AMERICAN BIRD CONSERVANCY

Shaping the future for birds

Report to Pompano Beach City Commissioners: The Science of Feral Cats

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Executive Summary

The population of feral domestic cats continues to grow throughout the United States as a result of pet owners not spaying/neutering their pets, the widespread abandonment of cats to a life on the streets, and the good-intentioned but misguided efforts of policy makers led astray by the emotional but uninformed pleas of a small segment of the public.

Pompano Beach wisely adopted a prohibition on the feeding of feral dogs and cats to help combat this growing public nuisance and threat to the health and welfare of domestic animals, wildlife, and people. For an organization dedicated to the science-based conservation of birds, it is incredibly concerning to see that Pompano Beach has suspended this ordinance and is considering officially adopting Trap, Neuter, Release (TNR). The sanctioned abandonment of domestic cats through TNR is inhumane, reckless, and a liability for the City. By not addressing the root causes of the feral cat population and failing to adequately adopt an effective management strategy, Pompano Beach will become overrun with feral cats and provide its citizens with no recourse for reprieve.

This report is an effort to provide the appropriate science-based information to the City's Commissioners so that they may make an informed decision on the subject of feral cat control and TNR as they pertain to Pompano Beach.

The Truth about TNR: Debunking the Claims

Feral cat activist organizations and their supporters cite several studies and phenomena as evidence that TNR is the "only humane solution" to dealing with feral cat populations. Not only is TNR an inhumane solution, the studies and phenomena these organizations cite do not support their claims. Feral cat activist organizations do not have the science to back up their position and, therefore, resort to a campaign of misinformation and clever deception. Below, I have outlined the truth regarding several of the claims made by feral cat activists and their backing organizations.

Claim #1 – Removing cats from the environment results in a vacuum effect that will only bring in more cats

Reality:
The "vacuum effect" refers to a situation in which a population is at carrying capacity, a scientific term that refers to the maximum number of animals that the local ecosystem can support. When an individual animal dies or is removed, the population has an opening for another individual to enter. The citation of the vacuum effect by feral cat activists is inappropriate for two reasons: 1) feral cats are unlikely to exclude one another from an area to begin with, and 2) the vacuum effect applies to TNR programs just as it does any other strategy for population reduction.

The carrying capacity of a local system may be determined by the limitation of food, water, shelter, etc. What TNR activities provide, unlike natural wild systems, is an increase in the carrying capacity. By continually feeding feral cats that arrive in a colony, "caretakers" never allow the population a chance to "even out." On the contrary, this behavior encourages additional cats to immigrate into the colony and is one of the reasons that feral cats are observed at densities of 10-100 times that of similarly sized native predators.[1,2]

Although feral cat activists often point to the vacuum effect as support for TNR, they fail to recognize or mention that this phenomenon would completely undermine the so-called management of a TNR program. TNR is sold as a way to diminish feral cat populations gradually through attrition. However, as each individual dies off in a colony, a "spot" opens up and creates the same "vacuum" as when cats are removed from the environment by other means. According to a peer-reviewed article in the journal *Conservation Biology*,[3] activists "refer to a so-called vacuum effect in which new cats are said to immigrate to a location after removal programs,[4,5] but fail to provide evidence that such a phenomenon

[1] Nowell K. and P. Jackson, editors. 1996. Status survey and conservation action plan: wild cats. IUCN, Gland and Cambridge.
[2] Liberg O., M. Sandell, D. Pontier, and E. Natoli. 2000. Density, spatial organization and reproductive tactics in the domestic cat and other felids. Pages 119-147 *in* D.C. Turner and P. Bateson, eds. The Domestic cat: the biology of its behavior. Cambridge University Press.
[3] Longcore T., C. Rich, and L. M. Sullivan. 2009. Critical assessment of claims regarding management of feral cats by trap-neuter-return. Conservation Biology 23: 887-894.
[4] Patronek G. J. 1998. Free-roaming and feral cats – their impact on wildlife and human beings. Journal of the American Veterinary Medical Association 212: 218-226.
[5] Gibson K. L., K. Keizer, and C. Golding. 2002. A trap, neuter, and release program for feral cats on Prince Edward Island. Canadian Veterinary Journal 43: 695-698.

does not also occur when TNR colonies decrease in size." To suggest that the vacuum effect only applies to non-TNR management programs is without merit.

