). Undergraduate students at the University of Florida reported high rates of affection for cats (53%) and extensive positive experiences with outdoor cats (94%), and they enjoyed watching outdoor cats (60%) (Wald and Jacobson 2013). Affection generally increases positive attitudes toward a risk event and lowers risk perceptions (Slovic et al. 1991). As expected, our results confirmed an inverse relationship between affection for cats, high rates of cat ownership, and positive experiences with outdoor cats and risk perceptions.

Consistent with other studies, we found a number of significant differences between cat owners and non-owners and cat feeders and non-feeders. Owners and feeders reported more negative experiences with outdoor cats than non-owners/non-feeders. Owners and feeders perceived fewer negative risks to the environment and more positive benefits from cats to people than non-owners. Owners and feeders acknowledged risks to wildlife from cats. However, owners had higher scores on the “benefits to humans” scale than the perceived “ecological risks” scale. This finding is similar to a study of cat owners in Perth, Australia, which found that owners were less con-

cerned about risks to wildlife from cats than non-owners (Grayson et al. 2002). Owners were also less concerned about the environmental impact of free-ranging cats (Dabritz et al. 2006), cat owners expressed stronger opposition to governmental control of cats (Dabritz et al. 2006, Lord 2008), and lower support for aggressive cat control initiatives than non-owners (Grayson et al. 2002). This finding corroborates an inverse relationship between perceived risks and perceived benefits, with the former decreasing as perceived immediate benefits from the object increase (Fischhoff et al. 1978). In the case of cats, the positive benefits perceived by cat owners/feeders may contribute to their acceptance of these animals and counteract the perceived risks associated with cats.

The more negative experiences individuals had with outdoor cats, the more likely they were to express negative perceptions of ecological risk. Previous research has suggested a similar relationship between experience with nuisance animals and risk beliefs. Negative experiences (e.g., damage to property) with beavers, white-tailed deer, and geese (Loker et al. 1999), black bears (Siemer et al. 2009), and prairie dogs (Zinn et al. 2000) amplified concerns over the presence of these animals. Negative experiences with feral cats increased negative perceptions of cats (Ash and Adams 2003) and support for lethal management techniques (Loyd and Miller 2010). However, the context of the experience as well as the frequency of the experience appears to be important in predicting perceived risk. Indeed, in this study the frequency of the positive experiences was associated with both increased perceived positive benefits to people and lower perceived risks from cats to the environment.

Individuals with high scores on the “cat impacts” scale were more likely to hold negative perceptions of the risk cats pose to ecosystems than participants with low scores. Strong and favorable “beliefs about cats” increased perceived positive benefits from cats to people and individual tolerance. These findings are consistent with previous research indicating that negative attitudes toward cougars (*Puma concolor*) reduced hunter support for increasing population levels (Riley 1998),

and strong and favorable wildlife benefits beliefs lessened stakeholder concern about bears (Siemer et al. 2009). Our findings, along with the results of previous research, indicate that willingness to absorb the cost of living with wildlife is dependent upon individual attitudes

**Table 5.** Mediation of the effect of beliefs about “Cat Impact” on tolerance for cat populations through perceptions of risks to ecosystems and benefits to people.

	Point Estimate	SE	Bootstrapping					
			Percentile 95% CI		BC 95% CI		Bca 95% CI	
			Lower	Upper	Lower	Upper	Lower	Upper
Benefits to People	-0.3176	0.1391	-0.6374	-0.1030	-0.6284	-0.1000	-0.6196	-0.0937
Risks to Ecosystems	-0.0586	0.0757	-0.2225	0.0865	-0.2405	0.0664	-0.2321	0.0685
<b>TOTAL</b>	<b>-0.3762</b>	<b>0.1411</b>	<b>-0.6868</b>	<b>-0.1372</b>	<b>-0.6676</b>	<b>-0.1165</b>	<b>-0.6603</b>	<b>-0.1071</b>

BC - bias corrected  
 Bca - bias corrected and accelerated  
 1000 bootstrap samples



and perceptions (Zinn et al. 2000, Riley 1998, Riley et al. 2002).

The relationship between attitudes and tolerance was mediated by individual perceptions of the perceived benefits to people from free-roaming cats. Perceived benefits from a risk item increased individual willingness to accept the costs of living with that risk (Fischhoff et al. 1978). Our results suggest that perceived risks of cats to wildlife and the environment alone may not be enough to influence tolerance for outdoor cats or attitudes toward cat management. Instead, perceived benefits to people was more important than perceived risks to wildlife and the environment, and more important in predicting tolerance for cats than attitudes alone. This finding has implications for the future development of effective cat management policies and education campaigns. Current messages focused on reducing the number of cats outdoors almost always focus on the potential risks that cats pose to wildlife and ecosystems and the potential risks that the outdoor lifestyle imposes on cats. Our results suggest that risks are not the most important predictor of tolerance. Policy makers, managers, and educators may be better off framing the issue of outdoor cats as it relates to perceived benefits from cats rather than focusing on risks to wildlife, cats, or people. Moreover, campaigns could focus on perceptions of the current cat population as “too large.” Model results indicated that this variable was a significant predictor of both risk perceptions and perceived benefits and might therefore play a more important role in influencing tolerance and attitudes about management than risk perceptions alone. In addition, students did not appear to be overly concerned about issues with outdoor cats. Education campaigns aimed at this population would likely need to raise awareness about this issue before targeting behavior.

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