

17 Reasons the Economic Impact of the Domestic Cat as a Non-Native Species in the U.S. Does Not Cost \$17 Billion

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*In July 2010, The University of Nebraska-Lincoln (UNL) Extension published a circular, "[Feral Cats and Their Management](#)," by Aaron Hildreth,[†] Stephen Vantassel,[‡] and Scott Hygnstrom.[§] AudubonMagazine.org's blog, The Perch, brought attention to the circular in December when they featured a piece, "[Feral Cat Predation on Birds Costs Billions of Dollars a Year](#)."^[46] The UNL authors claim "Predation by cats on birds has an economic impact of more than \$17 billion dollars per year in the U.S."^[32] Analysis of the circular indicates a) their math is incorrect and does not total \$17 billion, and b) though not cited, the source of the claim is a study authored by Professor David Pimentel^{**} and several graduate students (2005).*

The cost of an invasive species must be based on reliable estimates of economic losses and ecological impact.^[33] The approach taken by Pimentel et al. to attempt to estimate the economic and environmental impact of the cat on a national level is specious. Irrespective of the accuracy or inaccuracy of cat population or predation estimates, the literature on the subject provides little evidence of environmental loss to cat predation on native wildlife other than in isolated or fragmented habitats, thus the premise of a nationwide impact is unfounded. An irrational and subjective valuation of bird deaths, the sole valuation used to determine the impact of the domestic cat, renders the valuation meaningless. The publications are replete with errors. Cats do not belong everywhere, but misguided management policies driven by flawed or oversimplified science do not serve the public or our native populations of wildlife. Conservation efforts must be based on sound science.

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17 Reasons the Economic Impact of the Cat Is Not \$17 Billion

- 1) "Feral Cats and Their Management" calculates the cost incorrectly (based on their own assumptions);
- 2) The Pimentel 2005 Update alters the assumptions used to estimate the cost, lowering the impact by almost \$10 billion, *but this is not recorded in the publication.*

The premise of the valuation is flawed:

- 3) There is no strong research to support the viewpoint that cats are a serious threat to wildlife nationwide;

- 4) Cats kill non-native species;
- 5) Bird predation by cats may be primarily compensatory.

Pimentel's assumptions are based on poor research that overestimates the impact because:

- 6) Cats are opportunistic feeders;
- 7) Not all cats hunt birds;
- 8) 34% of pet cats roam, not 65%;
- 9) Cats kept indoors cannot hunt!
- 10) Not all free-roaming pet cats hunt;
- 11) Feral cat population estimates are poor;
- 12) Feral cats hunt fewer birds than house cats (dependent upon prey availability);

- 13) The 2000 and 2005 reports use aggressive bird depredation rate assumptions;
- 14) Proper numbers to scale-up study data to population-level estimates must be used.

The \$30 per bird valuation is subjective and thus not a reasonable estimate of financial loss:

- 15) Why are dead birds more valuable than dead fish?
- 16) Why are dead birds more valuable than dead pet cats?
- 17) Are wild birds 12x more valuable than chickens or 3x more valuable than turkeys?

Introduction

Birds are sensitive indicators of the health of our environment. Birds are one of the most populous life forms on the planet, and that biodiversity not only plays a vital role in our ecosystem, it leads to a richness of life and beauty everyone recognizes and enjoys.

Birds have direct ecological and economic functions; they also hold intangible cultural value. But measuring their loss via depredation by the domestic cat on a “per bird valuation” when it is unclear that the domestic cat even has an impact on their population is not a sound scientific approach.

What Pimentel and the authors of the University of Nebraska-Lincoln (UNL) Extension circular overlook in their very premise of valuing the economic impact of the cat on bird populations via depredation is that ***there is no strong research to support the viewpoint that cats are a serious threat to birds or other wildlife*** except where there are fragile prey populations (in isolated or fragmented ecosystems). In a review of 61 cat predation studies, Fitzgerald^{††} and Turner^{††} (2000) conclude that there is not enough information to attempt to estimate on

average how many birds a cat kills each year. Their work also indicates that there are “few, if any” studies (apart from island ones), that actually demonstrate that cats have reduced bird populations.^[29]

Cat predation is not a simple metric to measure. Some authors note at least some of the shortcomings and biases in their work. Issues include a wide range of potential problems:

- small sample sizes,
- method of study recruitment,
- data gathering techniques,
- time frames encompassed by the studies,
- methods applied in statistical analysis of the data gathered,
- assumptions used in “adjusting” the data,
- the proportion of scavenged animals in prey collection,
- not addressing the extent to which predation is compensatory versus additive.

State- and nationwide bird depredation extrapolations have their own host of problems (apart from the fact that they’re built on potentially flawed studies of predation rates). These errors encompass applying improper methods to “scale up” predation rates, such as

- using mean numbers instead of median numbers (resulting in inflated estimates of rates of predation),
- using inflated cat population estimates,
- assuming densities are evenly distributed,
- using inflated assumptions regarding the number of cats allowed outdoors,
- using inflated estimates of the number of cats that hunt,
- extrapolating predation rates from one habitat into another (e.g. using results from a rural village scaled up to nationwide estimates, &etc.).

In one widely cited work, Woods et al. (2003) extrapolate the data collected in their study to nationwide depredation rates in Great Britain. But the authors themselves state that the scaled-

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up estimates should be treated with “requisite caution” and that the figures do not “equate to an assessment of the impact of cats on wildlife populations.”^[68]

Cats may be a nonindigenous species, and their impact on the environment hotly debated, but no one can dispute the fact that companion animals, including cats, have a significant place in our hearts, our homes – and our economy. One does not need to seek benefit solely in the intangible aspects of companion animal ownership, or the human health benefits of owning a companion animal that have been so well documented. The economic contribution of the cat and other pets is also very real and tangible (section 3, page 7).

There is no accurate date as to when the domestic cat was introduced to the North American continent, but as they were “working” companions of European traders and settlers, it is generally believed the domestic cat arrived on the continent four centuries ago.^[43] As an introduced species, our wild domestic cats now live in a complex ecological web. Their diet and predation habits vary in each environment, and their eradication in some areas endangered the very species their removal attempted to protect (section 4.2, page 9).

Pimentel (1999 manuscript, 2000, 2005, 2007) and the authors of the UNL piece make many of the mistakes repeatedly found in the literature on the subject of cat predation. In the case of Pimentel et al., while the premise of the valuation can’t be justified ecologically or economically, the problems with the estimates given the premise can possibly be credited to editorial problems, oversights, and lack of research given the scope of the overall work. Hildreth, Vantassel, and Hygnstrom, on the other hand, the authors of the University of Nebraska-Lincoln Extension circular, appear to intentionally mislead given the apparent bias in their work.

Reason #1

1. “Feral Cats and Their Management:” Misleading and Inaccurate

In the circular, Hildreth, Vantassel, and Hygnstrom claim to provide “research-based information on the management of feral cats.” Unfortunately their work does not stand up to this claim. Throughout the document, research (none of which is cited in the body of the text) is misinterpreted and/or misrepresented.^[67] The University of Nebraska circular is clearly biased in its presentation of the subject (“There is no possibility of objectivity if the authors are going to label the animal under discussion as a pest”^[12]), and the authors make claims based on extremely poor research and already discredited information.^{§§}

As to the claim that cats cost the U.S. \$17 billion, examination of the bibliography provided in the circular indicates that the basis of the circular’s valuation is a study published by David Pimentel et al. (2005). The UNL circular’s published number is incorrect from two perspectives:

- a) Hildreth, Vantassel and Hygnstrom base their method of calculating the economic cost of the cat on the Pimentel et al. (2005), “*Update on the environmental and economic costs associated with alien-invasive species in the United States.*”^[53] They use the same number for bird kills per cat (eight), multiply that by an estimate for the number of feral cats, and then apply the same valuation per bird killed (\$30). They deviate from Pimentel et al.’s 2005 Update only by using a different estimate for the number of feral cats in the U.S.

