



# **AGENDA – City Council Meeting**

Mayor Jim Miller  
Mayor Pro Tem Stephen Willden  
Council Member Michael McOmber  
Council Member Chris Porter  
Council Member Shellie Baertsch

i

---

**CITY OF SARATOGA SPRINGS**  
**Tuesday, October 1, 2019, 6:00 pm**  
City of Saratoga Springs Council Chambers  
1307 North Commerce Drive, Suite 200, Saratoga Springs, UT 84045

## **CITY COUNCIL WORK SESSION**

1. Police and Court Facility Public Open House Discussion.

## **CITY COUNCIL POLICY MEETING**

2. Call to Order.
3. Roll Call.
4. Invocation / Reverence.
5. Pledge of Allegiance.
6. Public Input – This time has been set aside for the public to express ideas, concerns, and comments for subject matter not listed on this agenda.

### **REPORTS:**

1. Mayor.
2. City Council.
3. Administration: Animal Control Update; Ongoing Item Review.

### **PUBLIC HEARING:**

1. Ordinance Approving the Boyer MSA Addition Annexation (Mountain Sunrise Academy Charter School), Boyer Project Company Mike Glauser Applicant, ~1800 East 145 North; Ordinance 19-33 (10-1-19).

### **BUSINESS ITEMS:**

1. Appointment of City Treasurer; Resolution R19-58 (10-1-19).
2. Saratoga Springs Commercial Plat E Rezone and Development Agreement, Mark Horne on behalf of State of Utah DABC Applicant, ~1203 North Exchange Drive; Ordinance 19-34 (10-1-19).
3. The Crossing Village Plan 2 Major Amendment (Fat Cats), Dave Card Applicant, 212 West Pioneer Crossing; Ordinance 19-35 (10-1-19).
4. Utah Lake Estates Rezone and Concept Plan, and Development Agreement, Steve Israelsen SI Builders, LLC Applicant, Lake Mountain Estates Lot 27; Ordinance 19-36 (10-1-19).
5. The Hub Preliminary Plat, Boyd Brown Applicant, ~100 East 2650 North. 6. Store It At The Hub Conditional Use Permit (CUP), Boyd Brown Applicant, ~150 East 2650 North.

In compliance with the Americans with Disabilities Act, individuals needing special accommodations (including auxiliary communicative aids and services) during this meeting should notify the City Recorder at 801.766.9793 at least one day prior to the meeting.

### **MINUTES:**

1. September 17, 2019.

**CLOSED SESSION:**

Motion to enter into closed session for any of the following: purchase, exchange, or lease of real property; discussion regarding deployment of security personnel, devices, or systems; pending or reasonably imminent litigation; the character, professional competence, or the physical or mental health of an individual.

**ADJOURNMENT**

Councilmembers may participate in this meeting electronically via video or telephonic conferencing. The order of the agenda items are subject to change by the Mayor. Citizens may address the Council during Public Input which has been set aside to express ideas, concerns, and comments on issues not listed on the agenda as a Public Hearing. All comments must be recognized by the Mayor and addressed through the microphone. Final action may be taken concerning any topic listed on the agenda.

**Decorum** - The Council requests that citizens help maintain the decorum of the meeting by turning off electronic devices, being respectful to the Council and others.



# NORTH UTAH VALLEY ANIMAL SERVICES SPECIAL SERVICE DISTRICT

## THE SCIENCE OF FERAL CATS

*A Research Based Report*

STEVE ALDER

*Environmental Health Bureau Director  
Utah County Health Department*

TRENT COLLEDGE

*Lieutenant  
Orem City Police Department*

JOSH CHRISTENSEN

*Lieutenant  
American Fork Police Department*

TUG GETTLING

*Director  
North Utah Valley Animal Services*

OWEN JACKSON

*Assistant City Manager  
Saratoga Springs*

CARL NIELSON

*Sergeant  
Pleasant Grove Police Department*

YVETTE RICE

*Lieutenant  
Utah County Sheriff's Office*

1. Executive Summary.....3

2. Best Friends Animal Society Proposal.....4 3.

Statistical Comparison Brief.....5 4.

Addressing Inaccurate Claims.....6 5.

Scientific Excerpts by Topic of Concern.....8 6.

Summary of Select Peer-Reviewed Scientific Literature.....15 7.

Subject Matter Expert Statement.....22 8.

Position Statements.....27 9.

Research-based Conclusions.....36 10.

Organizations Opposed to TNR Programs.....37 11.

References.....40

# EXECUTIVE SUMMARY

Eagle Mountain, Highland, Lehi, Lindon, Orem, Pleasant Grove, Saratoga Springs, unincorporated areas of Utah County, and Vineyard.

In May 2019 NUVAS formed an ad-hoc committee (TNR Committee) to consider a feral and free-roaming cat Trap-Neuter-Return (TNR) program that was proposed by Best Friends Animal Society (BFAS). The purpose of this report is to give an account of the TNR Committee's findings of their investigation and ultimately make a recommendation regarding the implementation of a TNR program in our district. This document is intended to provide information to the public, municipal or governing organizations, decision makers, and NUVAS board members regarding the management of local feral and free-roaming cat populations and the efficacy of Trap, Neuter, and Release (TNR) programs.

This report is based entirely on relevant, science-based information; we gathered and reviewed data and information from:

- Empirical reports
- National coalitions
- Government agencies
- Medical professionals
- Best Friends Animal Society
- Research papers and projects
- Institutions of higher education
- Published, peer-reviewed works
- Scientific journals and periodicals
- Utah animal shelters currently implementing TNR programs
- Veterinary, wildlife, public health, conservation, ecology, biology, and animal agencies and organizations

This report will show that, overwhelmingly, science does not support TNR programs as an effective method to reduce feral cat populations in the community. Additionally, TNR programs not only fail to adequately mitigate the significant threat to public health or alleviate the negative impact on wildlife that feral and free-roaming cats pose, but actually exacerbate these issues.

## BEST FRIENDS ANIMAL SOCIETY PROPOSAL

Best Friends TNR program proposes that when a feral cat enters the shelter, it is taken to be surgically altered, vaccinated, ear-tipped, and is then returned to its original location. Any cat that enters the shelter without obvious identification (microchip, collar) is eligible for the TNR program, at the shelter's discretion. This includes feral cats, stray cats, and even friendly cats.

When a feral cat(s) enters the shelter, Best Friends will go to the intake address and speak with the feral cat(s) caregiver and any citizens who have complaints against the presence of the feral cat(s). If conflicts between a caregiver and the citizen(s) can be successfully mediated then the cat will be returned to its original location, if not then Best Friends will relocate the cat(s) elsewhere.

Best Friends can implement the proposed TNR program with approximately a two-week lead time. Best Friends will commit to fund this TNR pilot program completely for up to three years, however they will accommodate it for as short as six months if so desired.

**During the Pilot Program Best Friends Will Provide:**

- 100% funding for the duration of the pilot program, requires no public funds
- Staffing to implement and execute program
- Community cat hotline and email - staffed by Best Friends employees and volunteers Monday – Saturday ▪ Best Friends will relocate cats to a site of the shelter’s choosing in situations where the return is not possible ▪ All spay and neuter surgeries for cats in program
- All needed medical procedures
- All required vaccinations including rabies and FVRCP
- Resident conflict resolution and mediation services, including deterrents and relocation
- Assistance implementing any necessary ordinance changes
- Provide spay and neuter and trapping assistance to residents
- Free microchips provided to district residents – to cat redemption rates
- Spay and neuter surgeries for all of NUVAS’s adoptable cats

**Best Friends Estimated Annual Program Costs:**

- Surgeries @ \$35 per cat \$12,320
- Vaccinations \$1,200
- Medication \$1,320
- Employee to administer program \$37,360
- Fuel \$1,100
- Traps, feral dens, safety equipment, \$3,500
- **TOTAL: \$56,800**

**West Valley City Actual Annual Program Costs:**

- Surgeries @ \$35 per cat \$12,320
- Vaccinations \$1,200
- Medication \$1,320
- Employee to administer program \$37,360
- Fuel \$1,100
- Traps, feral dens, safety equipment, \$1,500
- Feral dens \$1300
- Misc safety equipment \$700
- Food \$5280
- Truck \$45,000
- Fuel \$1,100
- **TOTAL \$107,080**

# STATISTICAL COMPARISON BRIEF

**PARTICIPATING YEARS CAT INTAKE CAT INTAKE PERCENT AGENCY WITH TNR YEAR ONE 2018 DIFFERENCE**

*Salt Lake County 2011-2018 4864 4073 16% decrease West Valley City 2011-2018 2251 1577 30% decrease Weber*

*County 2016-2018 2096 2210 5% increase Davis County 2016-2018 2356 2255 4% decrease West Jordan City 2017-2018*

*962 940 2% decrease*

## PARTICIPATING YEARS CAT INTAKE CAT INTAKE PERCENT AGENCY WITHOUT TNR YEAR ONE 2018 DIFFERENCE

*South Utah Valley 2014-2018 2243 1197 15% decrease North Utah Valley 2010-2018 3403 1785 48% decrease*

### North Utah Valley Animal Shelter

YEAR CAT INTAKE DIED @ SHELTER EUTHANIZED

2012 2568 558 1710

2018 1785 57 744

Average Feral Cat Intake since 2013 = 198

5

## ADDRESSING INACCURATE CLAIMS

Proponents of feral cat TNR programs often make claims that are inaccurate and cite studies that, in fact, do not support their claims. The following (taken from *Report to Pompano Beach City Commissioners: The Science of Feral Cats*, written by Grant Sizemore of the American Bird Conservancy, bibliography included) outlines the truth in regards to four of these claims.

### **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.<sup>1,2</sup>

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*,<sup>3</sup> activists “refer to a so-called vacuum effect in which new cats are said to immigrate to a location after removal programs,<sup>4,5</sup> but fail to provide evidence that such a phenomenon<sup>3</sup> 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.

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.

### **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.”<sup>6</sup> 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.

#### 6

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),<sup>7</sup> yet this is far from standard procedure among TNR practitioners, where cats are lucky to be vaccinated for rabies even once. 4

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.<sup>8</sup> 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.<sup>9</sup> 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.<sup>10</sup>

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.<sup>11,12</sup>

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 and infected 52% of dead and 38% of live otters sampled between 1998 and 2004. Research has shown that those otters near heavy freshwater outflows were three times more likely to contract toxoplasmosis than individuals near low freshwater outflows. With the large number of cats defecating outdoors, toxoplasmosis contamination of watersheds may severely and negatively impact both people and wildlife.

8 Nutter F. B., J. P. Dubey, J. F. Levine, E. B. Breitschwerdt, R. B. Ford, and M. K. Stoskopf. 2004. Sero-prevalences of antibodies against *Bartonella henselae* and *Toxoplasma gondii* and fecal shedding of *Cryptosporidium* spp, *Giardia* spp, and *Toxocara cati* in feral and pet domestic cats. *Journal of the American Veterinary Medical Association* 225: 1394-1398.

9 Tenter A. M., A. R. Heckerroth, 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.

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.

## SCIENTIFIC EXCERPTS BY TOPIC OF CONCERN

### TNR DOES NOT REDUCE THE POPULATION OF FERAL CATS IN THE COMMUNITY

“Overwhelmingly, the scientific literature indicates that Trap, Neuter, Release (TNR) programs fail to reduce feral cat populations and negatively impact people and wildlife.”

“Data contradicted the assertion that managed cat colonies decline in size over time and suggested that trap, neuter, and release programs are not an effective method to help control the population of unwanted feral and free-roaming cats.” ▪ **American Bird Conservancy (2019). *The evidence against trap, neuter, release*. [www.abcbirds.org](http://www.abcbirds.org)**

“TNR was not effective at reducing free roaming cat numbers...”

