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## Garbage In, Garbage Out

By now—just about 72 hours after the story broke—it’s probably more difficult to find people who *haven’t* heard about the Smithsonian study claiming “that free-ranging domestic cats kill 1.4–3.7 billion birds and 6.9–20.7 billion mammals annually” [1] than it is to find people who’ve heard the news somewhere—the *New York Times*, the BBC, NPR’s *All Things Considered*, or any number of other media outlets.

Very few scientific papers receive the kind of press coverage that’s been given “*The impact of free-ranging domestic cats on wildlife of the United States*,” published in the online journal *Nature Communications*. Then again, very few studies make the kinds of claims made by the paper’s authors—claims the media has accepted without the slightest bit of scrutiny. Which is, unfortunately, to be expected.

And, I suspect, exactly what these researchers intended. Though they describe their work as a “data-driven systematic review,” [1] it’s difficult not to see it as part of a concerted effort to undermine TNR.

“Projects to manage free-ranging cats, such as Trap-Neuter-Return (TNR) TNR colonies, are potentially harmful to wildlife populations,” argue Scott Loss, Tom Will, and Peter Marra, “but are implemented across the United States without widespread public knowledge, consideration of scientific evidence or the environmental review processes typically required for actions with harmful environmental consequences.” [1]

Before considering *their* scientific evidence, a little background is in order.

Loss is a post-doctoral fellow at the Smithsonian Conservation Biology Institute, where, as regular readers will likely recall, Marra is employed as a research scientist. Will is a biologist with the U.S. Fish and Wildlife Service.

Long-time readers will also recall that Marra (a *vocal critic of TNR*) served as Nico Dauphiné’s advisor at the Smithsonian until October 2011, when she resigned after being *found guilty of attempted animal cruelty*. And Will, also an *outspoken critic of TNR*, helped Dauphiné land her post-doc fellowship there with a letter of recommendation.\* (Her position was funded by USFWS, just as Loss’ is today.)

None of which is meant to suggest that their work be dismissed out of hand. Under the circumstances, though, a little additional scrutiny doesn’t seem unreasonable. And, as it turns out, it only *takes* a little bit to discover a number of flaws that undermine the authors’ headline-grabbing “estimates.”

Indeed, when seen in context, these astronomical figures alone raise questions of credibility. If, as Arnold and Zink have suggested,\*\* the breeding population of North American landbirds is 4.9 billion, then the 1.4–3.7 billion mortalities reported by Loss et al. (which the authors argue throughout their paper is a *conservative* estimate) represent an astonishing 28.5–75.5 percent of the total population. That’s *on top of* the 2.1 percent Arnold and Zink attribute to collisions with towers and windows. [2]

While some species are, unquestionably, on the verge of extinction, *the entire population of North American landbirds* most certainly is not.

In addition to their wildly inflated predation estimates (a detailed discussion of which I’ll get to shortly), Loss et al. fail to acknowledge the fact that predation—even at very high levels—does not necessarily lead to population-level impacts. Like all predators, cats tend to prey on the young, the old, the weak, or unhealthy. At least two studies have investigated this in great detail, revealing that birds killed by cats are, on average, significantly less healthy than birds killed through non-predatory events (e.g., collisions with windows or cars). [3, 4]

As the UK’s Royal Society for the Protection of Birds notes:

“Despite the large numbers of birds killed, there is no scientific evidence that predation by

Providing critical analysis of claims made in the name of science by those opposed to feral/free-roaming cats and trap-neuter-return (TNR). More details [here](#).

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cats in gardens is having any impact on bird populations UK-wide... It is likely that most of the birds killed by cats would have died anyway from other causes before the next breeding season, so cats are unlikely to have a major impact on populations.” [5]

## (More) Extrapolation and (Greater) Imprecision

“The impact of free-ranging domestic cats,” isn’t the first paper on which these three have collaborated. But their previous effort, “[Direct human-caused mortality of birds: improving quantification of magnitude and assessment of population impact](#),” published late last year, was different in both its scope and tone. There, the authors pointed out that “quantification of direct anthropogenic mortality, although critical for conservation efforts, remains imprecise.”

“National mortality estimates are often based on extrapolation from a limited sample of small-scale studies, and estimates of uncertainty are ignored or only superficially assessed.” [6]

Ironically, Loss et al. include some of these very studies in their more recent analysis. And by pooling studies from various contexts, they actually *add* to the uncertainty they once seemed to find so troubling. And yet, it was *this* work, rather than their 2012 paper, that received the big PR push.

Despite all their claims to the contrary, this has very little to do with science or conservation. (One wonders if the timing of the [USFWS press release](#) announcing that the agency will resume its roundup of cats in the Florida Keys—issued just one day prior to the publication of “The impact of free-ranging domestic cats”—was more than coincidental.)

## Predation Attributed to Unowned Cats

Loss et al. claim that 69 percent of their overall mortality estimates can be attributed to un-owned cats. To calculate annual predation, they simply multiply (1) the estimated population of unowned cats in the contiguous U.S. (for which they use 30–80 million) by (2) the proportion of unowned cats that hunt (0.8–1.0) by (3) the estimated annual predation rate for either birds, mammals, amphibians, and reptiles—based on various studies around the world.