Claim #2 – A reduced intake rate by shelters is evidence for the success of TNR

Reality:
The only conclusion that can be drawn from a reduced intake rate is that a shelter is taking in fewer animals. It makes perfect sense that a shelter would experience a reduced intake rate as a result of TNR because the feral cats are no longer being taken to the shelter. Instead, these cats are being maintained in colonies throughout the community through a program of systematic re-abandonment. A reduced intake rate is absolutely no indication of fewer cats or success for TNR. To use intake rate as a proxy for the success of TNR is highly illogical and misleading. The only accurate representation of TNR's success would be a repeated complete census of the feral cat population beginning prior to the implementation of TNR and continuing throughout the implementation process.

Claim #3 – Feral cats are not at a higher risk of feline immunodeficiency virus (FIV) or feline leukemia virus (FeLV)

Reality:
The study often cited by feral cat activist organizations is "Seroprevalence of feline leukemia virus and feline immunodeficiency virus infection among cats in North America and risk factors for seropositivity."[6] Unfortunately, the activists are completely misusing the results of this study to support their agenda. Instead of showing that feral cats are not at an increased risk of FIV or FeLV, the results actually indicate quite the opposite. "Several factors were found in bivariate analyses to be significantly associated with risk of FeLV and FIV [infection]…Risk of [infection] was significantly higher in pet cats that were allowed outdoors than in pet cats that were kept strictly indoors." Furthermore, the authors state that "feral cats had a significantly higher risk of FIV [infection] than did stray cats and relinquished pet cats." The authors conclude that "this information can be used to support lifestyle recommendations to keep cats healthy, such as preventing cats from roaming outdoors." Clearly, outdoor cats, including feral cats, are at an increased risk of FIV and FeLV.

In addition to being at an increased risk of FIV and FeLV, there is evidence to suggest that FeLV-infected cats are at an increased risk of contracting rabies. FeLV-positive cats should receive more frequent rabies vaccinations (every 6 months),[7] yet this is far from standard procedure among TNR practitioners, where cats are lucky to be vaccinated for rabies even once.

[6] Levy J. K., H. M. Scott, J. L. Lachtera, and P. C. Crawford. 2006. Seroprevalence of feline leukemia virus and feline immunodeficiency virus infection among cats in North America and risk factors for seropositivity. Journal of the American Veterinary Medicine 228: 371-376.
[7] Franchini M. 1990. Die tollwutimpfung von mit felinem Leukamivirus infizierten Katzen. Veterinary Dissertation. Zurich University.

Claim #4 – Toxoplasmosis is not a threat from feral cats

Reality:
Cats are the definitive host of the parasitic protozoan *Toxoplasma gondii*, which causes toxoplasmosis, and are the only animals known to shed the infectious eggs. As the definitive host, *T. gondii* relies on cats for reproduction, but intermediate hosts may also be infected and include all warm-blooded animals (i.e., birds, mammals). Infection rates have been shown to be higher in free-roaming cats than pet cats, with the lowest prevalence in cats kept indoors.[8] Additionally, scientists have identified that as many as 74% of adult domestic cats have been infected by *T. gondii* at some point in their life.[9] The infection rate changes depending on whether cats are kept indoors or not and is "usually higher in stray or feral cats." An infected cat may shed hundreds of millions of infectious eggs in the environment. These eggs are extremely resistant to environmental conditions and may remain infectious for up to 18 months.[10]

The impacts of toxoplasmosis to humans may be severe. Consequences include sudden abortion of fetuses, fetal developmental defects, blindness, neurological impairment, and may particularly impact immunocompromised individuals (e.g., those suffering from HIV/AIDS). Behavioral manipulation is an innate part of *T. gondii's* life history that increases its chances of reproductive success but may have adverse and unintended effects on people. Infected rats become attracted to cat urine and, thus, are more likely to be predated by cats and pass on the parasite to the definitive host. This manipulative power of *T. gondii* has been proposed to explain impacts on humans as well. *T. gondii* preferentially creates cysts in the central nervous system that may result in an increased chance of schizophrenia, autism, Alzheimer's and other neuro-inflammatory diseases.[11,12]