▪ **Schmidt, P. M., Swannack, T. M., Lopez, R. P., Slater, M. R., (2009). *Evaluation of euthanasia and trap-neuter-return programs in managing free-roaming cat populations*. *Wildlife Research* 36, 117-125.**

“A 1 year study of TNR programs...revealed that well-fed cat colonies encouraged illegal abandonment...the arrival of new cats prevented the reduction of the colonies...”

▪ **Levy, J. K., Crawford, P. C., (2004). *Humane strategies for controlling feral cat populations*. *JAVMA* 225, 1354-1360.**

“Our analysis indicated that any population-level effects were minimal...which indicated ongoing population growth...” “...no plausible combinations of life history variables would likely allow for TNR to succeed in reducing population size...”

“Although causes of loss from the population included euthanasia of sick cats, adoption, and deaths (often vehicular trauma), increases in population were attributable to immigration...”

▪ **Foley, P., Foley, J. E., Levy, J. K., Paik, T., (2005) *Analysis of the impact of trap-neuter-return programs on the populations of feral cats*. *JAVMA* 227, 1775-1781.**

“...virtually no information exists to support the contention that neutering is an effective long-term method for controlling free

roaming cat populations.”

“Immigration or abandonment of new cats may be a frequent event, and free-roaming cats do not appear to have sufficient territorial activity to prevent new arrivals from permanently joining colonies. These new arrivals could substantially limit the success of TNR...”

- Levy, J. k., Gale, D. W., Gale, L. A., (2003) Evaluation of the effect of a long-term trap-neuter-return and adoption program on a free-roaming cat population. *JAVMA* 222, 42-46.

“Overall, we did not find any significant differences in population counts across years.”

“...we counted more than twice as many cats in 2012 as we did in 2011.”

“...while we did find a statistically significant increase in the proportion of sterilized individuals...this increase was not enough to expect any decline in population numbers.”

- Kilgour, R. J., Magle, S. B., Slater, M., Christian, A., Weiss, E., DiTullio, M., (2017) Estimating free-roaming cat populations and the effects of a one year Trap-Neuter-Return management effort in a highly urban area. *Urban Ecosyst* 20, 207-216

“Neither study reduced cat numbers.”

“Reducing cat survival (by increasing euthanasia rates) would likely have a greater effect on cat population growth than reducing fecundity (by increasing sterilization rates).”

“A 50% increase in annual euthanasia rates would likely result in a population decline of 10% per annum; whereas a 75% increase in annual sterilization rates would likely result in an increasing population.”

## 8

“Trap-euthanize strategies have proven effective at reducing cat populations...In contrast, TNR programs alone have never been shown to stabilize a feral cat population in the scientific literature.”

- Gotsis, T., (2014) Feral cats: Do trap-neuter-return programs work? *NSW Parliamentary Research Service* 18/2014, 1- 19

“...numerous scientific studies have found that trap-neuter-release operations fail to reduce populations within a colony.”

- Bies, L., (2019) Feral cats: impacts of an invasive species. *The Wildlife Society Fact Sheet, wildlife.org*

“It cannot be stated definitively that the total number of cats on campus decreased...”

- Hughes, K. L., Slater, M. R., (2002) Implementation of a feral cat management program on a university campus. *Journal of Applied Welfare Science* 5(1), 15-28

“Free-roaming cat populations have a high intrinsic growth rate, and euthanasia is estimated to be more effective at reducing cat populations than trap-neuter-return programs.”

“Thus, TNR programs are not likely to convert increasing cat populations into declining populations or even stable populations...”

- Andersen, M. C., Martin, B. J., Roemer, G. W., (2004) Use of matrix population models to estimate the efficacy of euthanasia versus trap-neuter-return for management of free-roaming cats. *JAVMA* 225, 1871-1876

“The model suggested that TNR...will not lead to long-term reduction in the numbers of cats because colonies can re-establish due to immigration.”

- Stoskopf, M., Nutter, F. (2004) Analyzing approaches to feral cat management – one size does not fit all. *JAVMA* 225, 1361-1364

“...all these (TNR) efforts...are a waste of money, time, and energy.”

- Natoli, E., et. al. (2006) Management of feral domestic cats in the urban environment of Rome (Italy). *Preventative Veterinary Medicine* 77, 180-185

“Stray dogs, cats, and ferrets should be removed from the community...”

“Stray and feral cats serve as a significant source of rabies exposure risk.”

- Brown, C. M., Slavinski, S., Ettestad, P., Sidwa, T. J., Sorhage, F. E., (2016) National Association of Public Health Veterinarians Compendium of animal rabies prevention and control. *JAVMA* 248, 505-517

“...free-roaming cats are not native to any environment in the United States. Many scientific studies report that non-lethal (TNR) programs do not reduce the numbers of feral cats in the environment.”

- Frey, N., (2015) Stray cats in your neighborhood. *Utah State University Extension, Featured Animal* September 2015

“A study of TNR implemented countywide in San Diego showed that feral cat populations had not decreased after 10 years, and a similar result was found after 7 years in Alachua County, Florida, where feral cat populations increased (Foley et al. 2005).”

“Two colonies subject to TNR in Florida were tracked for over a year and population size of both colonies increased owing to the influx of new cats dumped at the highly visible sites (Castillo & Clarke 2003).”

- **Longcore, T., Rich, C., Sullivan, L. M., (2009) Critical assessment of claims regarding management of feral cats by trap-neuter-return. *Conservation Biology* 23(4), 887-894**

“TNR programs require consistent funding and commitment and cannot be expected to lead to eradication as long as the environment is hospitable to cats and cats are available for immigration into the area.”

- **Kustritz, M.V.R., (2011) Managing feral cat colonies. *DVM Proceedings* May 01, 2011**

“In a survey of 101 cat feeders...the total surveyed cat population was reportedly 920 before participation in TNR and 678 after TNR. However, the total number of cats (n=920) minus deaths (151), disappearances (149), and adoptions (238) and plus births (498) and immigrations (103) equals 983, not 678.”

- **Winter, L., (2004) Trap-neuter-release programs: the reality and the impacts. *JAVMA* 225, 1369-1376.**

“The practice of trapping, neutering, and then re-releasing cats into managed cat colonies does not effectively control cat populations and their adverse impacts on wildlife and should be opposed...”

## 9

“The most effective and humane method of dealing with feral cats is to remove them through trapping followed by adoption or euthanasia”

“...eradication is the only real answer, however unpleasant...”

“...studies and practical experience with cat colonies have shown that they are the wrong solution to cat overpopulation.” ▪ **Wallace, G., Ellis, J., (2003) Impacts of feral and free-ranging domestic cats on wildlife in Florida. *Issue Assessment Florida Fish and Wildlife Conservation Commission.***

## FERAL CATS SPREAD DISEASE TO HUMANS

“Unowned free-roaming cats pose important threats to human health. Zoonotic concerns include the rabies virus, *Toxoplasma gondii*, *Bartonella* species, *Toxocara cati*, *Microsporium canis*, *Cryptosporidium* species, *Campylobacter* species, *Yersinia pestis*, *Cheyletiella* species and *Francisella tularensis*.”

- **Folfer, W. R., Lovelace, K., Robertson, S., Rose, C., (2013) American Association of Feline Practitioners: Free roaming, abandoned and feral cats. *Journal of Feline Medicine and Surgery*, 821-822**

“As a rabies vector, cats pose a disproportionate risk for potential human exposures...”

“A study of 67 counties in Pennsylvania found that 44% of postexposure prophylaxis administration was due to cats, most of which (82%) were feral, stray, or unowned.”

“Many other potential zoonotic and cat-specific diseases are harbored in feral cat populations in addition to rabies. Among these are bartonellosis, toxoplasmosis, plague, endo-and ectoparasites, feline immunodeficiency (FIV), feline leukemia virus (FeLV), and rickettsial diseases.”

“Group feeding of cats by colony caretakers puts cats at a greater risk for contracting diseases whose transmission is augmented by increased animal density and contact rates among cats...Group feeding also increases risk for contracting rabies and other wildlife diseases by enabling greater contact along the interface between cat colonies and wildlife reservoirs...Feeding sites that attract raccoons, skunks, and foxes are particularly dangerous because these species are rabies reservoirs in the U.S.”

“TNVR does not adequately meet feral cat population control needs that public health and animal welfare necessitate.”

“One recent study, which modeled costs and benefits for TNVR as compared to trap and euthanize programs, found that in all scenarios trap and euthanize programs were cheaper to conduct and had a higher economic benefit.”

“TNVR...should not be endorsed as an effective approach...for mitigating health concerns related to feral cat colonies.” ▪ **Roebing, A. D., Johnson, D., Blanton, J. D., Levin, M., Slate, D., Fenwick, G., Rupprecht, C. E., (2014) Rabies prevention management of cats in context of trap, neuter, vaccinate, release programs. *Zoonoses Public Health* 61(4), 290-296.**

“Domestic cats shed 3 to 349 million *T. gondii* oocysts 3 to 5 days after consuming infected animal tissues...”

“Annual fecal deposition...by owned cats in the 3 communities was estimated to be 76.4 tons...Feral cats...could be contributing 29.5 tons of feces to environment per year...”

“*T. gondii* oocysts...can remain viable for more than a year in the soil. Contaminated soil is an important source of infection for humans, herbivores, rodents, and birds.”

- **Dabritz, H. A., Atwill, R., Gardner, I. A., Miller, M. A., Conrad, P. A., (2006) Outdoor fecal deposition by free roaming cats and attitudes of cat owners and nonowners toward stray pets, wildlife, and water pollution. *JAVMA* 229, 74-81**

“Rabies is a disease of great significance in all species, including humans. In the most recently published survey of rabies surveillance in the United States, rabid animals were identified in 49 states...cats represented...nearly 4 times that reported for dogs.”

“In one survey of feral cats in Italy, two of eight rabid cats were from known feral cat colonies that were managed by human caregivers.”

“*Toxoplasma gondii* always is present in feral cat colonies...”

10

“One study estimated that in a single community, the amount of feces deposited outdoors by the 2046 feral cats living there every year was about 29.5 tons. A study tracking sources of *E. coli* in storm sewers feeding rivers and streams demonstrated that the highest percentage from any one source came from cats.”

- **Kustritz, M.V.R., (2011) Managing feral cat colonies. *DVM Proceedings* May 01, 2011**

“Of the more common zoonotic diseases spread by free-roaming cats, rabies is the most worrisome...the disease is diagnosed in cats more often than in any other domestic animal.”

“Among the other zoonoses of concern are plague, which has been spread from rodents to cats to humans; toxoplasmosis, which has been spread by free-roaming cats soiling water sources; and Lyme disease, which has been spread by infected ticks brought into the home by free-roaming cats.”

- **How do free-roaming and feral cats impact humans and wild animals? (1998) *Animal Sheltering*, May-June 1998**

“When *T. gondii* infects...pregnant women it may cause a congenital syndrome that includes deafness, seizures, retinal damage, and mental retardation in the fetus or neonate. In immunocompromised individuals...it may produce severe central nervous system damage...Additional concerns have been raised by recent studies of schizophrenia, depression, suicidal behavior, obsessive compulsive disorder, rheumatoid arthritis, brain cancer, and scholastic underachievement in children, which have reported correlations between such conditions and elevated *T. gondii*...”

“...10% of all deaths of people with HIV are directly from Toxoplasmosis.”

“*T. gondii* alone is sufficient reason to stop conducting TNR...”

“...a recent study...confirms previous reports of higher suicide rates in those infected with *T. gondii*.”

“...ocular toxocariasis...is terribly debilitating...blindness is the most common result, with children bearing the high portion of cases.”