I say *simply*. And the basic math *is* relatively simple—except that the authors apply a statistical technique (“random draws... made using distribution functions” [1]) to which I don’t have easy access. And there’s little point in using “straight” minimums and maximums to calculate some estimates of my own, as doing so would greatly inflate the upper estimate and greatly diminish the lower estimate. (By way of comparison: Loss et al. suggest that owned cats in the U.S. are responsible for 155 million to 2.7 billion bird mortalities each year; an estimate using only minimums and maximums yields a range of 19.6 million to 5.5 billion.)

And let’s set aside for the moment the estimate of 30–80 million unowned cats employed by Loss et al. Obviously, this is most influential of the three factors used in calculating the overall mortalities, but as the authors acknowledge: “No empirically-derived estimate of un-owned cat abundance exists for the contiguous U.S.” [7]

So what about the other two factors—are they as robust as the authors suggest? Not at all.

### Ratio of Unowned Cats That Kill Wildlife

For the purposes of calculating overall mortalities, Loss et al. suggest that 80 to 100 percent of unowned cats kill wildlife. But they’re referring only to rural cats here. What about in more densely populated areas, or areas where unowned cats aren’t entirely reliant on prey for their meals?

A brief review of some well-known studies is revealing.

- Of the 120 scat samples PhD student Cole Hawkins found by searching the “cat area” of his study site, “65 percent were found to contain rodent hair and 4 percent feathers.” [2] That could be just one bird, killed by just one cat (assuming the cat actually killed the bird in question). At the time, there were 22 cats in Hawkins’ “cat area.”

If it’s true that 80 to 100 percent of them were active hunters, we would expect far more evidence. Granted, these cats were being fed (though, curiously, there’s no mention of volume, frequency, or any other details about it in Hawkins’ work), but for the purposes of the current discussion, it’s a moot point—Loss et al. argue that “predation is independent of whether cats are fed by humans.” [1]

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- Researchers in Brooklyn observed 55–72 cats over three 60-day study periods during 1981 and 1982, and found that “although birds and small rodents are plentiful in the study area, only once in more than 180 hours of observations did we observe predation.” [8] Some of these cats were being fed, but again, that’s not relevant here. Loss et al. simply assume that at least 80 percent of these cats—and the many cats in similar contexts—are hunting for their meals.
- Over the course of approximately 300 hours of observation (this, in addition to what the researchers described as “several months identifying, describing, and photographing each of the cats living in the colonies” prior to beginning their research) in two Miami-Dade County (FL) parks, Castillo and Clarke “saw cats kill a juvenile common yellowthroat and a blue jay. Cats also caught and ate green anoles, bark anoles, and brown anoles... [and they] found the carcasses of a gray catbird and a juvenile opossum in the feeding area.” [9]

There were, at any one time, 85–95 cats across the two study sites—more than enough opportunity for documenting the kind of extensive predation suggested by Loss et al. (This, by the way, is the only study I know of that investigated predation by “colony cats.” Is it any wonder TNR opponents cite it only because “the colonies did not decline in size over time, partly because people continued to illegally dump their unwanted cats”? [10])

### Annual Predation Rates

In calculating their overall mortalities, Loss et al. suggest that, based on eight U.S. studies, a typical unowned cat kills 24.4–51.4 birds/year. (And here I’ll focus only on the U.S. data, and only the data for birds—for the sake of simplicity, but also because it’s the predation of birds that tends to be the focus of so much contentious debate.)

But five of the eight studies the authors included in their analysis (two were removed, as the values were considered too high) were conducted in the 1930s and 1950s, at a time when it wasn’t unusual for researchers interested in the diet of cats to simply shoot whatever cats could be found hunting along roadsides (or picked up dead, having been killed by a passing vehicle). [11]

Setting aside the obvious ethical objections, such methods may be useful for determining *what* the cats were hunting, but tell us very little about *how much*. Had they not been hunting at the time, they probably wouldn’t have been “collected.” By including these studies (which contribute four of the five highest predation rates included in the U.S. mortality calculation), then, Loss et al. inflate significantly their overall predation estimate.

The authors further inflate predation estimates by assuming that predation rates are described by a **uniform distribution** rather than a **skewed distribution** (as virtually every predation study has demonstrated, and which I’ve discussed in some detail [previously](#)).

### Predation Attributed to Owned Cats

Calculating annual predation from pet cats allowed outdoors is a little bit trickier than for unowned cats because of two additional factors: (1) the proportion of owned cats with outdoor access, and (2) “a correction factor to account for owned cats not returning all prey to owners.” [1]

#### Indoor/Outdoor Cats

For the first factor, Loss et al. use a range of 0.4–0.7, meaning somewhere between 40 and 70 percent of owned cats are allowed to go outdoors. They suggest that this is based on eight studies, though, in fact, one—a 1997 survey commissioned by the American Bird Conservancy—is counted twice. And misrepresented.