Pimentel et al. used an estimate of 30 million feral cats (for a total economic cost of \$7.2 billion); Hildreth et al. use an estimate of 60 million feral cats. Thus when Hildreth et al.

^{§§} For example inclusion of information from an old Humane Society of the U.S. calculation that 400,000 cats could result from one pair of breeding cats and their offspring in seven years. This information was removed from the HSUS website eight years ago.^[23]

published the \$17 billion economic cost of the cat (taken directly from Pimentel et al.'s 2000 study that adds in free-roaming pet cats to the total number of cats preying on birds, see section 2.1.1 page 5), **the math doesn't work. 60 million feral cats each preying on eight birds per year with a \$30 per bird valuation totals \$14.4 billion, not \$17 billion.**

- b) While \$17 billion was the originally published estimate of the cost of the cat in Pimentel et al. 2000, **the Pimentel et al. 2005 Update revised the total number of cats estimated to be preying on birds by excluding roaming pet cats. This reduced the estimated impact of the cat to \$7.2 billion.** (Again, please refer to section 2.1.1, page 5). Had Hildreth et al. reviewed the source documents with any depth, they would have known this: either that, or they simply chose to misrepresent Pimentel et al.'s work.

Hildreth, Vantassel and Hygnstrom claim to be "advocates for research-based information," yet they do not appear to have reviewed source material carefully or critically; nor do they support evidence for any statements in the "*Feral Cats and Their Management*" circular other than by providing a bibliography with no actual citations. The quasi-scientific piece is riddled with misrepresented, inaccurate, and/or discredited information. The errors and misrepresentation found in just their discussion of the economic impact of the cat calls into question their ability as researchers and their veracity as "scientists."

2. The Pimentel Papers

Dr. David Pimentel: **Ecologist and biologist; not an economist.** Dr. David Pimentel and graduate students in the College of Agriculture and Life Sciences of Cornell University, Lori Lach^{***}, Rodolfo Zuniga, and Doug Morrison, authored three studies in an attempt to estimate the environmental impact of non-native invasive species in the United States.

^{***} Lori Lach did not contribute to the 2005 Update.

One was an unpublished manuscript (1999). Pimentel ultimately published three papers: 2000, 2005, and 2007. Indicated after each are (Total non-native species estimated cost / estimated cost of the cat):

- 1) "*Environmental and economic costs of nonindigenous species in the United States*," published in *BioScience* (2000).^[52] (\$136.6 billion / \$17.0 billion).
- 2) "*Update on the environmental and economic costs associated with alien-invasive species in the United States*," published in *Ecological Economics* (2005) (referred to herein as the "2005 Update").^[53] (\$120.1 billion [sic] / \$17.0 billion [sic]. Correct numbers: \$139.1 billion / \$7.2 billion).
- 3) "*Environmental and economic costs of vertebrate species invasions into the United States*," published by David Pimentel for the USDA National Wildlife Research Center Symposia, in *Managing Vertebrate Invasive Species* (2007).^[50] (Total not comparable as the report covers only vertebrate species. Estimated cost of the cat is \$14.0 billion. [sic]. Correct number: \$14.6 billion).
- 4) The 1999 manuscript of "*Environmental and economic costs of nonindigenous species in the United States*" that deviates significantly from the published 2000 and 2005 pieces is available on the Cornell University website.^[51] Oddly, Pimentel's 2007 piece reverts to the estimates used in the 1999 manuscript.⁺⁺⁺ (\$138 billion / \$14 billion).

⁺⁺⁺ Pimentel 2007 reverts to predation estimates used in the 1999 manuscript (five per cat versus eight per cat in the 2000 and 2005 publications), updating only the number of pet cats in the U.S. (67 million in the 2007 paper versus 63 million in the 1999 manuscript). Oddly, the 1999 manuscript and the 2007 paper assume **ALL** pet cats (even if kept indoors 100% of the time!) prey on wild birds. See section 5.2.2., "Cats kept indoors cannot hunt!" p. 12.

Ecologists are not necessarily trained to properly assess financial impact. Calls to integrate ecology and economics in order to develop reliable estimates are on the rise. At stake is the foundation on which public policy decisions are made.^[33,36] Pimentel et al.'s effort was potentially important initial work in attempting to estimate an overall economic impact of exotic species in the U.S., but it must be viewed within the context for what it was: an initial attempt by ecologists.

As noted in the introduction to *Bioeconomics of Invasive Species: Integrating Ecology, Economics, Policy, and Management*,

"...invasive species are now often in the public discourse. At the same time, economists have begun to take a real interest in determining how invasive species interact with the economic systems, and how invaders should be controlled to optimize societal wealth. Although the work from ecologists and economists have both greatly expanded our understanding of the drivers and impacts of invasions, little integration between the fields has occurred that would allow managers and policy-makers to identify the optimal expenditures on, for example, prevention and control of invasive species. Because the level of effort expended on invasive species management is intricately linked to the costs and projected benefits of that management, there is an urgent need for greater synthesis between ecology and economics."^[36]

As an initial attempt at assessing total economic damage of invasive species in the U.S., it is not surprising that the Pimentel studies have been "roundly criticized for ignoring major economic benefits [of non-native plants and animals] and for including the cost of controlling species that may not need controlling, as well as factoring in events of questionable relevance, such as bird deaths caused by domestic cats."^[31] The studies have also been criticized for

inadequate research, lack of ecological understanding, and improper application of economic methods.^[33] Even ecologists have their areas of expertise, and the studies attempted to cover the entire gamut of invasives: plants, mammals, birds, reptiles and amphibians, fish, arthropods, mollusks, microbes, and livestock and human diseases. Thus it is not unexpected that work in some areas falls short.

Investigation into the premise and methodology used by Pimentel et al. in estimating the economic impact of domestic cats confirms the above assessments. Apart from critical problems with the premise itself, the section in each of the three published pieces (and the manuscript) reveals a lack of research, inappropriate assumptions, and an economically irrational valuation placed on bird deaths, the sole valuation used to determine the economic impact of the cat. In addition, Pimentel et al.'s 2005 Update was published with significant errors.

2.1 Problem: Egregious Publication Errors. Hildreth et al. in the University of Nebraska-Lincoln piece are not the only ones to have trouble with math and subsequent publication errors. Pimentel's work also has numerous errors, and the 2005 Update has inexcusably significant errors.

Reason #2

2.1.1 The estimated total economic impact of the cat published in the 2005 Update is overstated by \$9.8 billion (137%).

The cost of the cat as published in the 2005 Update is overstated by almost \$10 billion (137%). The total economic cost of the cat in the 2005 Update should have gone to print as \$7.2 billion based on the assumptions and estimates outlined by the authors, not \$17 billion (a reprint of the total economic impact of the cat as published in the 2000 report).

In the 2005 Update, Pimentel et al. exclude roaming pet cats from the equation. This change

in assumptions from the 2000 publication reduced the estimate of the number of cats preying on birds to 30 million from 71 million. No other assumptions are altered. Thus **eliminating free-roaming pet cats from the number of cats preying on birds reduced the estimated impact of cats to \$7.2 billion – a reduction of almost \$10 billion - yet this is not recorded anywhere in the publication.** The table in the 2005 Update is also inaccurate and does not reflect the authors' revised \$7.2 billion estimate.