“...many of the cat associated zoonoses are severe and can even include life threatening conditions, such as bubonic plague...”

- **Hillsborough Animal Health Foundation (2012) *Public Health Issues*. [Hahf.org/awake/public-health-issues/](http://Hahf.org/awake/public-health-issues/)**

“...stray cats serve as major reservoirs for the bacterium *Bartonella* spp. And *B. clarridgeiae*. Consequently, stray cats and their fleas are the only known vectors for infecting house bound cats and humans with this bacterium. Human infections that may result from exposure of this bacterium via stray cats include: cat scratch disease...bacillary angiomatosis, hepatic peliosis...endocarditis, bacteremia, osteolytic lesions, pulmonary nodules, neuroretinitis, and neurological diseases.”

- **United States Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services, United States Department of the Interior (2003) Management of feral and free-ranging cat populations to reduce threats to human health and safety and impacts to native wildlife species in the commonwealth of Puerto Rico. *Environmental Assessment*, 1-65**

“...the Centers for Disease Control and Prevention has determined that feral cat colonies pose a threat to human health.”

“Up to 74 percent of all cats will host the toxoplasmosis-causing parasite in their lifetime and shed hundreds of millions of infectious eggs as a result. Any contact, either directly or indirectly, with cat feces risks human and wildlife health.”

“Multiple peer-reviewed studies, including the CDC’s, have found that TNR programs do not adequately reduce feral cat populations

or effectively mitigate health concerns.”

“The only sure way to simultaneously protect wildlife and people is to remove feral cats from the landscape.” ▪ **American Bird Conservancy + 199 other agencies/organizations (2014) Letter to the Honorable Sally Jewell, Secretary, U.S. Dept. of the Interior. [www.abcbirds.org](http://www.abcbirds.org)**

## **FERAL CATS PREDATE ON OTHER ANIMALS**

“...cats are responsible for the extinction of at least 33 species of birds around the world.”

“Estimates from Wisconsin indicate that between 500,000 and 8 million birds are killed by rural cats each year in that state (urban cats are not included in these estimates).”

11

“Predation by cats has an economic impact of more than \$17 billion dollars per year in the U.S.”

- **Hildreth, A. M., Vantassel, S. M., Hygnstrom, S. E., (2010) Feral cats and their management. University of Nebraska, Extension, EC1781**

“We estimate that free-ranging domestic cats kill 1.4-3.7 billion birds and 6.9-20.7 billion mammals annually. Un-owned cats, as opposed to owned pets, cause the majority of this mortality. Our findings suggest that free-ranging cats cause substantially greater wildlife mortality than previously thought and are likely the single greatest source of anthropogenic mortality for US birds and mammals.”

“Domestic cats...have been listed among the 100 worst non-native invasive species in the world.”

“We estimate that between 258 and 822 million reptiles and between 95 and 299 million amphibians could be killed by cats in the contiguous United States each year.”

- **Loss, S. R., Will, T., Marra, P. P., (2013) The impact of free-ranging domestic cats on wildlife of the United States. Nature Communications DOI: 10.1038/ncomms2380**

“...scientists now list invasive species, including cats, as the second most serious threat to declining and rare wildlife.”

“The Mammal Society of England found that a minimum of 44 species of wild birds comprised 24% of the prey that cats brought home to their owners.”

“Studies of prey items that pet cats bring home reveal only the bare minimum of what those cats actually kill. Animals killed by cats but consumed or left elsewhere, animals that escaped the cat but died later because of trauma or secondary infection, or young animals that starved to death or died of exposure because cats killed one or both parents are not counted in such studies.”

“Scientific studies have also documented that declawing cats, putting bells on their collars, or keeping them well fed do not prevent them from killing animals...hunger and hunting behavior are controlled by different portions of a cat’s brain.”

“...well-fed cats were observed stalking and killing birds...”

- **Winter, L., (2004) Trap-neuter-release programs: the reality and the impacts. JAVMA 225, 1369-1376.**

“Even when cats do not directly kill birds, their mere presence has been shown to result in a reduction in the feeding of nesting chicks by one-third and an increased likelihood of nest failure by an order of magnitude.”

- **Sizemore, G., (2015) Do a little, save a lot: keep cats indoors. Louisiana Ornithological Society Newsletter, Winter 2015, 7.**

“Feral cats are almost exclusively carnivorous and generally obtain most of their food resources by hunting live prey.”

“Predation by feral cats can jeopardize conservation programs...and have non-lethal impacts on susceptible populations through competition, disease transmission, induced predator-avoidance behavior and hybridization.”

- **Doherty, T. S., Bengsen, A. J., Davis, R. A., (2015) A critical review of habitat use by feral cats and key directions for future research and management. Wildlife Research 10.1071/WR14159**

“...cats...hunt even when fed daily by humans. Laboratory studies of cats suggest that hunger and hunting are controlled by separate neurological centers in the brain.”

- **Wallace, G., Ellis, J., (2003) Impacts of feral and free-ranging domestic cats on wildlife in Florida. Issue Assessment Florida Fish and Wildlife Conservation Commission.**

“...TNVR can cost over \$100 per cat (including trapping, spaying/neutering, vaccination, and transport), and the cats are still able to prey on native birds and mammals.”

- **Opar, A., (2010) Feral cat predation on birds costs billions of dollars a year. *Audubon*, December 3, 2010**

12

## **FERAL CATS HAVE A NEGATIVE IMPACT OF BIODIVERSITY**

“Invasive mammalian predators are arguably the most damaging group of alien animal species for global biodiversity. Species such as cats...threaten biodiversity through predation, competition, disease transmission, and facilitation with other invasive species.”

“The decline and extinction of native species due to invasive predators can have impacts that cascade throughout entire ecosystems. For example, predation by feral cats and red foxes has led to the decline or extinction of two thirds of Australia’s digging mammal species...”

“Rodents are linked to the extinction of 75 species...and cats to 63 extinctions...”

“Introduced rodents and cats are major agents of extinction, collectively being listed as causal factors in 44% of modern bird, mammal, and reptile species extinctions.”

- **Doherty, T. S., Glen, A. S., Nimmo, D. G., Ritchie, E. G., Dickman, C. R., (2016) Invasive predators and global biodiversity loss. *Proceedings of the National Academy of Sciences* 113 (40), 11261-11265**

“...the rate of species extinctions is accelerating, with grave impacts on people around the world...”

“The health of ecosystems on which we and all other species depend is deteriorating more rapidly than ever. We are eroding the very foundations of our economies, livelihoods, food security, health and quality of life worldwide.”

“The number of invasive alien species per country have risen by about 70% since 1970”

- **Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (2019) *The global assessment of biodiversity and ecosystem services. 7<sup>th</sup> session, IPBES Plenary***

“The list of ‘100 of the World’s Worst Invasive Alien Species’ that is presented here is designed to enhance awareness of...the terrible consequences, of invasive alien species.”

“100 of the World’s Worst Invasive Alien Species...domestic cat (*Felis catus*)”

- **Lowe, S., Browne M., Boudjelas, S., De Poorter, M., (2000) *100 of the World’s Worst Invasive Alien Species. Special lift-out in Aliens* 12, December 2000, 12pp.**

“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...commitment to serve the welfare of all species, including cats and wildlife.”

- **Jessup, D. A., (2004) The welfare of feral cats and wildlife. *JAVMA* 225 (9), 1377-1383**

## **FERAL CATS HAVE A VERY POOR QUALITY OF LIFE**

“People for the Ethical Treatment of Animals (PETA) has called TNR “subsidized abandonment” and states that “feral cats do not die of ‘old age.’ They are poisoned, shot, tortured by cruel people, attacked by other animals, or hit by cars, or they die of exposure, starvation, or...contagious diseases.... In one feral cat colony, half of 32 cats were shot by a man who claimed that they were attacking his children. Cats in another colony were shot with darts. A loose dog killed several cats in another colony. Ferals often scratch their ears bloody, driven crazy by pain and itching of ear mites and accompanying infections. Others die of blood loss or anemia from worms and fleas. Urinary tract infections, which frequently lead to blockage in male cats, cause extremely painful, lingering death if not treated. Untreated upper respiratory infections leave eyes and noses so caked with mucus that animals can barely see or breathe.”

Many feral cats live short, brutal lives. 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%/y. Feral cats suffer considerably higher rates of injury and disease. Many feral cats succumb to vehicle trauma, predation, disease, or severe weather. Winter has presented a number of examples of the dangerous and unsanitary conditions found at feral cat feeding sites. Clearly these conditions and outcomes are not serving the welfare of feral cats.” ▪ **Jessup, D. A., (2004) *The welfare of***

“The average life expectancy of an “outdoor cat” is about two to five years compared with 12 to 15 years for a cat who lives indoors. Feral cats, as well as homeless domesticated cats who have been set loose outdoors by shelters seeking to avoid the criticism that they might face from euthanizing them, commonly suffer and die from feline leukemia, feline AIDS, and other infectious diseases—even rabies. They also succumb to ailments like anemia and upper respiratory infections—conditions that are easily treatable were the cats to be taken to a veterinarian—but they are not. In winter, cats in cold climates endure subzero temperatures, some losing ears, tails, or limbs to frostbite; others being cut to shreds when they climb into car engines seeking warmth; and still others simply freezing to death. Many cats “disappear”—and while some are hit by cars or attacked by dogs or wild predators and some succumb to parasites or starvation...others are victims of foul play.”

▪ **Nachminovitch, D., (2017) TNR is dangerous both to cats and to other animals. *Voices for Wildlife*, March 8, 2017**

“Parasitism is the most common transmissible problem of feral cats...92% were infested with fleas and 37% had ear mites.”

“A study of 80 feral cats...revealed that 54% carried intestinal ascarids, compared with only 4% of 70 pet cats. Tapeworms and coccidia were found in 26% and 13% of feral cats, compared to 4% and 0% of pet cats, respectively. More feral cats (20%) were seropositive for *Toxoplasma gondii* than pet cats (3%)...In another study, *Bartonella henselae* was the most common infection identified in 553 (34%) feral cats...”

“...a kitten mortality rate of >50%...”

▪ **Levy, J. K., Crawford, P. C., (2004). Humane strategies for controlling feral cat populations. *JAVMA* 225, 1354-1360.**

“The welfare of free-roaming cats concerns society because they are frequent victims of vehicular collisions and fights between themselves and other animals.”

“Published figures for survival rates of adults include 33% over a 42 month period...Anecdotal reports estimate adult life span of feral cats at 2 to 3 years.”

▪ **Andersen, M. C., Martin, B. J., Roemer, G. W., (2004) Use of matrix population models to estimate the efficacy of euthanasia versus trap-neuter-return for management of free-roaming cats. *JAVMA* 225, 1871-1876**

“There are ethical concerns about the well-being of free-roaming cats, as individual health and survival may be severely challenged in urban populations...”

“...Nutter et al. 2004 examined free-roaming cat populations...as part of a Trap-Neuter-Return study, and found kitten mortality...as high as 75%.”

▪ **Kilgour, R. J., Magle, S. B., Slater, M., Christian, A., Weiss, E., DiTullio, M., (2017) Estimating free-roaming cat populations and the effects of a one year Trap-Neuter-Return management effort in a highly urban area. *Urban Ecosyst* 20, 207-216**

“Overall, 127 of 169 (75%) kittens died or disappeared before 6 months of age. Trauma was the most common cause of death.” ▪

▪ **Nutter, F. B., Levine, J. F., Stoskopf, M. K., (2004) Reproductive capacity of free-roaming domestic cats and kitten survival rate. *JAVMA* 225(9), 1399-1402**

# SUMMARY OF SCIENTIFIC LITERATURE

## **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., Adamec 1976; 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 9

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)

16

## **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) 11

*“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: 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

17

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)

## 18

“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: Feral cats: Do Trap=neuter-Return programs work?