Although contraction of toxoplasmosis may occur by ingesting infectious eggs where cats have defecated in a garden, yard, sandbox, or beach, environmental contamination may be much broader and more dangerous for both humans and wildlife. Potential watershed contamination is a serious risk that may result in additional infections. Toxoplasmosis was the cause of 16% of all southern sea otter deaths between 1998 and 2001[13] and infected 52% of dead and 38% of live otters sampled between 1998 and

[8] Nutter F. B., J. P. Dubey, J. F. Levine, E. B. Breitschwerdt, R. B. Ford, and M. K. Stoskopf. 2004. Serooprevalences of antibodies against *Bartonella benselae* and *Toxoplasma gondii* and fecal shedding of *Cryptosporidium* spp, *Giardia* spp, and *Toxocara catii* in feral and pet domestic cats. Journal of the American Veterinary Medical Association 225: 1394-1398.
[9] Tenter A. M., A. R. Heckeroth, and L. M. Weiss. 2000. *Toxoplasma gondii*: from animals to humans. International Journal for Parasitology 30: 1217-1258.
[10] Berdyev A. S. and E. A. Shevkunova. 1988.On the distribution of toxoplasmosis among wild vertebrates in Turkmenia (according to serological data). Parazitologiya 22: 378-383.
[11] Fekadu A., T. Shibre, and A. J. Cleare. 2010. Toxoplasmosis as a cause for behavior disorders: overview of evidence and mechanisms. Folia Parasitologica 57: 105-113.
[12] Prandota J. 2010. Autism spectrum disorders may be due to cerebral toxoplasmosis associated with chronic neuro-inflammation causing persistent hypercytokinemia that resulted in an increased lipid peroxidation, oxidative stress, and depressed metabolism of endogenous and exogenous substances. Research in Autism Spectrum Disorders 4: 119-155.
[13] Kreuder C. M. A. Miller, D. A. Jessup, L. J. Lowenstine, M. D. Harris, J. A. Ames, T. E. Carpenter, P. A. Conrad, and J. A. Mazet. 2003. Patterns of mortality in southern sea otters (Enhydra lutris nereis) from 1998-2001. Journal of Wildlife Diseases 39: 495-509.

2004.[14] Research has shown that those otters near heavy freshwater outflows were three times more likely to contract toxoplasmosis than individuals near low freshwater outflows.[15] With the large number of cats defecating outdoors, toxoplasmosis contamination of watersheds may severely and negatively impact both people and wildlife.

[14] Conrad P. A., M. A. Miller, C. Kreuder, E. R. James, J. Mazet, H. Dabritz, D. A. Jessup, F. Gulland, and M. E. Grigg. 2005. Transmission of *Toxoplasma*: clues from the study of sea otters as sentinels of *Toxoplasma gondii* flow into the marine environment. International Journal for Parasitology 35: 1155-1168.

[15] Miller M. A., I. A. Gardner, C. Kreuder, D. M. Paradies, K. R. Worcester, D. A. Jessup, E. Dodd, M. D. Harris, J. A. Ames, A. E. Packham, P. A. Conrad. 2002. Coastal freshwater runoff is a risk factor for *Toxoplasma gondii* infection of southern sea otters (*Enhydra lutris nereis*). International Journal for Parasitology 32: 997-1006.

Peer-reviewed Scientific Literature Summary

Title:	**Trap/Neuter/Release methods ineffective in controlling domestic cat "colonies" on public lands**
Authors:	D. Castillo, A. L. Clarke
Affiliations:	Florida International University
Journal:	Natural Areas Journal
Year:	2003

Summary

A study was conducted to identify the outcome of a managed trap-neuter-release (TNR) program in two county parks in Miami, Florida. TNR failed to reduce the population of cats at either park and the population at one park actually increased. Stray cats were attracted by food provided to the colony by caretakers, and the community pet owners used the colony as a dumping ground for abandoning pets.