In the 2000 report, the authors use an estimate of the number of feral cats (30 million), add to that an estimate for the number of "outdoor pet cats," (41 million, 65% of the total pet cat population⁺⁺⁺) and arrive at a total of 71 million cats preying on birds. In the 2005 Update, the authors use the same estimate for the number of feral cats, but they state they do not add to that an estimate for outdoor pet cats. No other assumptions are altered in the 2005 Update from the 2000 publication, *yet the total economic cost is not reduced, despite the fact that the total estimate of cats preying on birds is reduced to 30 million from 71 million.* In the 2000 and 2005 papers, the authors estimate each cat preys upon eight birds per year, and that each bird has an economic value of \$30 (questionable assumptions in their own right as detailed herein).

The math:

30 million (feral) cats preying on birds X eight birds per year X \$30 per bird = **\$7.2 billion** (2005 Update)

71 million (feral and pet) cats preying on birds X eight birds per year X \$30 per bird = **\$17 billion** (2000)

The authors clearly state in the text of the 2005 Update that "This cost does not include the number of birds killed by pet or urban cats..." (emphasis added) yet they reprint the 2000 paper's \$17 billion cost estimate that

⁺⁺⁺ An incorrect assumption. Please see section 5.2.1 "34% of pet cats roam, not 65%," page 11.

a) **DOES** include outdoor pet cats (as per the 2000 publication), and

b) **DOES NOT** match the math given the assumptions and estimates as presented in the discussion in the 2005 Update.

The estimated economic cost of cats published in 2005 is simply incorrect. Based on the authors' own assumptions, the impact of domestic cats should be \$7.2 billion, not \$17 billion. Nowhere in the 2005 Update does the number that matches the correct math of the revised estimate appear.

2.1.2 The total economic cost of invasive species is calculated incorrectly.

The total economic cost of invasive species is miscalculated and went to print in the 2005 Update as \$120 billion. It should have been published as \$139 billion.

The total economic cost of nonindigenous or "alien invasive" species is reportedly reduced to an estimate of \$120 billion in the 2005 Update from an estimate of \$137 billion in the original 2000 paper, despite the fact that (erroneously) estimates of cost were not reduced in any category (they should have been reduced by almost \$10 billion as detailed above) and were raised for crop weeds, dogs, the brown tree snake, fisheries, the zebra mussel, livestock diseases, and human diseases. The sum of the increases is \$12.3 billion. A recreation of the table published in the 2005 Update indicates the revised total economic cost to be \$149 billion (including the overstatement error for the estimated cost of the cat), not \$120 billion as incorrectly published in both the table and text. Adjusted for the \$9.8 billion overstatement error in the cost of cats estimate (and accounting for the other cost revisions) the correct total economic cost of non-native species as presented by the authors should have been published in the 2005 update as \$139 billion, not \$120 billion.

3. Economics of Pets

As noted, the assumptions used to estimate the economic impact of cats changed in the 2005 Update as compared to the original 2000 publication. This change in calculation lowered the total economic impact of cats to an estimate of a \$7.2 billion cost (2005) from the previously published \$17.0 billion cost (2000). While the reason for the change is not addressed by the authors, the source of the change is notable. In the 2005 Update, the authors excluded pet cats from the cost estimate. Why? Was it an attempt to mollify critics? A concession – recognition, perhaps, that the pet cat provides a social and economic benefit?

The domestic cat may be a nonindigenous species, and its impact on the environment hotly debated, but no one can dispute the fact that companion animals, including cats, have a significant place in our hearts, our homes – and our economy. One does not need to seek benefit solely in the intangible aspects of companion animal ownership, or the human health benefits of owning a companion animal that have been so well documented. The economic contribution of the cat and other pets is very real and tangible.

According to the 2011-2012 APPA National Pet Owners Survey, 62% of all U.S. households own a pet: 39 million U.S. households (33%) own 86 million cats, and 46 million U.S. households (39%) own 78 million dogs.^[3] In 2006, Matthew Park, V.P. of Del Monte's Pet Products division said, "the humanization of pets is the single biggest trend driving our business."^[24] In 2009, a poll published by AP-Petside.com indicated that half (50%!) of U.S. companion pet owners consider their pets to be as much a part of the family as any person in the home.^[5] And we spend our money on them to prove it. Spas, insurance, lotions, potions, vitamins, dental care and products, alternative food & treats – products and services – proliferate (as does the advertising to sell them). According to the APPA, pet industry expenditures in 2010 totaled \$48 billion (up from \$23 billion in 1998 and \$36.3 billion in 2005, relevant years from the Pimentel et al. publishing

standpoint), and our pet-related expenditures are projected to grow to over \$50 billion in 2011.^[3] Available at the time research would have been conducted for the Pimentel et al. 2005 Update, the 2002 U.S. Economic Census indicates that the pet industry (stores, veterinary services, pet care, and pet food) accounted for over 360,000 (direct) jobs and \$7.7 billion in payroll.^[60]

The business of pets attracts capital. In March 2011, a group led by KKR completed the acquisition of Del Monte Foods in a deal valued at \$5.1 billion. This was the only private equity deal announced in 2010 that exceeded a \$5 billion valuation, and it is the second largest consumer-focused pet deal on record after Nestle S.A.'s \$12.1 billion acquisition of Ralston Purina in 2001. Approximately 50% of Del Monte's \$4 billion in sales are in its Pet Products Division (brands include Pounce, Meow Mix, 9 Lives, Nature's Recipe, Milk Bone, Kibbles N Bits, Gravy Train, and others), that was valued at 11.0x EBITDA. While many of the pet-related company transactions are private and valuations are not disclosed, it is clearly an area of great economic interest. In the first four months of 2011, four (domestic) pet-related industry deals have already taken place or been announced. In addition to the Del Monte Foods Co. acquisition, in January, MidOcean Partners acquired "a significant equity interest" in Professor Connor's Inc. (d/b/a FreshPet); Wind Point Partners acquired Dorskocil Manufacturing Company, Inc. (d/b/a/ Petmate); Wind Point Partners subsequently announced the acquisition of Bamboo (a maker of pet care products) from Munchkin, Inc. According to the Pitchbook Platform (a private equity deals database), 46 investment firms have completed investments in 44 pet-related companies over the past five years. No doubt about it, pets are big business.

4. Critical Problems with the Premise

Our Environment is a Complex Web

Introduced to the U.S. (and many environments around the world) by European explorers, traders, and settlers, cats have had four centuries to integrate into our environment.^[43] The current role of the domestic cat in the United States is complex, poorly studied, and is still not clearly understood.

Birds are sensitive indicators of biological richness and the health of our environment, and they play a vital role in our natural ecosystem. They have direct economic, environmental, and intangible cultural values for people. But measuring their loss on a “per bird valuation” when it is unclear that the domestic cat even has an impact on their population is not a sound scientific or economic approach.

As Hoagland and Jin (2006)^{§§§} point out, *the cost of an invasive species must be based on reliable estimates of economic losses and ecological impact.* “Heretofore, estimates of the economic losses arising from invasive species have been far too casual. Unfounded calculations of economic damages lacking a solid demonstration of ecological effects are misleading and wasteful.”^[33]

A very basic problem with Pimentel’s work (at least as it relates to the economic cost of the cat) is that **the very premise of the valuation is flawed:**

- 4.1 There is no strong research** to support the viewpoint that cats are a serious threat to wildlife
- 4.2 Cats kill non-native species**
- 4.3 Bird predation by cats may be primarily compensatory**

^{§§§} Resource economists at the Marine Policy Center, Woods Hole Oceanographic Institution, Woods Hole, MA.