Authors: Tom Gotsis

Affiliations: New South Wales Parliamentary Research Service

Journal: NSW Parliamentary Research Service, e-brief issue 18/2014

Year: 2014

## Summary

Utilizing 100 previously published studies the author summarizes their findings and concludes that TNR programs are ineffective at reducing feral cat populations and that they pose a significant threat to native wildlife.

## Key Quotes

*“For medium or large populations of feral cats the BBN calculated that the optimal population control measure was euthanasia. As Loyd and DeVore explain, other studies support their results: Trap-euthanize strategies have proven effective at reducing cat populations and mitigating adverse effects on wildlife in a number of locations. In contrast, TNR programs alone have never been shown to stabilize a feral cat population in the scientific literature.”*

*“Andersen, Martin and Roemer’s matrix population model predicted cat populations to have high intrinsic growth rates. It further predicted that euthanasia was likely to be more effective at controlling cat populations than TNR: Reducing cat survival (by*

19

*increasing euthanasia rates) would likely have a greater effect on cat population growth than reducing fecundity (by increasing sterilisation rates).”*

*“Castillo and Clarke studied two TNR programs in Florida... Neither study reduced cat numbers.”*

## Title: Evaluation of euthanasia and trap-neuter-return (TNR) programs in managing free-roaming cat populations

Authors: Paige M. Schmidt, Todd M. Swannack, Roel R. Lopez, Margaret R. Slater

Affiliations: College of Veterinary Medicine, Texas A&M University, Department of Wildlife and Fisheries Sciences

Journal: Wildlife Research

Year: 2009

## Summary

The authors evaluated free-roaming cat control methods using a demographic population model for a 25 year period to determine the effectiveness of both TNR and euthanasia.

## Key Quotes

*“Our results are consistent with long-term evaluations of TNR colonies that showed population abundance failed to decrease because*

of immigration (Castillo and Clark 2003) and with studies that showed high rates of transients and population turnover in feral cats (Langham and Porter 1991; Genovesi et al. 1995).”

“Our model results also are consistent with initial evaluations of TNR campaigns (Castillo and Clark 2003; Foley et al. 2005; Natoli et al. 2006). TNR was not effective at reducing free-roaming cat numbers...”

### **Title: Analysis of the impact of trap-neuter-return programs on populations of feral**

**cats** Authors: Patrick Foley, Julie K. Levy, Terry Paik

Affiliations: Department of Biological Sciences, University of California, College of Veterinary Medicine, University of Florida

Journal: Journal of American Veterinary Medical Association

Year: 2005

#### **Summary**

Using a theoretical population model, the authors evaluate two county TNR programs to assess the impact they have on feral cat populations.

#### **Key Quotes**

“Our analysis indicated that any population-level effects were minimal.”

“Implementation of the stage-structured model suggested that no plausible combinations of life history variables would likely allow for TNR to succeed in reducing population size, although neutering approximately 75% of the cats could achieve control (which is unrealistic), a value quite similar to results in the present study.”

“Feral cat control programs are notoriously difficult, and in many cases, short-term control has been followed by a long-term return to precontrol conditions.”

### **Title: Evaluation of the effect of a long term trap-neuter-return and adoption program on a free-roaming cat population**

Authors: Julie K. Levy, David W. Gale, Leslie A. Gale

Affiliations: College of Veterinary Medicine, University of Florida

Journal: Journal of American Veterinary Medical Association

Year: 2003

#### **Summary**

The authors evaluated the effect of a long-term trap-neuter-return program, with adoption whenever possible, on the dynamics of a free-roaming cat population.

20

#### **Key Quotes**

“More than 1,000 veterinary members of the California Veterinary Medical Association neutered more than 170,000 cats between July 1999 and May 2002 in a \$12 million project funded by Maddie’s Fund. However, virtually no information exists to support the contention that neutering is an effective long-term method for controlling free-roaming cat populations.”

“A 1-year study of TNR programs in 2 southern Florida parks revealed that the presence of well-fed cat colonies encouraged illegal abandonment of additional cats. While the original population of 81 cats declined 20% during 1 year, the arrival of new cats prevented reduction of the colonies, and 88 cats were present at the end of the study. Results of the study also refuted an oft-cited claim that an established colony of cats will defend its territory and prevent the immigration of new arrivals.”

“It is proposed that a mortality rate of > 50% in free-roaming kittens prior to maturity contributes to the relatively stable population of cats.”

“Immigration or abandonment of new cats may be a frequent event, and free-roaming cats do not appear to have sufficient territorial activity to prevent new arrivals from permanently joining colonies. These new arrivals could substantially limit the success of TNR...”

## SUBJECT MATTER EXPERT STATEMENT

Grant Sizemore, Director of Invasive Species Programs – American Bird Conservancy, wrote an authoritative white paper that was submitted to the City of Albuquerque to educate them regarding the realities and impacts of TNR programs. Because of its depth and relevancy we have included it in our report.

**Expert Statement of Grant C. Sizemore  
Trap, Neuter and Release (TNR) Programs  
Harm Wildlife, the Environment, Public Health,  
and the Cats They are Designed to Aid;  
They also Fail to Control Cat Populations**

### **A Need for Management**

Management of animal populations is an important element of maintaining a safe, healthy, and enjoyable environment for people and wildlife. When animal populations become too large or adversely affect the communities around them, human intervention is required. In the United States estimates suggest there are 114-188 million domestic cats (*Felis catus*) and that the number of owned cats has tripled in the last 40 years.<sup>2,3,4</sup> Of these, 60-160 million roam outdoors without restriction.<sup>2,3</sup> The presence of these outdoor cats has

serious implications for the health and welfare of cats, wildlife, and people. Thus, outdoor domestic cats require effective management solutions.

Although many governments and institutions agree that managing outdoor cats is both necessary and desirable, how to appropriately manage feral domestic cats – those cats that live in a “wild” state – is a matter of public debate. To be effective, management programs for the 2 growing number of feral cats, which have been estimated to number from 30-100 million, should eliminate the conditions which necessitated management in the first place.<sup>3,5</sup> The City of Albuquerque’s Animal Welfare Department has instituted a feral cat program called Trap, Neuter, Return (TNR)<sup>6</sup>. TNR programs trap feral cats, spay or neuter them, and then release the cats back to the location from which they were trapped. The City’s feral cat management strategy is inappropriate because TNR programs are ineffective as a means of population control and do not properly account for animal welfare, ecological, or public health concerns.<sup>7</sup>

### **TNR Is Ineffective at Population Control**

TNR programs are often hailed as the most humane and effective means of feral cat population control by its supporters, despite a preponderance of scientific evidence that suggests otherwise. Numerous studies have analyzed TNR programs to determine their impact on feral cat populations. Overwhelmingly, studies indicate that population control via TNR is either impractical or unachievable. Below is a summary of peer-reviewed scientific studies that assess the efficacy of TNR programs.

#### Castillo and Clarke (2003)<sup>8</sup>

In a study that analyzed two managed TNR programs in public parks in South Florida, data “contradict[ed] the assertion that managed cat colonies decline in size over time” and “suggest[ed] that trap, neuter, and release programs are not an effective method to help 3 control the population of unwanted feral and free-roaming cats.” Not only did these colonies not reduce in size, in one colony the number of cats present actually significantly increased, likely due to illegal dumping of cats and/or the attraction of large numbers of stray cats to food provided by colony caretakers.

#### Andersen et al. (2004)<sup>9</sup>

TNR and humane euthanasia were evaluated as potential feral cat population control methods. By constructing population models using data from cat populations in urban environments, researchers were able to vary the percentage of cats spayed/neutered or humanely euthanized and to determine the subsequent impact on population. Results indicated that a 50% humane euthanasia rate would yield a reduction in the feral cat population by 10% per year, but even a 75% spay/neuter rate would still yield an increasing feral cat population. A spay/neuter rate as high as 88% of the feral cat population would be needed to merely stabilize population growth.

#### Foley et al. (2005)<sup>10</sup>

In a study published in the Journal of American Veterinary Medicine, scientists evaluated a county TNR program in San Diego County, California, from 1992 to 2003 and a county TNR program in Alachua County, Florida, from 1998 to 2004. Researchers identified the critical neutering fraction, the fraction of the population of feral cats that would have to be spayed or neutered to result in a population decline. The critical neutering fractions were 71% for San Diego County and 94% for Alachua County. In the last year of data collection, the numbers of spayed or neutered cats represented only 0.63% and 9.6% of all feral cats in San Diego County 4

and Alachua County, respectively. In other words, in Alachua County the spay/neuter rate was approximately one tenth of what the researchers concluded was needed to achieve a population decline; in San Diego County the spay/neuter rate was approximately one hundredth of the rate required. Analyses “indicated that any population-level effects were minimal” and that population growth continued. The authors even commented that results were similar to a previous study, which indicated that “no plausible combination of life history variables [e.g., survival, fecundity] would likely allow for TNR to succeed in reducing population size.”

#### Natoli et al. (2006)<sup>11</sup>

Researchers in Rome, Italy, evaluated data from an urban feral cat TNR campaign conducted from 1991 to 2000. After evaluating the resulting populations, the authors stated that “although many feral cats are neutered and many neutered cats die (from car accidents, etc.), many cats are introduced into colonies (mainly by abandonment of house cats).” Despite a massive effort that spayed or neutered almost 8,000 cats and removed kittens from colonies, the researchers concluded that, alone, TNR is a “waste of money, time, and energy.”

#### Schmidt et al. (2009)<sup>12</sup>

This study evaluated the effects of TNR and humane euthanasia over a 25-year period on a free-roaming cat population in Texas. By using a population model, researchers were able to vary implementation rates of both management strategies and alter immigration rates – the number of cats moving into a feral cat colony – to determine impacts on population size. 5 Results of the models indicated that humane euthanasia was consistently more effective than TNR with any degree of immigration and at least comparable when no immigration occurred (which is a highly improbable likelihood unless a colony is completely and physically enclosed). The authors also addressed the vacuum effect – the notion that an animal may be “sucked” into a location by resource or niche availability – often cited by TNR practitioners as a benefit of TNR over humane euthanasia. According to the study’s authors, “regardless of the treatment type [humane euthanasia or TNR], any population reduction below carrying capacity would result in open niches that would eventually be filled by immigrants.” Therefore, it is inappropriate for advocates of TNR programs to claim any superiority in this aspect of population control on the basis of the vacuum effect. Furthermore, the study’s authors noted that the conditions often found in feral cat

colonies, perpetuated in TNR programs (e.g., provisioning of food), increase the likelihood of immigration, thus suggesting that the vacuum effect actually applies more to TNR programs than any strategy that removes feral cats from the environment.

### Gunther et al. (2011)<sup>13</sup>

Researchers monitored free-roaming cats in an urban environment and examined population differences between four colonies, two spayed or neutered via a TNR program and two consisting of sexually intact cats. The percentage of cats spayed or neutered in the two spayed and neutered colonies was 73% and 75%. The study's results indicated that the number of cats in the TNR colonies significantly increased during the study period because of higher immigration into the colony, largely from cats not simply abandoned but living a feral lifestyle. <sup>6</sup> The number of cats in the sexually intact colonies actually decreased during the same period. The study's authors proposed that a "behavioral vacuum" led to increased immigration when cats were spayed or neutered because of decreased aggressive behaviors by resident cats following surgery, allowing other cats to move into the colony. This finding is in direct contradiction to the frequent claim by TNR practitioners that spayed or neutered cats will hold a territory and keep other cats out, a major tenet of TNR philosophy.