Loss et al. cite the survey itself, but then indicate that ABC’s *Domestic Cat Predation on Birds and Other Wildlife* brochure is an additional source, when in fact it merely refers to the same 1997 survey. [12] And, although Loss et al. use 65 and 66 percent, respectively, for the two references, the actual survey results are quite different: “35 percent keep their cats indoors all of the time; 31 percent keep them indoors *mostly* with *some* outside access.” [13, emphasis mine]

There’s no telling what was meant by *mostly* and *some*. But another of the studies cited provides some useful insight. Of their 134 survey respondents who reported owning one or more cats, Kays and DeWan found that 53 (39.6 percent) of them allowed their cats to go outside. But, although Loss et al., include this figure in their pool of eight (seven), they fail to acknowledge that 41 percent of those cats were allowed outdoors for *four hours or less* each day. [14]

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Other surveys have pinned respondents down further still.

A 2003 survey conducted by Clancy, Moore, and Bertone suggested that nearly half of the cats with outdoor access (which made up just 40 percent of the total) were outside for two or fewer hours a day. And 29 percent were outdoors for less than an hour each day. [15] And Linda Lord found that 59 percent of the 217 cat owners participating in her study reported that their cats were indoor-only. Nearly 20 percent more allowed their cats outdoors no more than three hours each day. [16]

One might think of this in terms of *outdoor cat FTE* (full-time equivalent), a term used by Andrew Rowan, chief scientific officer for the Humane Society of the United States, at the [Outdoor Cat Conference](#) in December. If one cat spends, say, three hours outside every day, then it would take *eight* such cats to cover all 24 hours in a day. For every eight of these cats included in an estimate of outdoor pet cats, then, we've got just *one* outdoor cat FTE.\*\*\*

A few rough calculations reveal the implications.

Loss et al. estimate that there are 32.6–60.6 million "owned cats with outdoor access." Adjust their figures for (1) a more accurate measure of the proportion of cats going outside, and (2) what's known about the amount of time *these cats* actually spend outdoors, and you come up with something like 10.3–11.0 outdoor cat FTE.

### Correction Factors

Again, the Idea here is simple (though not uncontroversial, as I'll explain shortly): it's assumed that cats kill more prey than they bring home, so the tally of prey collected needs to be adjusted in order to more accurately estimate total kills. According to Loss et al.:

"Twice as many predation events were observed when cats were monitored continuously compared to average monitoring effort in Illinois. Compared to prey returns, 3.3 times more kills were directly observed in New York. Based on assessment of scat samples, 21 percent of prey captures were not detected in a study in Kansas." [7]

The Kansas example refers to [Carol Fiore's thesis work](#), but is hardly worth quibbling about in light of the other two references. The Illinois study is the often-cited 1974 paper by William George. Here, Loss et al. fall into the common trap of misreading George's paper; indeed, the figure to which they refer "has been reported widely, though it is unfounded" [17]. When George "double[d] the number of observed captured specimens," he did so not to account for the cats' behavior but his own: he was attempting to correct for discrepancies between periods "when the delivery area was under continuous day-and-night scrutiny" and periods "when continuously scrutinized for lesser amounts of time." [18]

Most interesting of all, though, is the New York study—a reference to the aforementioned work by Kays and DeWan. Based on their observation of 12 cats' hunting behavior (including failed attempts), the researchers concluded that monthly predation rates during the summer were "3.3 times greater than the rate estimated from prey brought home." [14]

Obviously, the study's small sample size, limited duration (181 total hours of observation), and seasonal constraints (summer only) raise serious questions about the applicability of this conversion factor to other research findings.

In particular, those documenting predation of birds.

As Kays and DeWan themselves point out, there *were* no birds among the prey items killed but not returned home:

"We documented 31 attempted hunts... Birds were the target in 22.6 percent of these attempts, small mammals in 51.6 percent and the target was unknown in 25.8 percent of the hunts (although it was probably small mammals). Eight of these hunts resulted in a capture (*all small mammals*, 26 percent capture rate), and four out of the eight animals escaped alive (13 percent total kill rate)." [14, emphasis mine]

By applying this correction factor to the predation rate for birds (already inflated, as described previously), Loss et al. overstate mortality levels significantly. (And again, even its application to predation rates for mammals is questionable.)

• • •

"Our findings," write Loss et al., "suggest that free-ranging cats cause substantially greater wildlife mortality than previously thought and are likely the single greatest source of



anthropogenic mortality for U.S. birds and mammals. Scientifically sound conservation and policy intervention is needed to reduce this impact.” [1]

The trouble is, the only reason for their “new” findings is their flawed, agenda-driven analysis. Loss et al. have demonstrated neither the impact they refer, nor an ability to apply the rigor necessary for a truly scientifically sound conservation and policy intervention.

[Note: [Alley Cat Allies](#), [HSUS](#), and [Best Friends](#) all responded to the Loss et al. paper earlier in the week.]

\* As explained in documents I obtained through a FOIA request.

\*\* While I don't have any reason to doubt the figure these authors use, I also haven't chased down the source cited.

\*\*\* One obvious weakness of such a conversion factor—at least as it applies to hunting behavior—is the implication that “all hours are created equal.” Clearly, the availability of prey varies with the time of day/night.

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