“Any bird populations on the continents that could not withstand these levels of predation from cats and other predators would have disappeared long ago.”^[29]

Reason #3

4.1 No Strong Research

First, there is no strong research to support the viewpoint that cats are a serious threat to wildlife or birds, except where there are fragile prey populations in isolated or fragmented ecosystems (Fitzgerald and Turner 2000, Kays and DeWan 2004). The impact of feral cats in a healthy ecosystem simply has not been adequately researched.

Despite the growing body of cat predation studies, population-level impacts on bird populations in continental environments remain poorly documented and have not been demonstrated. The focus of studies tends to be determining predation rates, not the actual impact of cats on prey populations. According to Kays and DeWan (2004), “The ecological impact of a cat population is a difficult metric to quantify, yet probably the most important when evaluating the conservation risks associated with their management. While a number of researchers have extrapolated kill rates from a few cats into huge estimates of prey killed by cats over large areas...these are rarely contrasted with similar estimates of potential prey populations over the same scales. Unfortunately, biologists have rarely sampled both cat and prey populations in such a way that direct effects on prey populations can be shown.”^[35] (Studying “inside/outside hunting cats,” Kays and DeWan found “there was no relationship between the number of cats detected in an area and the local small mammal abundance or rodent seed predation rates.”).

Reason #4

4.2 Cats Kill Non-Native Species

Second, implicit in the premise is the assumption that every bird killed by a cat is a native species. Given the number of non-native birds in the U.S., this assumption is ludicrous. Pimentel et al. themselves note that approximately 10% of bird species in the United States are non-native and assign an economic cost of \$1.8 billion to just two species. That 10% of the U.S. bird population is non-native is extremely deceptive given the prevalence of the nonindigenous birds. According to the North American Bluebird Society, European house sparrows are [now] the most abundant songbirds in North America.^[45] Released in the U.S. in the 1850s, as Pimentel et al. note, they cause extensive damage to crops and fruit trees, and “harass [native] robins, Baltimore orioles, yellow-billed cuckoos, and black-billed cuckoos, and displace native bluebirds, wrens, purple martins, and cliff swallows.” The loss of and competition for available nesting sites are the primary cause of bluebird population declines.^[26]

ANOTHER publication faux pas?

The text of the Pimentel et al. studies discusses European house sparrows (and pigeons) as non-native pests, but no economic cost is assigned to the house sparrow. The table provided in the studies only assigns an economic cost to *starlings* (not house sparrows) and pigeons (\$800 million and \$1.1 billion, respectively).

The premise of the valuation is that cats prey on native birds, but cats also prey on non-native species. A number of studies (conducted mainly in Australia) found that cats deplete primarily non-native species of rodents and birds and that this, in turn, may have a positive effect on native wildlife (Barratt 1998 I, Dickman 1996, Matias 2008). Notably, in a study in Wichita, Kansas, Fiore (2000) found that house sparrows and

starlings represented the highest proportion of depredated birds (26%).^[28]

Feral cats live in a complex ecological web, and removal of feral cats in some habitats has led to mesopredator release, causing in some instances a trophic cascade (Bergstrom 2009, Courchamp 1999, Fan 2005, Tidemann 1994). Such eradication attempts endangered the very species the eradications were attempting to protect.

Reason #5

4.3 Bird Predation by Cats May Be Primarily Compensatory

Third and finally, the “bird kills” by cats valuation premise assumes that all cat “takes” of birds are of live, healthy birds; e.g. that all hunting of birds by cats is additive. The premise by definition does not consider the potential that at least a portion of bird kills by cats is compensatory, another absurd assumption. The critical distinction between additive and compensatory predation is rarely considered in cat predation studies/estimates, yet there are studies indicating that bird kills by cats are primarily compensatory.

Predation is generally understood to be an important selective force in evolution, and studies on predation of birds indicate evidence of natural selection at work. In a large study of raptor predation on gulls, the study “unequivocally showed that age, muscle condition, and sickness were clues for differential predation by birds of prey.”^[30] Møller and Erritzøe (2000) studied 18 species of passerine birds and domestic cat predators. Their work found that disease and parasitism play a meaningful role in bird-related cat predation.^[44] Baker et al. (2008) reported that cat-killed birds were in significantly poorer condition than those killed following collisions, consistent with the notion that cat predation represents a compensatory rather than additive form of mortality.^[6] **In short, Pimentel et al.’s assumption that cat predation in the United States implies a decline in the bird population is flawed.**

5. Critical Problems with the Research, Estimates, and Citations

Pimentel's work is fraught with errors, poor research, and lazy citations. In addition to the careless editorial/peer review process apparent in each of the reports, there are serious flaws with the execution of building the valuation (given the premise). These problems, errors, and oversights include:

5.1 Estimating the number of cats preying on birds

- 5.1.1 Cats are opportunistic feeders
- 5.1.2 Not all cats hunt birds

5.2 Estimating the number of pet cats preying on birds

- 5.2.1 34% of pet cats roam, not 65%
- 5.2.2 Cats kept indoors cannot hunt!
- 5.2.3 Not all free-roaming pet cats hunt

5.3 Estimating the number of feral cats preying on birds

- 5.3.1 Feral cat population estimates are poor
- 5.3.2 Feral cats hunt fewer birds than pet cats (given prey availability)

5.4 Estimating the number of birds individual cats kill each year

- 5.4.1 Imprudent citations
 - 5.4.1.A McKay 1996 is Paton 1991
 - 5.4.1.B Luoma 1997 is Churcher and Lawton 1987
- 5.4.2 Studies on continents provide a wide range of bird depredation rates
- 5.4.3 Median versus Mean: proper numbers to extrapolate population-level estimates must be used to scale up rates to population-level estimates

“A new generation of scientists now argues that our view of nuisance species is too simple.”^[64]

5.1 Problem: Estimating the number of cats preying on birds.

A very basic problem with the estimates developed for the rate of cat depredation of birds by Pimentel et al. is that the authors fail to account for the fact that cats are opportunistic feeders. This makes scaling up individual predation study estimates to nationwide levels problematic. Further, bird hunting is difficult for most cats given their typical hunting methods, thus not all cats hunt birds.

Reason #6

5.1.1 Cats are Opportunistic Feeders

Cats are opportunistic feeders (Coman and Brunner 1972, Paton 1991, Barratt 1994, Fitzgerald and Turner 2000, Berkeley 2001, van Heezik 2010). Cats are scavengers; they eat carrion and garbage (Tabor 1983, Fitzgerald and Turner 2000, Hutchings 2003). Given that cats are flexible in their dietary habits, extrapolations of the diet of the cat from one habitat to another are unreasonable given variable prey availability. Variable abundances of birds, mammals, other species (and garbage) between rural and urban areas – even across urban gradients (Mitchell and Beck 1992, Blair 1996, Chace and Walsh 2004, van Heezik 2008) – mean that **cats in different habitats will have different hunting or scavenging profiles** (van Heezik 2010).

Some of studies indicate that urban cats depredate birds at a higher rate than other habitats (Paton 1991, van Heezick 2010). Yet as Roger Tabor (1995) points out, suburban and urban areas support unnaturally high concentrations of birds. Thus an observation of

higher bird depredation rates in urban areas is consistent with cats being opportunistic hunters.

It is enticing to extrapolate data from one study site in one habitat to produce state-wide or nation-wide figures, but it is inappropriate. Of course it is done all the time. But it is scientifically and ecologically meaningless.