### **Summary**

These studies confirm that TNR programs do not successfully reduce feral cat populations. The sterilization percentage required for each feral cat colony even to merely stabilize populations is impractical and potentially unachievable. For example, even for the 10-year, intensive TNR programs in San Diego County and Alachua County, the percentage of feral cats spayed or neutered required for program success (i.e., population decline) was "far greater than what was achieved."<sup>10</sup> In addition, Gunther et al. (2011) found that, even with relatively high spay/neuter rates, cat colony numbers still did not decline.<sup>12</sup> Furthermore, due to the conditions within cat colonies (e.g., feeding cats), TNR programs are likely to actually increase the number of cats in an area. The City of Albuquerque's Animal Welfare Department has stated it is following the advice of organizations such as The Humane Society of the United States, which advocates that TNR programs feed cat colonies. <sup>14,15</sup> Even if Albuquerque staff do not feed the colonies, the colony presence often encourages individuals to provide food.<sup>13</sup> Finally, because TNR programs do not completely enclose feral cat colonies, immigrant or abandoned cats are drawn into colonies and ensure that the population will not reduce.

### **TNR Sacrifices Animal Welfare**

Although animal welfare concerns are often used to justify TNR programs, these programs actually decrease the welfare of both cats and wildlife by enabling feral cats to continue to roam outdoors. Feral cats are subject to disease, predation, trauma, and poisoning from toxic materials. For feline leukemia virus and feline immunodeficiency virus, for example, risk of infection with these two potentially fatal viruses is significantly greater in cats living outdoors.<sup>16</sup> In fact, studies indicate that stray and feral cats are far more likely to be infected by disease-causing pathogens than owned cats, including those that roam.<sup>6</sup> Feral cats are also a potential reservoir for parasites like hookworms, and one study found that over 92% of randomly selected feral cats were infested with fleas, which are both uncomfortable and dangerous for cats.<sup>17,18</sup> Outdoor cats are also at risk of being attacked and/or killed by dogs, raptors, or coyotes. Coyotes, in particular, are adept cat predators. Although not always killing cats for food, studies have found coyote diets with

## 23

up to 42% cat content.<sup>19,20</sup> Conditions are such that People for the Ethical Treatment of Animals vigorously opposes TNR, taking the position that it is inhumane for the cats as well as the wildlife they hunt, injure, and/or kill.<sup>21</sup> In the *Journal of American Veterinary Medicine*, veterinarian David Jessup acknowledged the implications for wild animal welfare as well, stating that "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 [bacteria in the mouths] of cats."<sup>5</sup> The cumulative result of these threats for cats and wildlife is an often an untimely death and what the American Veterinary Medical Association calls "a national tragedy of epidemic proportions."<sup>22</sup>

### **TNR Sacrifices Wildlife**

Domestic cats are a product of thousands of years of artificial selection, and these cats are now a distinct and separate species from their wild ancestors. As a domesticated species, cats have not shaped and been shaped by their natural environment as many other predators have. Consequently, domestic cats are a non-native species that has been artificially introduced by people into environments in the United States and globally, with significant impacts to natural systems. TNR programs, by maintaining cats in the environment, facilitate these impacts.

Feral and free-roaming cats are a well-known threat to wildlife. Globally, cats have contributed to the extinction of 33 species and remain the principal threat to 8% of the critically 9 endangered birds, mammals, and reptiles.<sup>23</sup> Due to the scale and severity of their impacts outdoors, the International Union for the Conservation of Nature (IUCN) lists domestic cats as one of the world's worst non native invasive species.<sup>24</sup> An invasive species is one whose introduction causes "economic, or environmental harm or harm to human health."<sup>25</sup> Cat impacts to wildlife are particularly severe because domestic cats are instinctive predators that will hunt and kill regardless of hunger. While indoors, this prey drive is evident when cats chase feather toys, balls of yarn, or lasers. When outdoors, however, these toys are replaced by birds, mammals, and reptiles. This instinctive predatory drive of cats and the resulting environmental impacts are amplified with feral cats because of their constant presence outdoors and their ability to maintain a much closer affiliation with people than native predators. Cats are generally far more comfortable around people, and people are generally more comfortable around cats than native predators (e.g., coyotes, skunks, or cougars). Furthermore, outdoor cats may exist in densities 10-100 times greater than native predators and reach over 3,885 animals per square mile.<sup>26,27</sup>

In the United States and Canada, predation by outdoor cats is the number one source of direct, human-caused mortality to birds.<sup>4,28</sup> A

study by scientists from the Smithsonian Conservation Biology Institute and the U.S. Fish and Wildlife Service in 2013 estimated that cats kill approximately 2.4 billion birds and 12.3 billion mammals every year in the lower 48 states alone.<sup>4</sup> In this study, 69% of bird mortality and 89% of mammal mortality was caused exclusively by un-owned (e.g., feral) cats. These estimates are often surprising to many people, including cat owners, because cat owners significantly underestimate their owned cat's hunting prowess. In a study that attached cameras to owned cats allowed outdoors, researchers identified that only 23% of all wildlife kills made by cats were returned to the home, thus suggesting that personal observations are insufficient to accurately evaluate total wildlife mortality caused by cats.<sup>29</sup>

Even when feral cats do not directly kill or maim wildlife, their mere presence is enough to cause sublethal effects (e.g., altered prey behavior) that can have lethal results. Scientists have evaluated the sublethal effects of cats on nesting birds and observed a reduction in feeding of young and an increase in nest predation by other predators when cats are simply nearby.<sup>30</sup> This observed phenomenon may contribute to the "reduced chick conditions and smaller clutch sizes that characterize urban bird populations [where cats are more abundant] in comparison with their rural [counterparts]."<sup>27,31</sup> By altering the behavior of wildlife, outdoor 11 cats disrupt ecological communities with potentially fatal consequences for individuals and widespread consequences for populations.

### **TNR Endangers Public Health**

TNR programs fail to address the public health concerns associated with colonies of feral cats roaming outdoors. Not only do feral cats have the potential to bite or scratch, they also carry a number of parasites and diseases. The Centers for Disease Control and Prevention (CDC) recognizes 16 separate diseases and parasites that cats may transmit to people.<sup>32</sup> These include cat scratch disease, hookworms, *salmonella*, roundworms, and plague. Since 2004, 70 cats have tested positive for plague in New Mexico alone.<sup>33</sup> The Centers for Disease Control and Prevention recognizes cats as a "highly susceptible" and "common source of...infection in humans."<sup>34</sup> Perhaps the most insidious of the diseases cats can spread to people, however, are rabies and toxoplasmosis.

Rabies is a fatal viral disease that affects all mammals, including cats and people. Although wildlife species account for the majority of rabid animals in the United States, domestic cats are consistently the top source of rabies among domestic animals.<sup>35</sup> Furthermore, domestic cats represent a far greater risk of human exposures to the disease because people, especially children, are more likely to interact with cats than wildlife.<sup>36</sup> According to a study led by CDC scientists, TNR programs – even those that incorporate a one-time rabies vaccine – "[do] not adequately meet feral cat population control needs that public health and animal welfare necessitate" and "should not be endorsed as an effective approach for mitigating health concerns related to feral cat colonies."<sup>36</sup> In 2012, at least a dozen residents in Carlsbad, New Mexico, were forced to undergo post-exposure prophylaxis injections and 30 dogs had to be euthanized after being exposed to rabies by feral cats released back into the environment through the city's TNR program.<sup>37</sup> The National Association of State Public Health Veterinarians' (NASPHV) *Compendium of Animal Rabies Prevention and Control, 2011*, which is endorsed by the American Public Health Association, American Veterinary Medical Association, Association of Public

## 24

Health Laboratories, Council of State and Territorial Epidemiologists, and National Animal Control Association, recommends that stray cats should be removed from the community.<sup>38</sup> The NASPHV, recognizing the public health risks from feral cats, also takes the position that "there is no evidence that colony management programs will reduce diseases such as bartonellosis, larval migrans, toxoplasmosis, and vector-borne diseases. Rabies will also continue to be a risk, as such colonies are not closed."<sup>39</sup>

Toxoplasmosis, a disease caused by infection with the parasite *Toxoplasma gondii*, is another public health risk that TNR entirely fails to address and, in fact, exacerbates. *T. gondii* relies on felids, animals in the cat family – including domestic cats – to complete its life cycle but may infect a wide variety of intermediate hosts, including humans and all other warm-blooded species.<sup>40</sup> As many as 74% of all domestic cats will acquire *T. gondii* during their lifetime and excrete hundreds of millions of tiny, infectious eggs called oocysts in their feces.<sup>40</sup> These highly resilient eggs can survive periods of cold and dehydration and may remain infectious in the environment for up to 18 months.<sup>40,41</sup> A study published in 2013 by scientists from The Stanley Medical Research Institute and Johns Hopkins University admitted that "because cats are now so ubiquitous in the environment, one may become infected by neighboring cats which defecate in one's garden or play area, or by playing in public areas such as parks or school grounds. Indeed, as cats increasingly contaminate public areas with *T. gondii* [eggs] it will become progressively more difficult to avoid exposure."<sup>42</sup>

Toxoplasmosis in humans can be contracted in multiple ways and may be severe. Humans may acquire infection with *T. gondii* by ingesting or inhaling the parasite's eggs, by eating undercooked and infected meat, from a pregnant woman to her fetus, or through blood transfusions and organ transplants.<sup>40,43</sup> Although tracking the source of infection has historically been difficult and pathways may vary by country, exposure in the United States is most likely from infectious eggs excreted in cat feces because there is not a strong tradition of eating undercooked foods. Indeed, evidence suggests that infections from *T. gondii* eggs excreted by cats are more prevalent than from eating undercooked meat, and one study of mothers with infants born with toxoplasmosis found that 78% were infected by cat-excreted parasitic eggs.<sup>44,45</sup> TNR programs purposefully maintain cats outdoors, where they are likely to acquire and transmit *T. gondii* infection.

The consequences of human infection vary depending on how the parasite is acquired. Toxoplasmosis acquired by a fetus from its mother may experience blindness, deafness, seizures, mental retardation, abortion, or neonatal death.<sup>40,42</sup> Infection can also be fatal for individuals with weakened immune systems, such as those with HIV, AIDS, or undergoing chemotherapy.<sup>40,42,46</sup> Even in adults with healthy immune systems toxoplasmosis has been linked to chorioretinitis, lymphadenopathy, multi-organ failure, schizophrenia, Alzheimer's Disease, depression, and brain cancer.<sup>40,42,44,47,48</sup> A 2014 study found a "remarkable" 35% reduction in certain memory capabilities in elderly adults infected with *T. gondii*.<sup>49</sup> These varied 15 negative health effects and clear connection with cats

indicate that any program, such as TNR, that keeps cats roaming outdoors jeopardizes public health.

## Conclusion

The need to humanely and effectively manage feral cat populations in Albuquerque and the rest of the United States is evident; however, the scientific evidence and New Mexico Department of Game and Fish concur that TNR is not a viable solution. 50 TNR programs not only fail to reduce populations of feral cats, they also diminish the health and welfare of cats, wildlife, and people. The City of Albuquerque's Animal Welfare Department, in the interest of animals and people, should discontinue its TNR program and instead establish an evidence-based feral cat management program that is proven to reliably reduce cat populations and simultaneously eliminate the many risks posed by roaming feral cats.