Key Quotes

"*The establishment of cat colonies in public parks and natural areas creates a number of wildlife conservation problems. The most serious of these problems are wildlife predation and disease transmission. Despite the fact that cat colony supporters assert that well-fed colony cats will not prey on wildlife, numerous scientific studies provide evidence to the contrary (e.g., Adamec1976; Biben 1979; Leyhausen 1979; Liberg 1984; Fitzgerald 1988; Fitzgerald and Turner 2000)*." (p. 248)

"*Several outbreaks of toxoplasmosis in humans have been attributed to soil and water contaminated with oocysts shed from the feces of free-roaming cats (Patronek 1998)*." (p. 248)

"*In 1994, five Florida children were hospitalized with encephalitis that was associated with cat-scratch fever (Patronek 1998)*." (p. 248)

"*Our results contradict the assertion that managed cat colonies decline in size over time*." (p. 251)

"*The high number of cats and kittens that were dumped at the colonies throughout the course of our study confirms that the establishment of cat colonies on public lands with unrestricted access encourages illegal dumping of cats and creates…[a] nuisance*." (p. 252)

"*Our results suggest that trap, neuter, and release programs are not an effective method to help control the population of unwanted feral and free-roaming cats on public lands*." (p. 252)

"*We suggest that supporters of managed cat colonies seek a long-term solution to the pet overpopulation issue by redirecting their efforts toward the underlying problem of managing irresponsible pet owners*." (p. 252)

Title: **Professional, ethical, and legal dilemmas of trap-neuter-return**
Authors: P. L. Barrows
Affiliations: Active Environments Inc.
Journal: Journal of the American Veterinary Medical Association
Year: 2004

Summary
The author provides a veterinary medical practitioner's perspective to the issue of how to deal with the problem of free-roaming cats. Specifically discussed are the professional, ethical, and legal dilemmas and disease concerns for people.

Key Quotes
"*Cats are variably and correctly identified as nonnative, exotic, introduced, alien, foreign, or invasive species. Invasive species are defined as "species (animals, plants, microbes, etc.) alien or nonnative to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm, or harm to human health*." (p. 1)

"*Although well meaning, many advocates of TNR lack professional training in the biological, ecologic, and wildlife sciences. Consequently, they may misunderstand, minimize, or choose to ignore the documented concerns regarding the ecologic, domestic animal and public health, legal, humane, and social nuisance impacts of feral cats, including those in TNR programs*." (p. 1)

The American Veterinary Medical Association's Council on Environmental Issues (CEI) "*has concluded [that] managed cat colonies do not solve the problems of cat overpopulation and suffering, wildlife predation, or zoonotic disease transmission*." (p. 1366)

The CEI "*strongly supports and encourages humane elimination of feral cat colonies*." (p. 1366)

The CEI "*opposes passage of local or state ordinances that legalize the maintenance of managed (i.e., TNR) cat colonies*." (p. 1366)

"*Despite cats being the most frequently reported rabid domestic animal in the United States, proponents of TNR rarely address the fatal nature of untreated human rabies infections, nor do they readily acknowledge that nearly all TNR colonies contain unvaccinated cats or previously immunized cats whose immunity against rabies is diminished or has disappeared*." (p. 1367)

"*The CEI has expressed its concern regarding potential legal liability for veterinarians and other allied professionals who opt to participate in TNR programs*." (p. 1368)

"*Free-roaming dog colonies have not been condoned and neither should free-roaming cat colonies. Arguing that cats warrant preferential treatment ignores the damage they cause and the risks they pose*." (p. 1368)

Title: **The welfare of feral cats and wildlife**
Author: D. A. Jessup
Affiliations: Marine Wildlife and Veterinary Care and Research Center
Journal: Journal of the American Veterinary Medical Association
Year: 2004

Summary

The author discusses the impacts of Trap-Neuter-Release (TNR) programs on the welfare of cats and wildlife, identifies why TNR is inappropriate, and suggests alternative actions to address the feral cat population.