Reason #7

5.1.2 Not All Cats Hunt Birds

There are numerous studies on the diets of feral and free-roaming house cats. The literature is quite clear, **not all cats hunt birds**:

- Coman and Brunner's (1972) study of feral cats in Victoria (Australia) found that 92.5% of the 80 cats with food in their stomach contained no bird remains.^[20]
- Liberg's (1984) study found that 31% of cat scat from house and feral cats collected from January 1974 – August 1977 contained no vertebrate remains.^[38]
- Paton's several year survey (1991) of 421 respondents with cats in Australia reported that 38% of cats without bells did not hunt birds and 53% of cats with bells did not hunt birds; ****
- Fiore's thesis (2000) found that 37% of 41 cats studied in Wichita, KS over the course of one year did not hunt birds;^[28]
- Lepczyk et al. (2003) published that in the area studied in Michigan, 53% of outdoor cat owners reported that their cat(s) brought home no birds during the nesting season;^[37]
- Woods et al. (2003) found that 20% of 634 hunting cats studied across the U.K.

**** Pimentel et al.'s citation for the number of birds killed per year per cat in the 2000 and 2005 reports is McKay 1996. McKay's report is an article, not a study. (See section 4.5.1.A "McKay 1996 is Paton 1991," page 15). McKay's citation is Paton 1991.^[42,47]

from April-August of 1997 did not hunt birds.^[68]

- Matias and Catry (2008) found no evidence of birds (or eggs) in 53.4% of scat analyzed during the austral summers of 2004/2005 and 2005/2006 in the population of feral cats on New Island, Falkland Islands^[41] (39 species of bird regularly breed on New Island. More than two million seabirds inhabit its shores and surrounding smaller islands ([New Island Conservation Trust](#)));
- van Heezik et al. (2008) found that 17% of 96 hunting cats studied over the course of one year did not hunt birds in Dunedin, NZ (a country that has no native mammals other than two species of bat);^[62]

That the number of hunting cats preying on birds in these studies ranges from 7.5% to 83% illustrates the importance of where the cats are located (and likely the length of time of the studies). It also clearly demonstrates that to assume that all cats hunt birds is incorrect.

5.2 Problem: Estimating the number of PET cats preying on birds. The 2000 piece includes an estimate of free-roaming pet cats preying on birds. The 2005 Update eliminates pet cats from the "economic damage" equation. In an inexplicably bizarre approach, the 1999 manuscript and the 2007 paper include ALL pet cats as preying on wild birds (even those that never go outside).

Reason #8

5.2.1 34% of Pet Cats Roam, not 65%^{†††}

Pimentel et al.'s work in this area also reflects inadequate research. While it is appropriate to include pet cats that are allowed to roam in the

††† Based on the citation referenced by Pimentel et al. (2000).^[52,65]

total population of cats preying on birds, the execution in the 2000 piece falls short.

To estimate the percentage of pet cats that are allowed to roam, Pimentel et al. (2000) cite an article by Linda Winter of the American Bird Conservancy published in the *Earth Island Journal* (1999) where she states “A recent poll shows approximately 35 percent [of pet cats] never go outside.”^[65] The authors of the environmental impact study did not go to the source material. The results of the 1997 nationwide telephone survey cited by Winter in the article (commissioned by the American Bird Conservancy in 1997, of which Linda Winter was head of the Cats Indoors! Program at the time) were published in an article by ABC Birds, “*Human attitudes and behavior regarding cats.*”^[1]

This “nationally-representative” study indicates that 35% of cats are kept indoors all of the time and that 31% of cat owners “keep them indoors mostly with some outside access.”^[1] Thus on the basis of the ABC Birds’ commissioned survey cited by Winter, only 34% of pet cats should be considered free-roaming, not 65%.^{****}

Reason #9

5.2.2. Cats Kept Indoors Cannot Hunt!

In what can only be explained as an extremely bizarre assumption, the 1999 manuscript and the 2007 USDA National Wildlife Research Center Symposia piece include **indoor-only** pet cats as preying on wild birds. Citing McKay 1996,^[42] Pimentel’s assumption is based on the comment that “pet cats kill a similar number of birds as

**** The estimate of 34% of pet cats that are allowed to roam is in-line with other literature on the subject. A survey published in JAVMA (2008) conducted by Linda Lord, Assistant Professor of Veterinary Preventative Medicine at Ohio State University, indicates 40% of cat owners allow their pets to roam.^[39] The APPA 2009-2010 National Pet Owners Survey indicates 66% of pet cats are kept indoors at night and 64% are kept indoors during the day;^[2] and Clancy 2003 indicates 60% of cats are kept indoors all the time (and of the 40% allowed outdoors, 29% were outdoors for less than an hour each day).^[16] Please see “*Inside Job*” by Peter Wolf^[66] for a more complete discussion.

feral cats.” McKay should not have needed to clarify that the reference was to pet cats allowed to roam outside.

Mystery Math. The numbers according to Pimentel 2007’s citations:

$$\begin{aligned}
 & 67 \text{ million pet cats (ALL of them)} \\
 & + 30 \text{ million feral cats} \\
 & = 97 \text{ million total cats preying on birds} \\
 & \times 5 \text{ bird kills per year per cat} \\
 & = 485 \text{ million birds killed by cats/year in US} \\
 & \times \$30 \text{ per bird valuation estimate} \\
 & = \$14,550 \text{ million } (\$14.6 \text{ billion})
 \end{aligned}$$

Pimentel 2007 published 470 million birds killed by cats annually in the U.S. Backing into his number, the number of... roaming?... pet cats used in the equation must be 64 million, 96% of the owned cat population, an estimate that makes no sense at all.

In this universe, pet cats kept indoors cannot hunt wild birds. Clearly the McKay citation was taken out of context. Either way, to make such a claim is certainly irresponsible and nonsensical. Indeed, not only do pet cats that are kept indoors not hunt wild birds; **not all outdoor pet cats hunt** (anything, let alone birds), and as discussed already, **not all cats hunt birds** (section 5.1.2, page 11).

Reason #10

5.2.3. Not All Free-Roaming Pet Cats Hunt

Importantly, all cat predation research^{§§§§} of roaming house cats indicates that **not all free-roaming pet cats hunt**. Pet cats that are allowed to roam are generally regularly fed by their owners, thus hunting is not primarily food motivated. With access to human-provided food, it should come as no surprise that individual pet cats vary considerably in the degree to which they depredate wild animals (this has also been shown to be an age-related function in most predation studies).

Table 1 summarizes results of pet cat predation (studies conducted on continents of

§§§§ Studies of reasonable sample size.

reasonable sample size). There is a very wide range of non-hunting cats: from 8.6% of cats in Churcher and Lawton’s 1987 study to 74% of cats in Baker et al.’s 2005 study. Study design will impact results, and each methodology (scat

analysis, owner observation, prey collection, owner recollection via survey) has its own potential flaws. **But the message is clear: not all pet cats with outdoor access hunt.**

Table 1: Not All Free-Roaming Pet Cats Hunt
(Cat Predation Studies Conducted on Continents)

Location	Methodology	No. of Cats	% of house cats that did NOT hunt	Reference
Southern Sweden (Rural)	Scat Analysis 1974-1979	84 - 121	31%	Liberg (1984)
English village (Felmersham)	Prey collection over 12 months	70	8.6%	Churcher and Lawton (1987)
Rural-Sub/Urban Australia	Survey 421 cat owners	612	27.0%	Paton (1991)
Urban Australia (62.% of private dwellings)	Survey of over 4,000 households		56.0%	REARK (1994)
Mt Isa, Queensland Australia	Survey	1,280	51.0%	Perry (1999)
Wichita, KS (**)	Collection/owner observation/scat analysis over 1 Year	41	37.0%	Fiore (2000)
Various: UK	Survey between April 1 and August 31, 1997	986	8.9%	Woods et al. (2003)
Bristol, UK	Seasonal Survey (40/35/30/39 days in winter/spring/summer/autumn)	131	51% - 74%*	Baker et al. (2005)
Dunedin, NZ	Collection/owner reporting over 1 year	151	33.0%	van Heezik et al. (2010)

*The results varied during the four sampling periods.