- 1 Grant C. Sizemore is the Director of Invasive Species Programs for the American Bird Conservancy. Mr. Sizemore has received a Masters in Science in Wildlife Ecology and Conservation and a Bachelor of Science in Zoology and Environmental Science. His curriculum vitae is attached as Exhibit A. 2 Dauphine N. and R.J. Cooper. 2009. Impacts of free-ranging domestic cats (*Felis catus*) on birds in the United States: a review of recent research with conservation and management recommendations. Proceedings of the Fourth International Partners in Flight Conference: Tundra to Tropics 205-219. 3 Lepezyk C.A., N. Dauphine, D.M. Bird, S. Conant, R.J. Cooper, D.C. Duffy, P.J. Hatley, P.P. Marra, E. Stone, and S.A. Temple. 2010. What conservation biologists can do to counter Trap-Neuter-Return: Response to Longcore et al. Conservation Biology 24: 627-629.
- 4 Loss S.R., T. Will, and P.P. Marra. 2013. The impact of free-ranging domestic cats on wildlife of the United States. Nature Communications. doi: 10.1038/ncomms2380.
- 5 Jessup D. 2004. The welfare of feral cats and wildlife. Journal of the American Veterinary Medical Association 225: 1377-1383. 6 Such programs are also referred to as "Trap, Neuter, Release."
- 7 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. 8 Castillo D. and A.L. Clarke. 2003. Trap/Neuter/Release methods ineffective in controlling domestic cat "colonies" on public lands. Natural Areas Journal 23: 247-253.
- 9 Andersen M.C., B.J. Martin, and G.W. Roemer. 2004. Use of matrix population models to estimate the efficacy of euthanasia versus trap-neuter-return for management of free-roaming cats. Journal of the American Veterinary Medical Association 225: 1871-1876.
- 10 Foley P., J.E. Foley, J.K. Levy, and T. Paik. 2005. Analysis of the impact of trap-neuter-return programs on populations of feral cats. Journal of the American Veterinary Medical Association 227: 1775-1781.
- 11 Natoli E., L. Maralano, G. Cariola, A. Faini, R. Bonanni, S. Cafazzo, and C. Fantini. 2006. Management of feral domestic cats in the urban environment of Rome (Italy). Preventive Veterinary Medicine 77: 180-185.
- 12 Schmidt P.M., T.M. Swannack, R.R. Lopez, and M.R. Slater 2009. Evaluation of euthanasia and trap-neuter-return (TNR) programs in managing free-roaming cat populations. Wildlife Research 36: 117-125.
- 13 Gunther I., H. Finkler, and J. Terkel. 2011. Demographic differences between urban feeding groups of neutered and sexually intact free-roaming cats following a trap-neuter-return procedure. Journal of the American Veterinary Medical Association 238: 1134-1140.
- 14 Ayres K. Animal Activist Fights Feral Cat Programs. KRQE News 13, 12/8/2013, <https://www.youtube.com/watch?v=3YT1hdQdG9E>.

## 25

- 15 The Humane Society of the United States. Outdoor Cats: Frequently Asked Questions. 6/20/2014, [http://www.humanesociety.org/issues/feral\\_cats/qa/feral\\_cat\\_FAQs.html?credit=web\\_id83574224#Do\\_people\\_take\\_care\\_of\\_feral\\_cats\\_What\\_d](http://www.humanesociety.org/issues/feral_cats/qa/feral_cat_FAQs.html?credit=web_id83574224#Do_people_take_care_of_feral_cats_What_d), accessed 6/25/2014. 7
- 16 Levy J.K., H.M. Scott, J.L. Lachtara, 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 Medical Association 228: 371-376.
- 17 Akucewich L.H, K. Philman, A. Clark, J. Gillespie, G. Kunkle, C.F. Nicklin, E.C. Greiner. 2002. Prevalence of ectoparasites in a population of feral cats from north central Florida during the summer. Veterinary Parasitology 109: 129-139.
- 18 Andersen T.C., G.W. Foster, and D.J. Forrester. 2003. Hookworms of feral cats in Florida. Veterinary Parasitology 115: 19-24. 19 Gehrt S.D. 2007. Ecology of coyotes in urban landscapes. Proceedings of the 12th Wildlife Damage Management Conference 303-311. 20 Grubbs S.E. and P.R. Krausmann. 2009. Observations of coyote-cat interactions. The Journal of Wildlife Management 73: 683-685. 8 21 People for the Ethical Treatment of Animals. 2013. The Great Outdoors? Not for Cats! <http://www.peta.org/issues/companion-animals/the-great-outdoors-not-for-cats.aspx>, accessed 6/18/2014.
- 22 American Veterinary Medical Association. 2014. Free-roaming abandoned and feral cats. <https://www.avma.org/KB/Policies/Pages/Free-roaming-Abandoned-and-Feral-Cats.aspx>, accessed 6/18/2014.
- 23 Medina F.M., 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. 2011. A global review of the impacts of invasive cats on islands endangered vertebrates. Global Change Biology 17: 3503-3510.
- 24 Lowe S., M. Browne, S. Boudjelas, and M. De Poorter. 2000. 100 of the World's Worst Invasive Alien Species: A Selection from the Global Invasive Species Database. The Invasive Species Specialist Group, International Union for the Conservation of Nature.
- 25 Executive Order Number 13112, 64 Federal Register 6183-6186 (February 3, 1999).
- 26 Liberg O., M. Sandel, D. Pontier, and E. Natoli. 2000. Density, spatial organization and reproductive tactics in the domestic cat and other felids. pp. 119-147 in D.C. Turner and P. Bateson (Ed.), The Domestic Cat: the Biology of its Behavior, Cambridge University Press.
- 27 Sims V., K.L. Evans, S.E. Newson, J.A. Tratalos, and K.J. Gaston. 2008. Avian assemblage structure and domestic cat densities in urban environments. Diversity and Distributions 14: 387-399. 10
- 28 Blancher P. 2013. Estimated number of birds killed by house cats (*Felis catus*) in Canada. Avian Conservation and Ecology 8: 3. <http://dx.doi.org/10.5751/ACE-00557-080203>.
- 29 Loyd K.A.T., S.M. Hernandez, J.P. Carroll, K.J. Abernathy, and G.J. Marshall. 2013. Quantifying free-roaming domestic cat predation using animal-borne video cameras. Biological Conservation 160: 183-189.
- 30 Bonnington C., J.J. Gaston, and K.L. Evans. 2013. Fearing the feline: domestic cats reduce avian fecundity through trait-mediated indirect effects that increase nest predation by other species. Journal of Applied Ecology 50: 15-24.
- 31 Chamberlain D.E., A.R. Cannon, M.P. Toms, D.I. Leech, B.J. Hatchwell, and K.J. Gaston. 2009. Avian productivity in urban landscapes: a review and meta analysis. Ibis 151: 1-18.
- 32 Centers for Disease Control and Prevention. 2014. Cats. <http://www.cdc.gov/healthypets/pets/cats.html>, accessed 6/19/2014.
- 33 New Mexico Department of Health. Confirmed Pet Plague, New Mexico, 2004-2012. [http://nmhealth.org/ERD/HealthData/documents/ConfirmedPetCases\\_NM\\_2004\\_2012.pdf](http://nmhealth.org/ERD/HealthData/documents/ConfirmedPetCases_NM_2004_2012.pdf), accessed 9/23/2013.
- 34 Centers for Disease Control and Prevention. 2012. Plague, Information for Veterinarians. <http://www.cdc.gov/plague/healthcare/veterinarians.html>, accessed 7/28/2014.
- 35 Dyer J.L., R. Wallace, L. Orciari, D. Hightower, P. Yager, and J.D. Blanton. 2013. Rabies surveillance in the United States during 2012. Journal of the American Veterinary Medical Association 243: 805-815.
- 36 Roebing A.D., D. Johnson, J.D. Blanton, M. Levin, D. Slate, G. Fenwick, and C.E. Rupprecht. 2013. Rabies prevention and management of cats in the context of Trap-Neuter-Vaccinate-Release programmes. Zoonoses and Public Health. doi: 10.1111/zph. 12070.
- 37 Justin D.A. 2012. Feral Cats Cause Rabies Outbreak in New Mexico. Opposing Views (April 17, 2012), <http://www.opposingviews.com/i/society/animal-rights/feral-cats-cause-rabies-outbreak-new-mexico>.
- 38 National Association of State Public Health Veterinarians. 2011. Compendium of Animal Rabies Prevention and Control, 2011.

<http://www.nasphv.org/Documents/RabiesCompendium.pdf>.

39 National Association of State Public Health Veterinarians. 1996. Free-roaming/Unowned/Feral Cats. Position Statement.

<http://www.abcbirds.org/abcprograms/policy/cats/pdf/NASPHV%201996%20-%20-%20Free-roaming,%20unowned,%20feral%20cats.pdf>. 13 40 Tenter A.M., A.R. Heckerroth, and L.M. Weiss. 2000. *Toxoplasma gondii*: from animals to humans. *International Journal of Parasitology* 30: 1217-1258. 41 Frenkel J.K. 2000. *Biology of Toxoplasma gondii*. pp. 9-25 in P. Ambroise-Thomas and E. Peterse (Ed.), *Congenital Toxoplasmosis: Scientific Background, Clinical Management, and Control*. Springer-Verlag, Paris.

42 Torrey E.F. and R.H. Yolken. 2013. *Toxoplasma* oocysts as a public health problem. *Trends in Parasitology* 29: 380-384.

43 Hill D. and J.P. Dubey. 2012. *Toxoplasma gondii*: transmission, diagnosis, and prevention. *Clinical Microbiology and Infection* 8: 634-640. 44 Hill D., C. Coss, J.P. Dubey, K. Wroblewski, M. Sautter, T. Hosten, C. Munoz-Zanzi, E. Mui, S. Withers, K. Boyer, G. Hermes, J. Coyne, F. Jagdis, A. Burnett, P. McLeod, H. Morton, D. Robinson, and R. McLeod. 2011. Identification of a sporozoite-specific antigen from *Toxoplasma gondii*. *Journal of Parasitology* 97: 328-337. 45 Boyer K., D. Hill, E. Mui, K. Wroblewski, T. Karrison, J.P. Dubey, M. Sautter, A.G. Noble, S. Withers, C. Swisher, P. Heydmann, T. Hosten, J. Babiarz, D. Lee, P. Meier, and R. McLeod. 2011. Unrecognized ingestion of *Toxoplasma gondii* oocysts leads to congenital toxoplasmosis and causes epidemics in North America. *Clinical Infectious Diseases* 53: 1081-1089.

46 Montoya J.G. and O. Liesenfeld. 2004. *Toxoplasmosis*. *The Lancet* 363: 1965-1976.

47 Kubesci O.Y., O. Miman, M. Yaman, O.C. Aktepe, and S. Yazar. 2011. Could *Toxoplasma gondii* have any role in Alzheimer's disease? *Alzheimer Disease and Associated Disorders* 25: 1-3.

48 Undseth O., P. Gerlyng, A.K. Goplen, E.S. Holter, E. Von Der Lippe, and O. Dunlop. 2014. Primary toxoplasmosis with critical illness and multi-organ failure in an immunocompetent young man. *Scandinavian Journal of Infectious Diseases* 46: 58-62. 49 Gajewski P.D., M. Falkenstein, J.G. Hengstler, and K. Golka. 2014. *Toxoplasma gondii* impairs memory in infected seniors. *Brain, Behavior, and Immunity* 36: 193-199.

## POSITION STATEMENTS

The following is a small sampling of position statements, letters, and resolutions from various professional agencies and organizations declaring their opposition to TNR programs.

### **THE UNITED STATES MARINE CORPS FORCE, PACIFIC**

#### TNR Position Statement

The U.S. Marine Corps Force, Pacific has looked into the issues with TNR and advises against it.

Trap-Neuter-Release (TNR) as a viable program has been debunked in a number of scientific, peer-reviewed studies and summarized in a meta-analysis titled "Critical Assessment of Claims Regarding Management of Feral Cats by Trap-Neuter-Return" by Longcore et al. (2009) in the journal *Conservation Biology*. This analysis has shown TNR to be ineffective at its primary goal of reducing the number of cats on the landscape. TNR also does not mitigate the primary impacts of feral cats on native wildlife or humans. TNR cats can continue to prey on native wildlife and continue to spread disease that is harmful to wildlife and humans. Wildlife veterinarians, public health officials, natural resources agencies, and other animal-focused organizations oppose TNR.