Key Quotes

"*Attempting to maintain cats in colonies only compounds the problem by causing massive killing and crippling of native wildlife, jeopardizing biodiversity, undermining traditional animal control, enabling irresponsible people to abandon cats, and sending mixed messages about the veterinary profession's commitment to serve the welfare of all species, including cats and wildlife*." (p. 1377)

"*Providing abundant food for outdoor cats, even overfeeding, does not stop this…hunting behavior*." (p. 1377)

"*The loss of [wildlife caused by cats] reduces biodiversity, even in somewhat degraded ecosystems. Loss of their ecosystem services has implications for such basic life processes as insect population dynamics, soil fertility and stability, pollination, and seed dispersal*." (p. 1378)

"*Wild animals are not only killed by cats but are also maimed, dismembered, ripped apart, and gutted while still alive, and if they survive the encounter, they often die of sepsis because of the virulent nature of the oral flora of cats*." (p. 1378)

"*In the world of TNR, unless a stray cat has a collar or is microchipped, it is very difficult to distinguish from a truly feral animal. Once trapped, neutered, and marked, these lost cats are much less likely to ever be found and returned to their owners or adopted. Trap, neuter, and reabandonment is a cruel fate for many former pet cats*." (P. 1378)

"*Figures vary, but the AVMA has used the figure of 2 years as opposed to 10 for the mean lifespan of owned cats; others estimate that feral cats live approximately half as long as owned cats. Mortality rates for feral cats can be up to 80%/yr. Feral cats suffer considerably higher rates of injury and disease. Many feral cats succumb to vehicle trauma, predation, disease, or severe weather*." (p. 1379)

"*Maintaining feral cats where they can deposit cat feces in national, state, county, or city public parks; on campuses; and around schools and hospitals constitutes a public health risk*." (p. 1379)

"*Trap-neuter-return's failures are, in part, attributable to its being based on several false assumptions, including the following: rates of abandonment and immigration are relatively low; cats at existing sites will exclude others (in reality the presence of food attracts others); feral cats will stay where you put*

them (you cannot herd cats, well fed or not); all cats can be caught; and populations of cats in colonies will behave in general as if they were isolated and in a closed system." (p. 1380)

Title:	**Critical assessment of claims regarding management of feral cats by trap-neuter-return**
Authors:	T. Longcore, C. Rich, and L. M. Sullivan
Affiliations:	The Urban Wildlands Group, University of Southern California Los Angeles
Journal:	Conservation Biology
Year:	2009

Summary

The authors compared claims made by feral cat advocates to the scientific literature. Advocate claims were found to be contradictory to the literature, and the authors suggest a role for conservation biologists in conducting research and disseminating the results of that research to educate the general public and policy makers.

Key Quotes

"*Domestic cats are on the list of the 100 worst invasive species globally (Lowe et al. 2000)*." (p. 888)

"*The stated goals of [no kill programs] is for feral cats to be recognized as 'protected healthy wildlife [that] should not enter shelters in the first place*.'" (p. 888)

"*Unfortunately, TNR does not eliminate feral cat colonies under prevailing conditions (Jessup 2004; Winter 2004, 2006) and many false claims used to support the approach go unchallenged*." (p. 888)

"*[TNR] advocates argue that studies showing adverse effects of feral cats on islands do not apply to continents (Gorman and Levy 2004; Alley Cat Allies 2005). In urban and suburban areas, natural habitats resemble islands, where fragments are surrounded by an inhospitable matrix, but unlike on islands, the inhospitable areas serve as an ongoing source of subsidized predators (Walter 2004)*." (p. 888)

"*Feral cats are exotic and do not fill an existing niche*." (p. 889)

"*Feral cats are generally found at densities 10-100 times higher than similarly sized native predators (Nowell and Jackson 1996; Liberg et al. 2000)*." (p. 889)

"*Feeding by humans reduces the average range size of free-roaming cats, but increases densities, concentrating predation on wildlife where feeding occurs (Schmidt et al. 2007)*." (p. 889)

"*Contrary to claims that well-fed cats pose little threat to wildlife, hunting and hunger are not linked in domestic cats (Adamec 1976). Even well-fed cats hunt and kill lizards, small mammals, birds, and insects (Liberg 1984; Castillo and Clarke 2003; Hutchings 2003)*." (p. 889)

"*We argue that it is philosophically inappropriate for population-level impacts to be the only criteria by which the effects of cats are judged…We see no justification for valuing birds and other wildlife only as populations while valuing cats as individuals*." (p. 890)