**Only bird depredation was studied.

5.3 Problem: Estimating the number of FERAL cats preying on birds in the U.S.

First, there is a paucity of reasonably researched estimates of the number of feral cats in the U.S. Second, as pet cats are (generally) well fed, their hunting may indicate prey preference: but feral cats hunt and scavenge to meet their energy

needs. Pimentel indicates feral cats and pet cats depredate birds at the same rate (citing McKay 1996), but other literature questions that notion (other than perhaps on islands where birds are the primary prey available) as feral cats are shown to optimize their hunting strategy.

Reason #11

5.3.1 Feral Cat Population Estimates are Poor

Apart from the great debate as to how many feral cats there are in the U.S., at the time of publication of the manuscript in 1999 and the first paper in 2000, a guesstimate of 30 million feral cats is probably as good a guesstimate as any. The citation used by Pimentel et al. (Luoma 1997) for the feral cat estimate seems a poor choice (see section 5.4.1.B, page 15). Titled “*Catfight*,” it is an article published in the non-peer review magazine, Audubon. The reference reads, “Estimates suggest that the numbers of feral (semiwild) and abandoned cats in the United States run well into the millions – and may exceed 30 million”^[40] and provides no citations: a surprising selection for the report(s) given its lack of credibility.

As a matter of fact, there are no scientific estimates of the feral cat population in the United States. There are estimates cited in peer-review work: some are based on phone surveys of people feeding stray cats (Humane Society 1993, 32.7 million feral cat population estimate);^[55] most are based on some estimated percentage of the pet cat population. None are based on traditional wildlife management population density measurement methods.

The closest feral cat population estimate there is to something based in science belongs to Merritt Clifton of ANIMAL PEOPLE, who estimates that the winter feral cat population may be as low as 13 million and the summer peak is probably no more than 24 million.^[17] The estimates were projected from information about the typical numbers of cats found in common habitat types taken from a national survey of cat rescuers, and cross compared with animal shelter intake data.^[17] The notion that there are fewer feral cats than generally cited in the literature (then and now) is supported by road kill data gathered by ANIMAL PEOPLE from various cities around the country.^[18] ANIMAL PEOPLE is not a peer-review journal.

Reason #12

5.3.2 Feral Cats Hunt Fewer Birds than Pet Cats

It is much easier to estimate the hunting patterns of pet cats than feral cats, thus pet cats are usually the object of predation studies. Pimentel assumes pet and feral cats depredate birds at the same rate based on the McKay 1996 citation. But studies of feral cats in varying habitats on continents do not bear out this notion. (Liberg 1984, Hutchings 2003).

Table 2: Feral Cat vs. House Cat Predation on Birds (Liberg 1984)

% Occurrence of Birds in total Prey

	House Cats	Feral Cats
1974-76		
Jan-Mar	11%	7%
Apr-May	5%	0%
Jun-Sep	11%	0%
Oct-Dec	3%	3%
1977		
Jan-Mar	4%	4%
Apr-May	10%	28%
Jun-Aug	7%	0%
1978		
Apr-May	23%	0%
Oct-Dec	3%	0%
1979		
Jan-Mar	9%	0%

In Liberg’s detailed study of cat hunting behavior in southern Sweden, he found that feral cats optimized their hunting strategy given prey availability when compared to house cats. The diet of feral cats was primarily rabbits. He observed that rabbits caught weighed on average ten times more than the average rodent, but each rabbit took only about five times as long to catch as a rodent; therefore rabbit hunting provided double the rewards of rodent hunting. Table 2

illustrates the lack of bird hunting by the feral cats in Liberg's study, with bird remains in feral cat scats in just four of ten measured periods over a five-year period (1974 – 1979).

Hutchings (2003), studying the predation habits of feral cats around a garbage tip (landfill) in Victoria (Australia) for two years, found that cats selected mainly meat and chicken scraps from the garbage and vertebrates were "hunted opportunistically." Garbage occurred significantly more in the cat scats (81.6%) than any other dietary categories; mammal remains, vegetation, and insects also occurred regularly in the scats, but birds did not. (Flocks of pied currawongs and ravens fed from the garbage, and a "variety" of birds surrounded the landfill).^[34]

Feral cats must hunt and scavenge to fulfill their energy requirements: when ready alternatives are available, feral cats appear to optimize their hunting/scavenging given available sources of food. Bird hunting (usually) does not optimize energy for the effort expended. (Tabor 1983, Liberg 1984, Fitzgerald and Turner 2000).

5.4 Problem: Estimating the number of birds individual cats kill each year. "Five." Or is it eight? Pimentel uses both. Neither estimate is cited to a source study.

Cat predation research indicates a wide range of bird depredation by the "average" cat depending upon where (and how) the studies were conducted. As shown in Table 3, "Depredation Rates of Cats on Continents," Pimentel et al.'s (2000, 2005) choice of eight bird kills per cat is just about the most aggressive estimate they could have chosen. But just as there are cats that don't hunt, there are also cats that are exceptional predators. Given the highly skewed nature of most cat predation studies, Barratt (1998 II) cautions that the median number of prey better represents an actual rate of predation when being used to create population-level impact estimates. The mean rate of predation over-estimated predation observed during his study.^[9]

5.4.1 Imprudent Citations

The Pimentel et al. 2000 and 2005 reports use an estimate of eight birds killed per cat per year, citing McKay 1996.

The Pimentel 2007 and the 1999 manuscript use an estimate of five birds killed per cat per year, citing Luoma's 1997 "Catfight" article published in *Audubon* magazine.

5.4.1.A McKay 1996 is Paton 1991

McKay 1996 is not a predation study, and its selection for the source of the number of birds individual cats kill each year (eight) in the 2000 and 2005 publications is peculiar. McKay wrote an article, "*Feral cats in Australia: origins and impacts*," that was published in 1996 in *Unwanted Aliens: Australia's Introduced Animals*, the proceedings of a seminar held at the Australian Museum (Sydney), September 23-24, 1994. McKay derives his bird depredation rate of eight birds per cat from Paton 1991. Why not just drill down to the source research and then cite Paton 1991 if the research seemed appropriate?

Barratt (1994, p. 1) points out that the study of predation by domestic cats in Australia was "largely pioneered" by Paton;^[7] Paton indicates repeatedly in his study that the numbers (of predation rates and cat densities) are "crude estimates," and, ironically, Paton also notes the very problem with scaling up estimates: **cats in different locations hunt different prey and at differing rates.** "Rates with which various types of prey were taken, however, varied between suburbs of large cities, country towns, and rural areas, with rates on a per cat basis being lowest in the suburban habitat," (p. 66).^[47] Why Pimentel et al. picked this initial work with its "crude" estimates is puzzling.