### **FLORIDA VETERINARY MEDICAL ASSOCIATION**

#### FVMA 2014 Position Statement on Free Roaming Cats

The Florida Veterinary Medical Association (FVMA) promotes animal health, public health and responsible pet ownership through support of the veterinary medical profession in Florida. The FVMA embraces the concept of the human-animal bond and seeks to provide guidance for the welfare and care of all animals in Florida: domestic, livestock, captive wildlife and free-ranging native species. In fulfilling this mission, the FVMA seeks to address issues related to the management of free-roaming, abandoned, and feral cats in Florida.

The FVMA encourages and supports efforts to eliminate the problem of free-roaming, abandoned and feral cats. It is believed that millions of these cats exist in Florida. Unfortunately, most of these cats will suffer premature mortality from disease, starvation or trauma. The magnitude of their suffering is a tragedy of epidemic proportions. Free-roaming, abandoned and feral cats are a significant factor in the deaths of hundreds of millions of birds, small mammals, reptiles, amphibians, and fish. Free roaming cats also pose a significant zoonotic disease risk to the general public, especially children.

According to the Florida Department of Health, domestic cats maintained indoors, without the risk of contact with wildlife and

environmental threats, pose little to no risk of disease transmission to people. On the other hand, free-roaming, feral and abandoned domestic cats are a persistent threat to our communities because these cats do not receive appropriate preventive veterinary medical care. Additionally, free-roaming/feral cats present a risk to native Florida wildlife, including the Florida Panther.

The FVMA supports the use of properly designed and appropriately maintained enclosures for the management of feral cat colonies. Such a management strategy mitigates the risk to the public at large, to the sensitive Florida ecological system, and allows for improved welfare of the cats.

The FVMA encourages public education that reduces abandonment of domestic cats and eliminates public feeding of free-roaming feral cats in compliance with existing statutes.

## **NEW JERSEY FISH AND GAME COUNCIL**

WHEREAS, free-ranging domestic cats are a non-native, invasive predator species; and

WHEREAS, free-ranging domestic cats annually kill millions of native birds, small mammals, reptiles, and amphibians; and

WHEREAS, free-ranging domestic cats are a threat to the survival of endangered and threatened species, and also those that are considered rare and those designated as being of special concern); and

27

WHEREAS, free-ranging domestic cats kill many of the species that serve as prey for a variety of native wildlife, including raptors, which, by depriving these native species of valuable food unnecessarily compounds the difficulty of their survival, and places unnecessary stress on the larger ecosystem; and

WHEREAS, the "management" (supplemental feeding, trap-neuter-release etc.) of domestic cat colonies does not moderate unacceptable negative impacts on natural resources as even well-fed cats kill native wildlife and in fact, are in better physical condition and therefore better able to kill native wildlife; and

WHEREAS, domestic cat colonies are sometimes established in areas that are considered to be of little value but, in fact, these areas provide temporary, essential resting and foraging areas for migrant species, especially birds; and

WHEREAS, any time large numbers of animals congregate in one area, as in domestic cat colonies, there is increased risk for the spread of diseases, including feline leukemia, toxoplasmosis, and rabies, among others; and

WHEREAS, food provided for free-ranging cats also attracts skunks, raccoons, black bears and other species that are capable of contracting and/or spreading rabies through interactions with vector species; and

WHEREAS, these diseases not only endanger native wildlife, but rabies, toxoplasmosis, and other diseases also pose significant health risks to people: and

WHEREAS, the National Association of State Public Health Veterinarians has stated that there is no evidence that colony management programs will reduce diseases; and

WHEREAS, NJSA 23:2A-14 makes it illegal to intentionally leave out food that can be accessed by or attractive to bears; therefore, be it

RESOLVED, that the New Jersey Fish and Game Council does not support non-native, invasive domestic cats being allowed to roam freely anywhere in New Jersey.

## **NATIONAL WILDLIFE REHABILITATORS ASSOCIATION**

NWRA Policy on Free-Ranging Domestic Cats

Considering the following:

- free-ranging domestic cats, both pets and feral, are those that roam freely for periods of time from a few minutes to their entire lives; and
- free-ranging domestic cats are a non-native, frequently invasive predator species; and
- free-ranging domestic cats annually kill, injure or alter the natural behavior of millions of native birds, small mammals, reptiles and amphibians; and

- free-ranging domestic cats can be a significant threat to the survival of rare, endangered and threatened species, those designated as being of special concern, and other native wildlife; and
- free-ranging domestic cats kill many of the species that serve as prey for a variety of native wildlife which, by depriving these native species of valuable food compounds the difficulty of their survival, and places unnecessary stress on the larger ecosystem; and
- supplemental feeding and the trap-neuter-release of feral domestic cats does not significantly reduce the negative impacts on natural resources, as even well-fed cats kill native wildlife; and
- domestic cat colonies are sometimes established in areas that are considered to be of little wildlife value but, in fact, these areas can provide temporary, essential resting and foraging areas for migrant species, especially birds; and
- any time large numbers of animals congregate in one area, as in domestic cat colonies, there is an increased risk for the concentration and spread of infectious diseases, including feline leukemia, toxoplasmosis, and rabies, among others, which not only affect domestic cats but can spread to susceptible wildlife species; and
- food provided for free-ranging cats also attracts skunks, raccoons, foxes and other species that are capable of contracting and/or spreading rabies through interactions with vector species; and
- these diseases not only endanger native wildlife, but rabies, toxoplasmosis and other diseases also pose significant health risks to people; and
- the National Association of State Public Health Veterinarians has stated that there is no evidence that feral cat colony management programs will reduce diseases; the NWRA does not support domestic cats being allowed to roam freely.

28

NWRA supports (recommends) that all domestic cats be kept indoors, or if allowed outside they be securely restrained physically (by means of a harness and leash, for example) or kept in a fully secured enclosure. NWRA does not support feral domestic cat colonies unless they are actively managed in a secure enclosure to prevent movement of any animals, including wildlife species, in or out of the colony. Allowing domestic cats, whether pets or feral, to be free-ranging is not supported or condoned by NWRA in any manner.

## PEOPLE FOR THE ETHICAL TREATMENT OF ANIMALS

It's a debate that can turn even the mildest-mannered "cat people" into snarling, hissing adversaries: trap, neuter, release (TNR). The topic is heating up as so-called "no-kill" lobbyists are pressuring animal shelters to embrace TNR in an effort to make their "saved" statistics look better. But are cats who are turned back out onto the streets actually "saved"?

The statistics say otherwise.

The average lifespan of a cat who lives outdoors is just 1 to 5 years, compared to 12 to 20 years for a cat who lives indoors. So when people turn cats loose, they often aren't buying them much—if any—time. Some worry that animals taken to shelters will be euthanized, but the very definition of euthanasia is "good death." On the streets, cats' deaths are inevitably *bad*. They die of deadly contagious diseases, traffic accidents, parasite infestations, dehydration, exposure, attacks by predators (including cruel humans), and other terrible fates. Just a few recent examples include the following:

-A cat who was allowed to roam outdoors without supervision was found dead, impaled by an arrow, in the yard of an abandoned house in Iowa. Another "outdoor cat" was shot and killed by a neighbor in Connecticut who said that he was "annoyed" that the animal was in his backyard.

-A stray cat was reportedly tortured and killed in a Maryland alley by five teenagers who threw cinder blocks at the cat's head and burned the animal with a cigarette lighter, among other abuses.

-A free-roaming cat in Indiana was found frozen to death near an apartment complex, and one in Nebraska froze to death, even though the animal had a "shelter." Another cat in the area was found barely alive under a car. Despite treatment, the animal later succumbed to frostbite and exposure.

Moreover, not all TNR cats are "feral"—many are quite tame. Not only are such cats adoptable, they may also be someone's lost companion. Refraining from taking these animals to shelters means that they lose their best chance of being reclaimed by their guardians, who may be frantically searching for them.

Even if you set aside the risks associated with turning cats loose to fend for themselves, there are the dangers that the cats themselves pose to native wildlife, whose welfare must be taken into account by anyone who considers him- or herself a defender of *all* animals' rights. Cats are the leading cause of human-related bird deaths, killing as many as 3.7 billion birds in the U.S. every year. Even so called "ferals" (who are genetically identical to tame cats) are domesticated animals—they're native to nowhere and therefore invasive everywhere. In fact, cats are considered the most deadly invasive species in the world, responsible or partly responsible for the extinctions of more than 60 species.

As "subsidized predators" (i.e., predators fed by humans), cats can far exceed the carrying capacity of a habitat, making them even more lethal than native predators. Feeding them doesn't stop them from hunting, something tacitly acknowledged by those who promote releasing cats to "catch rodents" (while downplaying that they will also hunt birds and other animals).

And then there's the "inconvenient truth" that TNR doesn't even work. On the contrary, it actually encourages *more* people to abandon their cats because they think the animals will be cared for. The food set out for "managed" colonies also attracts more cats (as well as wildlife, including rabies-vector species). Show of hands: How many of you who put out food for cats have had new cats (as well as opossums, foxes, raccoons, and even rats) show up at meal times? I thought so.

The bottom line is that TNR makes humans feel better, not cats. Veterinarian and syndicated animal-advice columnist Dr. Michael W. Fox doesn't mince words when he says that it's "unconscionable" to abandon cats who are considered "unadoptable" and calls TNR a "blight" on the animal-sheltering community. "It is time to reevaluate the 'no-kill' policies that incentivize these terrible outcomes for cats and wildlife, and it is time to work for responsible solutions," he says.

Instead of abandoning cats, we must address feline homelessness at its roots by requiring that all cats be spayed and neutered, vaccinated, licensed, microchipped, and kept indoors. If your local shelter is considering adopting a policy of refusing to admit cats

29

and/or spaying/neutering and abandoning them, remind shelter officials that cats should be their top priority—not deceptive, feel-good statistics.

**What is PETA's stance on programs that advocate trapping, spaying and neutering, and releasing feral cats?** Sadly, our experience with trap, spay-and-neuter, and release programs and "managed" feral cat colonies has led us to question whether or not these programs are truly in the cats' best interests. We receive countless reports of incidents in which cats—"managed" or not—suffer and die horrible deaths because they must fend for themselves outdoors. Having witnessed firsthand the gruesome things that can happen to feral cats, we cannot in good conscience advocate trapping and releasing as a humane way to deal with overpopulation.

Advocates argue that feral cats are just as deserving as other felines and that it is our responsibility to alleviate their suffering and assure their safety. We absolutely agree. It is precisely because we would never encourage anyone to let their own cats outdoors to roam that we do not encourage the same for feral cats. In fact, the act of releasing a feral cat is, in the eyes of the law, abandonment and is illegal in many areas.

We believe that although altering feral cats prevents the suffering of future generations, it does little to improve the quality of life for the cats who are left outdoors and that allowing feral cats to continue their daily struggle for survival in a hostile environment is not usually a humane option.

Nevertheless, PETA's position has never been that all feral cats should be euthanized. We believe that trap, vaccinate, spay/neuter, and release programs are acceptable when the cats are isolated from roads, people, and other animals who could harm them; regularly attended to by people who not only feed them but care for their medical needs; and situated in an area where they do not have access to wildlife and where the weather is temperate.

## **THE AMERICAN SOCIETY OF MAMMALOGISTS**

Position of the American Society of Mammalogists on Trap-Neuter-Release (Return) of Feral Cats

Trap-Neuter-Release (TNR) programs in which feral cats (*Felis catus*) are sterilized and then released back into the environment have been proposed as a non-lethal alternative to control feral populations of this predator and to lessen their environmental impact. TNR programs have been adopted or tacitly allowed by a number of metropolitan areas in the US, despite lack of evidence of their efficacy and despite accumulation of data confirming the negative effect of free-ranging cats on birds and mammals.

