

Supplementary Information

Responding to misinformation and criticisms regarding United States cat predation estimates

Scott R. Loss^{1*}, Tom Will², Travis Longcore³, Peter P. Marra⁴

¹Department of Natural Resource Ecology and Management, Oklahoma State University, 008C Ag Hall, Stillwater, OK 74078, USA

²Division of Migratory Birds, Midwest Regional Office, US Fish and Wildlife Service, 5600 American Boulevard West, Suite 990, Bloomington, MN 55437, USA

³Spatial Sciences Institute, University of Southern California, 3616 Trousdale Parkway, Los Angeles, CA 90089-0374, USA

⁴Migratory Bird Center, Smithsonian Conservation Biology Institute, National Zoological Park, P.O. Box 37012, MRC 5503, Washington, DC 20013, USA

**Corresponding author:* Email: scott.loss@okstate.edu; Telephone: +1 405-744-4607

Online Resource 3. Summary of responses to criticisms of Loss et al. (2013) paper estimating annual predation of free-ranging domestic cats on wildlife of the United States; The full text of all criticisms is in Online Resource 1 (Alley Cat Allies Commissioned Report) and Online Resource 2 (*Vox Felina* post).

Criticism/claim	Source	Basis	Response
<i>Cat predation estimates are unrealistic given the total number of U.S. birds</i>	<i>Vox Felina</i> post	Cats estimated to kill 1.4-4.0 billion birds/yr but total US bird population only 4.9 billion	Estimate of 4.9 billion is extremely low & excludes nestlings/fledglings & some bird groups (e.g., shorebirds & marshbirds); other estimates as high as 20 billion US birds ¹ & even high estimates exclude young. Total birds vulnerable to predation changes throughout the year; after the breeding season there may be 4-6 times as many birds in the population
<i>Cat predation does not necessarily lead to population-level impacts</i>	<i>Vox Felina</i> post	Cats unlikely to affect populations, partly because they prey on individuals that would have died anyway	Extensive peer-reviewed evidence showing cats impact wildlife populations ² ; claim that cats kill weak & unhealthy individuals not supported by scientific evidence & misrepresents conclusions of the cited studies; ^{3,4} population-level focus ignores individual wild animal suffering
<i>Cat predation estimates have broad uncertainty</i>	<i>Vox Felina</i> post	Estimates have broad uncertainty & authors contradict own previous recommendations for estimating uncertainty	Authors used systematic, transparent approach to generate parameter distributions & uncertainty ranges; sensitivity analysis was conducted to assess uncertainty sources; Claim of self-contradiction cites authors out of context ⁵
<i>The estimate of predation by unowned cats is inflated for several reasons, including:</i>			
<i>Empirically derived estimates of unowned cat populations are lacking</i>	<i>Vox Felina</i> post	The used range of unowned US cats (30-80 million) has no empirical data behind it	Authors acknowledged this limitation & the need to improve estimates of unowned cat populations; nearly all sources (e.g. Humane Society of the U.S. estimate ⁶) are within this range
<i>The proportion of unowned cats that kill wildlife is too high</i>	<i>Vox Felina</i> post	Used only rural studies but some urban studies have few observed predation events & urban cats hunt less when fed by humans	Studies cited in criticism had no objective of estimating predation so observations do not allow conclusions about cat hunting behavior; studies show cats kill regardless of whether they are fed by humans ^{7,8}

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| • <i>The unowned cat predation rates are too high</i> | Vox Felina post | Used studies with methods biased toward hunting cats | Criticism is irrelevant because predation rate distributions only meant to reflect hunting cats; authors defined a separate parameter for proportion of cats hunting |
| • <i>The unowned cat predation rate is based on a uniform rather than skewed distribution</i> | Vox Felina post | Cat predation rates vary among individuals & follow a skewed distribution | Criticism ignores and/or misrepresents estimation approach; authors based predation distributions on study-level average predation rates not individual cat rates; no evidence that study-level averages follow skewed distribution |

The estimate of predation by owned cats is inflated for several reasons, including:

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| • <i>Two of the sources used to estimate the proportion of pet cats outdoors are based on the same data</i> | ACA Report; Vox Felina post | Estimate from American Bird Conservancy source ⁹ based on Marketing and Research Services source ¹⁰ | The two estimates do appear to reflect the same data source; however, this error has no effect on predation estimates because predation rate distribution was uniform & upper/lower bounds would remain unchanged |
| • <i>No differentiation was made between cats that are outdoors at all times and those that spend at least some time indoors</i> | ACA Report; Vox Felina post | Cats outdoors at all times kill more wildlife than outdoor cats that spend some time indoors | Authors based predation rate distributions on multiple studies, each of which sampled numerous cats, thus sample used to inform predation estimates captures variation in amount of time pet cats spent outdoors |
| • <i>The proportion of owned cats that kill wildlife is too high</i> | Vox Felina post | No basis provided | Range of this parameter distribution supported by peer-reviewed literature; more recent estimates support this range ¹¹ |
| • <i>The owned cat predation rate is based on a uniform rather than skewed distribution</i> | Vox Felina post | Cat predation rates vary among individuals & follow a skewed distribution | Criticism ignores and/or misrepresents estimation approach; authors based predation distributions on study-level average predation rates not individual cat rates; no evidence that study-level averages follow skewed distribution |
| • <i>The correction factor to account for prey not returned to owners is too high</i> | Vox Felina post | Correction factor value based on study observing cat prey return behavior in summer only ¹² | Although prey return <i>frequency</i> varies seasonally, no evidence that <i>proportion</i> of prey returned to owners varies seasonally; more recent study suggests even higher correction factor appropriate ¹¹ |

<i>No meta-analysis was performed</i>	ACA Report	Instead of Monte Carlo simulation, authors should have conducted meta-analysis	Meta-analysis requires studies estimating effect size for a cause-effect relationship; this is not possible for question of how many animals are killed by cats because there is no cause-effect relationship
<i>Extrapolation was misused, including:</i>			
• <i>Extrapolation to cats with characteristics different than those sampled</i>	ACA Report	Uses analogy of applying an age-height relationship for children to adults, suggesting same approach used for cats	Analogy flawed because it suggests extrapolation beyond the characteristics of a sample; no evidence that cats in data sample differ from unsampled US cats, so authors did not use extrapolation in same manner as insinuated
• <i>Extrapolation from partial-year studies to annual predation estimates</i>	ACA Report	Authors multiplied monthly estimates by 12 to generate annual estimates	Criticism ignores and/or misrepresents estimation approach; authors transparently accounted for seasonal variation when converting partial-year estimates to annual estimates
• <i>Extrapolation from a small sample of cats to all U.S. cats</i>	ACA Report	Authors extrapolate from a small sample of cats studied over a few months to the entire US and entire year	Criticism ignores and/or misrepresents estimation approach; authors based predation distributions on multiple study-level averages of predation rate, with each representing multiple cats; seasonal variation in predation also accounted for
• <i>Unclear how stomach/scat contents for unowned cats were extrapolated</i>	ACA Report	Authors do not describe extrapolation approach for stomach/scat contents for unowned cats	Authors used systematic, transparent, clearly described approach to convert stomach/scat contents data into study-level average predation rates; approach was more likely to result in lower rather than higher estimates
<i>Ad hoc analysis</i>	ACA Report	Authors used many uniform probability distributions and distributions not derived systematically	For many parameters, limited data prevented definition of distributions more informative than uniform distribution; formal statistical procedures were followed for prey return rate and predation rate parameters, which had more data
<i>Mischaracterization of error</i>	ACA Report	Individual predation estimates used for parameter distributions had error that was not accounted for	Incorporating error/uncertainty from individual studies would increase range of parameter distributions, which would increase predation estimate uncertainty but median predation estimates would remain unchanged
Authors cite sources that are not peer-reviewed	ACA Report	Values used to estimate proportion of pet cats outdoors not peer-reviewed	No rationale provided for why use of these sources biases predation estimates; industry reports are most comprehensive analyses of pet ownership behaviors available & they follow statistically valid methodologies

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