5.4.1.B Luoma 1997 is Churcher & Lawton 1987

Luoma 1997 is credited in the 1999 manuscript and Pimentel 2007 as the source of the five birds killed per cat per year estimate. "Luoma 1997" is not a cat predation study either. It is an opinion

piece titled “*Catfight*,” published in Audubon Magazine.^[40]

No “per cat” bird depredation rates are mentioned in the “*Catfight*” article. Pimentel writes, “Estimates are that feral cats in Wisconsin and Virginia kill more than 3 million birds in each state per year (Luoma 1997). Based on the Wisconsin and Virginia data, I assume that 5 birds are killed per feral cat/year.”^[50,51] This statement is spurious, because given the information provided in the “*Catfight*” article, it isn’t possible to calculate a per cat bird depredation number from the “Wisconsin and Virginia” data, and they wouldn’t yield an estimate of five bird kills per cat.^{§§§§}

Luoma doesn’t cite it, but the Virginia “data” is a frequently cited number published by Mitchell and Beck (1992). Their study encompassed exactly four urban cats and one rural cat. The average bird depredation rate by urban cats was a total of three birds per cat over 11 months; the one rural cat depredated 25 birds over 11 months.^[43]

The “Wisconsin data” was cited even more frequently; its source is Coleman and Temple. Coleman and Temple never published actual predation data. They did publish several articles about the potential impact of cats utilizing data from other studies and using cat density data derived from their survey in Wisconsin. But the authors themselves identify their guesstimates of cat predation on birds as “guesses.”^[19]

Actually, the rate of five birds killed per cat can be derived from data provided in the article: data sourced from Churcher and Lawton (1987), which is mentioned in the article. Why misrepresent the source of the estimate? Or why

§§§§ In fact, in the 2000 piece, Pimentel et al. indicate that Winter (1999), not Luoma 1997, “reported that feral cats in Wisconsin kill from 7.8 million to 217 million birds each year. Based on an estimated 600,000 feral cats in Wisconsin, these data suggest that feral cats kill at least 13 birds per cat per year.” (The high end of the range indicates each cat kills 362 birds per year, a number not supported in any cat predation study results. 13 birds per cat per year is at the high end of continental predation study results).

not just research the actual cat predation studies – and cite real research?

“I’d be wary about extrapolating our results even for the rest of Britain, let alone America. I don’t really go along with the idea of cats being a threat to wildlife.”^[15]

~ Peter Churcher

Reason #13

5.4.2 Studies on Continents Provide a Wide Range of Bird Depredation Rates

Despite the poor research, to Pimentel’s credit, at least both estimates of cat predation on birds used in the reports are at their source from cat predation studies on continents. As can be seen in **Table 3: Cat Predation Studies Conducted on Continents**, where notable studies of reasonable sample size^{*****} are summarized, the rate at which cats hunt varies considerably. Average bird depredation rates per cat vary from 1.0 per cat to 8.0 per cat. Thus in using the McKay 1996/Paton 1991 estimate of eight birds killed per cat per year, Pimentel et al. are using just about the most aggressive number there is (of studies on continents) to develop a population-level bird depredation estimate.⁺⁺⁺⁺⁺ As discussed in section 5.1.1 “Cats are opportunistic feeders,” page 10,

***** Fiore’s thesis (2000) study is a sample size of just 41 cats, but there is a dearth of actual studies of reasonable sample size conducted in the U.S.

+++++ Crooks and Soule 1999 in a study of 35 free-roaming pet cats in “urban habitat fragments” around San Diego found that mean cat depredation of birds was 13 per cat annually.^[22]

the availability of prey affects what cats hunt, and state- or nationwide population-level extrapolations come with a host of problems.

Given the complexity of cat and prey interactions, to base an estimate of feral cat predation on bird kills utilizing information of

“crude” data from just one “pioneering” study conducted in Australia – or scaling up results to nationwide estimates in the United States based on the average predation habits of 70 house cats (with highly positively skewed data) in an English village – is unrealistically simplistic at best.

Table 3: Cat Predation Studies Conducted on Continents
(Median versus Mean Predation Rates noted where possible)

Location	Methodology	No. of Cats	Median Annual Predation Rate (a)	Average Annual Predation Rate (a)	% That were Birds	Average # of Birds per Cat per Year	Reference
English village (Felmersham)	Prey collection over 12 months	70	NA	14	35.0%	4.9	Churcher and Lawton (1987)
Rural-Sub/Urban Australia	Survey 421 cat owners	612	NA	32	25.4%	8.0	Paton (1991)
Urban Australia (62.% of private dwellings)	Survey of over 4,000 households		NA	4.76	21.0%	1.0	REARK (1994)
Canberra Australia (b)	Prey collection over 12 months	138	6	10.2	27.0%	2.6	Barratt (1998)
Wichita, KS (c) Bird Predation Only	Collection/owner observation/scat analysis over 1 Year	41	2	NA	NA	4.2	Fiore (2000)
Various: UK	Survey between April 1 and August 31, 1997	986	NA	11.3	24.0%	4.1	Woods et al. (2003)
Dunedin, NZ (d)	Collection/owner reporting over 1 year	151	4	13.4	37.0%	5.0	van Heezik et al. (2010)

a) ALL prey: mammals, birds, reptiles, invertebrates, amphibians, except in Fiore 2000 study. See note (c)

b) Only hunting cats were recruited into the study

c) Only bird depredation rates were studied. Using the median, cats depredated just two birds per year.

d) The authors note that NZ has no native terrestrial mammals other than two species of bat

Reason #14

5.4.3 Median versus Mean: Proper Numbers to Extrapolate Population-level Estimates Must Be Used

Of course, for the purposes of estimating population-level impacts, a measure spreading rates of predation across the population of predators is normal practice. But as discussed, such extrapolations should be made with caution.

“Scaling up” is typically done with average predation rates, but as Barratt (1998 II) points out, when the distribution of predation data is highly positively skewed (only a few cats depredate a large number of prey), mean numbers of prey caught per year deviates significantly from the median. This potentially dramatically overestimates projections of predation. Just as a number of studies indicate that about 30% of house cats don’t hunt at all

(section 5.2.3, page 12), they also indicate a small percentage of cats can be exceptional predators. In Barratt's 1998 study (138 cats), 70% of cats were observed to catch less than 10 prey annually (all prey, not just birds), but for 6% of cats, more than 50 prey were recorded. **The total number of prey caught using the sample median was approximately half the estimate based on the sample mean.**^[9] The implications are obvious, and Barratt notes that the mean rate of predation overestimated predation observed during his study. Barratt cautions that the median number of prey better represents an appropriate rate of predation when being used to create population-level estimates when data results are skewed.

Unfortunately, most predation studies do not provide enough data to calculate the median predation rate, even though numerous studies indicate the data is highly positively skewed (Churcher and Lawton 1986, Mitchell and Beck 1992, Barratt 1998 II, Fiore 2000, Woods 2003, van Heezik 2010, to name a few that provided the data or noted the issue). When median rates of predation are provided, they usually refer to total prey taken, not the median rates of depredation for each species.

Fiore (2000) studied only predation of cats on birds. Her thesis (University of Kansas, Wichita) indicated that the average number of birds killed per year was 4.2 per cat. Bird kills per cat and scat sampling data was provided: the median number of birds killed per cat was just 2 per cat per year (consistent with Barratt's observation, though Fiore's median rate of predation was less than half of the mean rate).^[28]

6. The "Per Bird" Valuation

The \$30 "per bird" valuation is subjective, thus not a reasonable estimate of financial or environmental loss. In this critique of Pimentel et al.'s assumptions used to estimate the economic cost of the cat, I've already had to use descriptions such as "egregious," "ludicrous," "absurd," "inexplicably bizarre," and "spurious." The \$30 value per bird "estimate" is ...

outrageous. It certainly doesn't bear scrutiny and isn't defensible. In fact, it is subjective.

Pimentel et al. assign the "cost per bird" value by way of *comparison* to money being spent on birds recreationally (bird watching, \$0.40 per bird; or hunting, \$216 per bird), EPA fines for killing fish via pollution (\$10 per fish), or the cost of bird recovery efforts (\$800 per bird).