"*Over 80% of the prophylactic treatments administered to humans in the United States for possible exposure to rabies resulted from contact with stray or feral cats (Moore et al. 2000)*." (p. 890)

"*Studies show elevated infection rates of disease-causing pathogens in stray and feral cats compared with owned cats as a whole, including those that roam (Dubey 1973; Nutter et al. 1974; Norris et al. 2007)*." (p. 890)

"*Fecal matter from feral and free-roaming cats degrades water quality (Dabritz et al. 2006)*." (p. 890)

"*The definition of a successful TNR program for feral cat advocates is almost always different from what a conservation biologist or policy maker might view as a successful feral cat management program. For many TNR advocates, success is not defined by elimination of feral cats in an area, but rather by the welfare of the cats*." (p. 891)

"*Feral cat advocates usually argue that managed colonies are stable and resist invasion by cats from surrounding areas (Berkeley 2004), but this assertion is not consistent with scientific literature or reports from TNR colonies (Stull 2007)*." (p. 891)

Title:	**A global review of the impacts of invasive cats on island endangered vertebrates**
Authors:	F. M. Medina, E. Bonnaud, E. Vidal, B. R. Tershy, E. S. Zavaleta, C. J. Donlan, B. S. Keitt, M. Le Corre, S. V. Horwath, and M. Nogales
Affiliations:	Cabildo Insular de La Palma, Island Ecology and Evolution Research Group (IPNA-CSIC), Paul Cezanne University, University of California Santa Cruz, Cornell University, Université de La Réunion
Journal:	Global Change Biology
Year:	2011

Summary

The authors reviewed the impacts of feral cats introduced to islands on native vertebrate species across the world and conducted a meta-analysis of peer-reviewed literature to help predict the most heavily impacted native island species by feral cats. The results identified feral cats as having contributed to at least 14% of the total 238 global bird, mammal, and reptile extinctions and a principal threat to nearly 8% of critically endangered birds, mammals, and reptiles.

Key Quotes

"*Cats can be eradicated from islands (Nogales et al. 2004) after which threatened species can recover (Aguirre-Munoz et al. 2008)*." (p. 3504)

"*Cats impacted 48 taxa of endemic birds in four main groups: [landbirds, seabirds, shorebirds, and waterbirds]*." (p. 3505)

"*Based on our database, feral cats on islands have contributed to 33 (13.9%) of the 238 global bird, mammal, and reptile extinctions (including species extinct in the wild but extant in captivity) recorded by the IUCN Red List. They have also contributed to 38 (8.2%) of the 464 critically endangered birds, mammals, and reptiles*." (p. 3505-3506)

"*Our review suggests that cats have negative impacts on a wide range of native vertebrates, that endemic island species are particularly vulnerable compared to species that occur on continents, that endemic island mammals may be the most vulnerable, and that introduced alternate prey species such as mice and rabbits increase the risk to native species*." (p. 3509)

Title: **Zoonotic diseases associated with free-roaming cats**
Authors: R. W. Gerhold, D. A. Jessup
Affiliations: The University of Tennessee, California Department of Fish and Game
Journal: Zoonoses and Public Health
Year: 2012

Summary

The authors review the various diseases of free-roaming cats and the public health implications associated with free-roaming cat populations.

Key Quotes

"*Free-roaming cats often lack the necessary preventative care to control [infectious diseases] and consequently pose a potential health threat to other domestic animals, wildlife, and humans*." (p. 1)

"*Since 1988, rabies has been detected more frequently in cats than dogs in the United States (Rupprecht 2002), and in 2008 the number of rabies cases in cats (n = 294) was approximately four times the number of cases in dogs (Blanton et al. 2009). In 2010, rabies cases declined in all domestic animals, except for cats, which comprised 62% (n = 303) of all rabies cases in domestic animals (Blanton et al. 2011)*." (p. 2)

"*Multiple studies have disclosed that human exposure to rabies is largely associated with free-roaming cats because of people being more likely to come in contact with cats, large free-roaming cat populations, and lack of stringent rabies vaccination programs (Childs 1990; Cole and Atkins 2007; Roseveare et al. 2009; Eidson and Bigman 2010)*." (p. 2)

"*Individuals exposed to potentially rabid animals are administered PEP, and cat exposures account for approximately 1/3 of all PEP recipients. Post-exposure prophylaxis regimen generally costs $5000-$8000 for each individual, which is mostly borne by public health agencies (Recuanco et al. 2007)*." (p. 2)

"*TNR advocates are unlikely to administer rabies immunization of all free-roaming cats. This is significant because one rabid cat in an aggressive (i.e., furious rabies) condition can lead to multiple exposure events because furious rabid animals often seek potential hosts to bite…rabid cats were significantly more likely than rabid dogs to bite a person (62% vs. 36%) (Eng and Fishbein 1990)*." (p. 2)

"*The risk of being seropositive for [feline leukemia virus or feline immunodeficiency virus] was most frequently associated with being free-roaming, followed by having access to outdoors*." (p. 3)

"*The 2011 Compendium of Animal Rabies Prevention and Control states that stray animals including cats should be removed from the community through local health departments and animal control officials (Brown et al. 2011)*." (p. 3)

"*Data suggest that neutered cat groups act as attractant of sexually intact free-roaming cats, thus negating the belief that TNR program leads to [a] decrease in free-roaming cat populations*." (p. 3)

"*Free-roaming cat colony feeding stations attract wild mesocarnivores (Gehrt 2003), potentially exacerbating human rabies exposure incidents*." (p. 3)

"*Domestic and wild felids are the definitive host for…Toxoplasma gondii and the ascarid Toxocara cati…The host-defecated eggs (Toxocara) or oocysts (Toxoplasma) of these parasites are extremely environmentally resistant (Long 1990; Kazacos 2001), and human infections can occur months or possibly even years after the cat has excreted the parasite egg. For this reason, cat feces-contaminated playgrounds, garden soil, sandboxes, and other outdoor recreational areas may serve as a source of infection for humans (Holland and Smith 2006; Lee et al. 2010)*." (p. 3-4)

"*Toxoplasma infections can manifest as ocular diseases, neurological impairment, and lead to blindness, abortions, and birth defects, particularly hydrocephalus, in humans (Dubey and Odening 2001). Toxoplasmosis is also a significant risk for individuals receiving immunosuppressive therapy, transplant recipients, and is a major cause of systemic infection and death for immunosuppressed (e.g., HIV/AIDS) patients (Elmore et al. 2010). An increased risk of schizophrenia, autism, Alzheimer's, and other neuro-inflammatory diseases has been proposed with T. gondii infection (Fekadu et al. 2010; Prandota 2010)*." (p. 4)

"*Approximately 75% of free-roaming cats in Florida were positive for [one species of hookworms], and 33% were positive for [another hookworm species] (Andersen et al. 2003)*." (p. 4)

"*Three major flea-associated diseases of cats in the United States include cat-scratch disease (CSD), flea-borne typhus, and plague (McElroy et al. 2010)*." (p. 4)

"*Human bacterial diseases, including tularemia…and plague…have been associated with direct contact with cats or cat fleas (Liles and Burger 1993; Gage et al. 2000; McElroy et al. 2010). Approximately, 8% of plague cases in the United States are associated with transmission from cats, and cases of cat exposure associated plague are reported year round where flea-associated cases are generally restricted to warmer months (Gage et al. 2000)*." (p. 5)

"*Rabies exposure in humans is disproportionately associated with free-roaming cats compared to other domestic animals. This fact should be of paramount concern to public health officials because of the high mortality rate of clinical rabies and the significant cost of PEP in exposed people*." (p. 5)

Title: **The impact of free-ranging domestic cats on wildlife of the United States**
Authors: Scott R. Loss, Tom Will, Peter P. Marra
Affiliations: Smithsonian Conservation Biology Institute, U.S. Fish and Wildlife Service
Journal: Nature Communications
Year: 2013

Summary

Using a data-driven systematic review of previously published studies that estimated predation rates of owned and un-owned cats, the authors quantitatively estimated total mortality caused by cats in the contiguous United States. The results showed that free-roaming domestic cats kill 1.4-3.7 billion birds and 6.9-20.7 billion mammals every year. The majority of this mortality is caused by un-owned cats, whose predation rates averaged three times greater than rates for owned cats.