- 1) As discussed in section 4.2 "Cats kill non-native species" (page 9), if the cats are preying on non-native species of birds, this does not represent an environmental or economic cost: it's a benefit.
- 2) As discussed in section 4.3 "Bird predation by cats may be primarily compensatory" (page 9), if the cats are scavenging already dead birds or hunting unhealthy birds that would not have survived, this does not represent an environmental or economic cost, and could represent a benefit.

If the cats are preying on non-native birds; birds that are already dead; or birds that would have died anyway and thus wouldn't or couldn't have been watched or shot, then there is no environmental (or financial) loss. Of course, the obvious problem with these numbers apparently escaped the authors: "According to his bizarre form of accounting, hunters value an individual bird more than 500 times as much as a birdwatcher does – suggesting, it seems, that dead birds are far more valuable than live birds."^[67] Which begs the questions – why are dead birds more valuable than dead fish? Or dead pet cats? And are they more valuable than chickens or turkeys?

Reason #15

6.1 Why are Dead Birds More Valuable than Dead Fish?

Pimentel et al. in all of the published pieces estimates the value of a fish at \$10. Cited to his own work in several of the reports, the actual source of this estimate is an article published in The Daily Barometer, (the Oregon State University

student paper), *“Too much beer kills thousands.”* I was unable to obtain a copy of the article, but in a published piece on the environmental and economic costs of pesticides, Pimentel (2005) notes that the article indicated that the “EPA fined Coors Beer \$10 per fish when they polluted a river.”^[49]

According to the American Sport fishing Association (ASA), almost 60 million sport anglers in the U.S. generate over \$45 billion in sales with a \$125 billion impact on the nation’s economy, promoting employment for more than one million people.^[4] The *2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation* indicates that in 2006, 30 million people spent \$42 billion sport-fishing.^[61] The sources may not agree on the per capita numbers, but the industry expenditures (given the ASA numbers are for 2010 and the 2006 Survey numbers are for 2006) don’t deviate much. It’s big business and a very popular sport.

The *2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation* indicates that 47.7 million people watch or photograph birds and “wildlife watching” (not just birds) is a \$45.7 billion industry in the U.S.^[61]

Fishing... \$45 billion. Wildlife Watching (including birds) ... \$46 billion. Why is a dead bird worth more than a dead fish? Are fish less important to the environment than birds?

Reason #16

6.2 Why are Dead Birds More Valuable than Dead Pet Cats?

In the same 2005 piece on the cost of pesticides, Pimentel values domestic cats at \$20 per cat (dogs are valued at \$125 per animal). No source of the estimate for cats (or dogs) is provided: the notes to Table II where these valuations are provided just say “estimated.” (p. 233).^[49] (Good thing cats aren’t preying on dogs, or the cost estimates would be really astronomical).

According to the APPA’s 2011-2012 survey, U.S. citizens spent a total of \$1,217 per pet cat and \$1,542 per pet dog in 2010.^[3] The average cost to adopt a rescue cat is \$40 - \$60, and the

average cost to adopt a rescue dog is \$45 - \$70.^[58] Pimentel’s dog:cat valuation ratio is 6.25:1. Annual expenditures indicate a ratio of 1.26:1. The low-end adoption cost is 1.13:1, and the high-end adoption cost is 1.17:1.

So across the various reports, Pimentel values fish at \$10 a head; pet cats \$20 a head; wild birds \$30 a head (and dogs \$125 a head). An EPA fine is the source for the estimate of the value of dead fish (\$10); there is no source for the value of a dead cat (\$20) (or dog, \$125); numbers are presented for money spent on bird watching, hunting, and recovery efforts (\$0.40, \$216, and \$800, respectively), but these numbers are not used to arrive at the \$30 per bird valuation, they are provided only for context. Pimentel et al. provide *nothing* that can reasonably be turned into a “per bird” value that makes any *economic* sense. **The financial values assigned to wild birds, cats (and dogs) are completely subjective,** and appear to simply reflect Pimentel’s personal values.

Reason #17

6.3 Why are wild birds more valuable than chickens or turkeys?

Again, in the same 2005 piece on the cost of pesticides,^[49] chickens are valued at \$2.50 per chicken (sourced to “USDA 1989a, though there is no citation for this in the list of references), and turkeys are valued at \$10.00 per turkey (sourced to the 1990 Statistical Abstract of the U.S., US Bureau of the Census). Wild birds clearly have a value above and beyond just an economic value. But are they really worth 12x more than chickens or 3x more than turkeys?

6.4 Unable to Evaluate Tinney 1981

For the \$800 per bird cost “comparison,” Pimentel et al. cite Tinney 1981 *“The oil drilling prohibitions at the Channel Islands and Pt. Reyes-Fallallon Islands National Marine Sanctuaries: Some costs and benefits.”* I cannot evaluate this number because I was unable to obtain a copy of

the report.^{****} However, Pimentel in his 2005 piece *“Environmental and economic costs of the application of pesticides primarily in the United States,”* presents the same \$800 number but cites a different source (p. 244): “In addition, the estimated cost of replacing a bird of an affected species to the wild, as in the case of the Exxon Valdez oil spill, was \$800 per bird (Dobbins, 1986).”^[49] Either Dobbins 1986 and Tinney 1981 refer to the same recovery efforts, or Pimentel confuses his source. Two things are clear: 1) neither citation refers to the Exxon Valdez oil spill, as that occurred in 1989, and 2) comparing the cost of cleaning up a bird from an oil spill (with enormous capital costs to support recovery efforts in remote locations) to the cost of bird deaths by cat predation is not a reasonable comparison. Why Pimentel would even include such a number is perplexing.

Pimentel’s Estimate of the Economic Cost of the Domestic Cat Does Not Employ Sound Science or Economics

Hoagland and Jin (2006) state,

“To date, policy responses to the introduction and spread of invasive species have been based on very crude estimates of economic damages. For example, in drafting the Ballast Water Management Act of 2005 (S. 363), the US Senate found that annual estimates of the costs to the US economy from aquatic nuisance species alone range from millions to billions of dollars. This finding can be traced back to a compilation by Pimentel and coauthors (2000, 2005) of the annual economic effects of many of the invasive species that have become established in the United States. There are many reasons to be

concerned about the use of these estimates for policy-making.”^[33]

The cost of an invasive species must be based on reliable estimates of economic losses and ecological impact.^[33] Pimentel et al. do not provide any such thing as it relates to the impact of the domestic cat. The approach taken by Pimentel et al. to attempt to estimate the environmental and economic impact of the cat on a national level is, simply, indefensible and irresponsible.

Irrespective of the accuracy or inaccuracy of cat population(s) or predation estimates, without measurements of the abundance and population dynamics of native species of birds throughout the U.S., the impact of predation by domestic cats cannot be determined. The notion that there is a population-level impact on bird populations nationwide by cats is not supported by literature on the subject. Thus cat predation of birds in and of itself is not a reasonable or reliable method to determine economic or environmental impact across the United States. Any valuation based on the premise is unfounded. Finally, an irrational subjective valuation of bird deaths, the sole valuation used to determine the impact of the domestic cat, renders the valuation meaningless.

Cats do not belong everywhere, but misguided management policies driven by flawed or oversimplified science do not serve the public or our native populations of wildlife. Conservation efforts must be based on sound science.

^{****} The Center for Environmental Education changed its name to the Ocean Conservancy in 1997. They have been unable to provide the study. Contacting Dr. David Pimentel for the study elicited no response. The Library of Congress doesn’t have it.

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