Key Quotes

"*Cat predation on wildlife…may exceed all other sources of anthropogenic mortality of U.S. birds and mammals*." (p. 2)

"*We excluded high local predation rates and used assumptions that led to minimum predation rates for un-owned cats; therefore, actual numbers of birds killed may be even greater than our estimates*." (p. 4)

"*Native species make up the majority of the birds preyed upon by cats*." (p. 4)

"*For all North American land birds, the group of species most susceptible to mainland cat predation, existing estimates range from 10-20 billion individuals in North America*." (p. 5)

"*Threatened species in close proximity to cat colonies – including managed TNR colonies – face an especially high level of risk; therefore, cat colonies in such locations comprise a wildlife management priority*." (P. 5)

"*Claims that TNR colonies are effective in reducing cat populations, and, therefore, wildlife mortality, are not supported by peer-reviewed scientific studies*." (p. 5)

Title:	**Fearing the feline: domestic cats reduce avian fecundity through trait-mediated indirect effects that increase nest predation by other species**
Authors:	C. Bonnington, K. J. Gaston, K. L. Evans
Affiliations:	University of Sheffield, University of Exeter
Journal:	Journal of Applied Ecology
Year:	2013

Summary

The authors conducted controlled model presentation experiments to quantify the potential sublethal and indirect impacts of predators on avian reproductive success. When domestic cat models were presented, the amount of food fed to nestlings was diminished by one-third relative to a control model, and nest predation increased by an order of magnitude relative to another predator and control model. This study provided evidence for indirect negative effects on bird reproductive success caused by the presence of free-roaming cats.

Key Quotes

"*The non-native domestic cat…contribute[s] significantly to mortality in local avian populations and kill[s] up to 29 million birds per year in Britain, yet their full impacts on avian populations remain controversial and unresolved (Churcher and Lawton 1987; Woods et al. 2003; Baker et al. 2008; Sims et al. 2008; van Heezik et al. 2010)*." (p. 15-16)

"*Sublethal effects…may have considerable implications for population and community dynamics of prey species (Agrawal 2001)*." (p. 16)

"*Following exposure to the domestic cat model, and its subsequent removal, parental blackbirds reduced their provisioning rates by over one-third relative to the rabbit control, and rates were also typically significantly reduced relative to the grey squirrel. There was no evidence that provisioning rates returned to normal 90 min after removal of the domestic cat model*." (p. 18)

"*Predation rates were higher following exposure to the domestic cat than the rabbit and the grey squirrel*." (p. 18)

"*Reduced food delivery, even over short time periods, can adversely influence chick condition and reproductive success (Schwagmeyer and Mock 2008; Dunn et al. 2010; Martin et al. 2011), and over longer time periods can promote smaller clutches (Skutch 1949; Martin et al. 2000). Our results provide the first empirical evidence that domestic cats have the potential to exert such effects*." (p. 21)

"*We have thus demonstrated that the brief presence of a domestic cat close to an urban blackbird nest…is significantly associated with increased rates of nest predation*." (p. 21)

"*These data thus indicate that the presence of domestic cats can significantly reduce avian breeding success by indirectly increasing nest predation rates*." (p. 21)

"*Simple proportioning of predator impacts based on the relative frequency at which each species predates nests could generate biased estimates of predator impacts*." (p. 22)

"*The most effective management option simultaneously to mitigate direct predation, sublethal and lethal indirect trait-mediated effects of domestic cats on avian populations is thus to house cats permanently indoors*." (p. 23)

Key Supporting Organizations

The following organizations are a sampling of the many organizations, like American Bird Conservancy, that have taken a stance against TNR as a management strategy for feral cats. Additional information on the published positions of these organizations will be included in external documentation.

Florida Department of Health

Florida Fish and Wildlife Conservation Commission

Florida Veterinary Medical Association

National Association of State Public Health Veterinarians

American Association of Wildlife Veterinarians

The Wildlife Society

People for the Ethical Treatment of Animals