As mesocarnivores, domestic cats commonly prey upon native vertebrates, including mammals. Whereas predators are normally in low abundance in natural communities, feral populations of cats are frequently maintained at high levels through recruitment from human-maintained sources and through food subsidies. Although feeding feral cats lessens their dependence on predation, it does not necessarily lessen their frequency of predation.

Cats have been implicated in population decreases of mammals, birds, and reptiles on islands, as well as in mainland communities. Further, fragmentation of natural environments through agriculture and urbanization results in mammalian assemblages that more closely resemble insular than continental communities, which magnifies the impact of subsidized predators on natural populations. In addition to their direct impact through predation, feral cats are sources of parasites and diseases transmissible to humans, livestock, pets, and native populations.

It is the position of the American Society of Mammalogists that maintenance of high populations of these non-native predators through TNR or similar programs, or by subsidizing feral populations with supplemental food, is extremely detrimental to native mammalian assemblages. The American Society of Mammalogists strongly opposes TNR and urges municipalities to ban use of such programs and to prohibit feeding of feral cats. We further encourage effective measures to reduce or eliminate feral populations of these introduced predators.

## TEXAS PARKS AND WILDLIFE DEPARTMENT

### Management of feral cat colonies & Trap, Neuter, and Release (TNR) Programs

**BACKGROUND:** Municipalities are often asked to mediate public debate on the issue of managing feral cat populations and provide solutions to address the conflicting priorities of different stakeholders within a community. TNR programs are sometimes suggested as a humane way to address public concerns about the threats feral and free-roaming cats pose. TPWD provides this objective, science-

30

based statement to organizations and governments tasked with balancing the needs of feral and free-roaming cats, public health, and local ecosystem health.

**TPWD POSITION:** Feral (non-owned) and free-roaming cats pose a direct threat to the health of our natural resources. Feral cat colonies negatively impact songbirds, small mammals, amphibians, and other native wildlife populations. Feeding programs are not recommended because they concentrate cats and wild animals into single areas, which can increase disease transmission and pose greater threats to native wildlife in the area. Neither intentional feeding of free-roaming cats or the sanctioning of managed cat colonies addresses ecological, animal health, or public health concerns, nor does it address population control. Additionally, TNR programs are not effective at alleviating the threats of feral and free-roaming cat colonies on feline health, human health or native wildlife populations. Sterilization programs are ineffective in managing feral and free-roaming cat populations, and do not address the ecological impacts that these cat populations can have on our natural resources. For these reasons, which are explained in detail below, TPWD does not support the creation or perpetuation of feral or free-roaming cat colonies or feeding, sterilization, or Trap, Neuter, and Release programs.

#### KEY INFORMATION:

**ECOLOGICAL EFFECTS ON WILDLIFE:** Because hunting is a deeply instinctive behavior of cats, even well-fed cats will prey on native wildlife.<sup>5</sup> They prey on native species, especially impacting declining, rare, or sensitive populations, including birds, reptiles, and mammals. Domestic and feral cats are not native predators in Texas, and their hunting behaviors disrupt natural ecological processes. Feral and free-roaming cats alter the ecological balance of a region, as does any other feral non-native (exotic) animal. Feral cats' diets have been shown to consist of 69 percent mammal (including native voles, rabbits, and mice), 24 percent birds, and around 5 percent reptiles/amphibians. Scientific research shows that free-roaming domestic cats kill between 1.4–3.7 billion birds and 6.9–20.7 billion mammals annually and that free-roaming cats are likely the single greatest source of anthropogenic mortality for US birds and mammals. Studies have also shown that food provisions from colonies attract immigrating cats and other wildlife species, and that native wildlife closest to feeding stations are at the greatest risk of depredation by feral cats. This is of particular concern when managed cat colonies are located in sensitive or particularly diverse natural areas.

**PUBLIC HEALTH EFFECTS.** Rabies in cats is more than twice as common as in dogs or cattle, and cats are the domestic animal most commonly reported rabid.<sup>10</sup> Zoonotic diseases and their agents known to be associated with cats include rabies, toxoplasmosis (*Toxoplasma gondii*), cat scratch disease (*Bartonella spp.*), roundworm (*Toxocara cati*), ringworm (*Microsporum canis*), cryptosporidiosis (*Cryptosporidium spp.*), campylobacteriosis (*Campylobacter spp.*), plague (*Yersinia pestis*), *Cheyletiella* mites, and tularemia (*Francisella tularensis*). Feeding stations intended for cats actually attract a variety of animals such as rats, raccoons, skunks, opossums, and foxes, putting these animals in unusually close contact with humans, cats, and each other. This close contact increases the risk of contracting and spreading diseases, including rabies, to other wildlife, cats, and humans.

**HEALTH OF INDIVIDUAL CATS.** Wild and free-roaming cats lead a stressful life. Diseases, depredation, and accidental or intentional injuries significantly decrease the quality of life for feral and free-roaming cats, even if municipal staff or volunteers have the resources to intensively manage a colony. In addition to the zoonotic diseases listed above, several diseases commonly found in cat colonies impact the health of cats, including rabies, feline leukemia, feline immunodeficiency virus, roundworm, ringworm, fleas, ticks, ear mites, abscesses, respiratory infections, urinary tract infections, and eye infections. Some of these maladies are incurable, and others require multiple treatments or vaccinations. Cats that have been previously trapped to administer medical treatment often become shy of traps and are difficult to trap again for immunization or continued treatment for illness or injury. Feral cats are also particularly vulnerable to vehicle impacts, injury, and depredation by native wildlife. Cat colonies lead to a stressful, painful and unhealthy existence for individual cats within a colony.

**EFFICACY OF TNR PROGRAMS.** TNR programs are ineffective. Managers of these programs cannot prevent new cats from being added to a population, and they cannot neuter the vast majority (70% to 90%) of the population, both of which are required assumptions for population reduction. TNR programs repeatedly fail to eliminate or control cat colonies due to ongoing cat immigration from surrounding areas. Scientifically vetted studies have demonstrated that TNR programs do not prevent overpopulation of feral cats, reduce population size over time, prevent losses to native wildlife, or prevent disease transmission.

This letter is in regard to the Seacoast Area Feline Education and Rescue (SAFER) program to encourage and assist with feral cat feeding stations near beaches in the Towns of Seabrook and Hampton, New Hampshire. Promoting cat feeding stations and Trap, Neuter and Release (TNR) programs in areas where federally-listed threatened piping plovers (*Charadrius melodus*) occur

31

has resulted in the documented mortality of piping plovers by cats, an unauthorized taking under the Endangered Species Act of 1973, (ESA) as amended (16 U.S.C. § 1531 et seq.).

Many people believe that cats should be permitted to roam free and exercise their predatory instincts; however, domestic cats are not native to North America and are, therefore, an introduced predator and not part of a naturally functioning ecosystem. It has been estimated that hundreds of millions of birds and small mammals are killed annually by free-roaming cats (Hatley 2003). Piping plovers, which are the focus of intensive recovery efforts by federal, state, and numerous other partners, are highly vulnerable to cat predation. Two essential plover behaviors make them especially susceptible to cats. First, adult plovers are famous for feigning a broken-wing to distract predators away from their nests and chicks, then flying away at the last minute. Unfortunately, a plover may not be able to actually escape from a predator that is more agile than those that are native to their natural environment. We believe this was the fate of at least one adult plover killed at Seabrook Beach in 2005. Second, plover chicks are precocial, which means that they must move around on the beach to feed themselves during the approximately 25 days before they become capable of flight. Again, this behavior makes them highly vulnerable to cat predation during this life-stage. In light of these behaviors, we advise you as president of SAFER that releasing or maintaining feral cats within dispersal distance of a piping plover breeding site may cause take in violation of the ESA.

Predation of nests and chicks of the piping plover has been an ongoing issue at Seabrook and Hampton Beaches. New Hampshire Fish and Game biologists have documented cat tracks within piping plover nesting areas. Moreover, cat predation was likely the most significant cause of chick and adult plover mortality in 2002, 2004 and 2005. In 2003, the Seabrook Conservation Commission chairperson wrote to the Selectmen of the Town of Seabrook, requesting that the town take steps to prevent feeding stations and remove feral cats from the beach area. In 2005, two cats with SAFER-notched ears were removed from Hampton Beach State Park and turned over to a representative of SAFER for holding until after the plover season. However, it is our understanding that the cats have since been returned to the Hampton Beach area and therefore may continue to disturb and/or predate nesting piping plovers upon the birds' return this spring.

Through this letter, the Service informs you that should free-ranging cats from managed cat colonies in Seabrook and Hampton kill, injure, harass or harm nesting piping plovers or their young, SAFER may be liable for this unauthorized take in violation of Section 9 of the ESA and its implementing regulations. Unless a cat colony is confined to an escape-proof enclosure that prevents cats from ranging at-large, SAFER and associated volunteers are unable to ensure that cats from a managed colony would not prey upon or harass piping plovers or their young and, thus, cause take of a federally-listed species.

The following information is provided to assist SAFER in understanding its responsibilities for protecting federally-listed threatened and endangered species.

- Under the ESA and its implementing regulations, it is unlawful for any person to "take" a threatened species, or cause such take to occur. 16 U.S.C. § 1538(a)(1)(G); 50 C.F.R. §§ 17.31(a), 17.21(a & c).
- The ESA defines "take" to mean: to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. 16 U.S.C. § 1532(19).
- The ESA defines "person" to mean "an individual, corporation, partnership, trust, association, or any other private entity; or any officer, employee, agent, department, or instrumentality of the Federal Government, of any State, municipality, or political subdivision of a State, or of any foreign government; any State, municipality, or political subdivision of a State; or any other entity subject to the jurisdiction of the United States." 16 U.S.C. § 1532(13).
- The Service's regulations further define harassment and harm. Harassment in the definition of "take" in the Act means an intentional or negligent act or omission that creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns, which include, but are not limited to, breeding, feeding or sheltering. 50 C.F.R. § 17.3. Harm in the definition of "take" in the Act means any act that actually kills or injures wildlife. Such acts may include significant habitat modification or degradation where the act actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering.

The ESA provides a variety of enforcement mechanisms, including the imposition of civil penalties, criminal fines, and the ability for third parties to bring citizen lawsuits. See, e.g., 16 U.S.C. § 1540(a), (b) & (g).

As shown above, an entity that carries out, authorizes, or encourages others to engage in an activity that is likely to result in take of a federally-listed species, such as the establishment and maintenance of a managed TNR cat colony, may be held responsible for violations of Section 9 of the ESA. To ensure protection of federally-listed species, the Service strongly advises SAFER to discontinue

its current practice of encouraging and maintaining the establishment of feral cat colonies through cat-feeding stations and TNR activities within five miles of any piping plover beaches, including Seabrook and Hampton Beaches.

## THE WILDLIFE SOCIETY

### Final Position Statement – Feral and Free-ranging Domestic Cats

Feral and free-ranging domestic cats are exotic species to North America. Exotic species are recognized as one of the most widespread and serious threats to the integrity of native wildlife populations and natural ecosystems. Exotic species present special challenges for wildlife managers because their negative impacts on native species are poorly understood by the public to the point that many exotic species are perceived as a natural component of the environment. Some exotic species have advocacy groups that promote their continued presence, and few policies and laws deal directly with their control. Perhaps no issue has captured more of the challenges for contemporary wildlife management than the impacts of feral or free-ranging domestic cats and their impacts on native wildlife.

Domestic cats originated from an ancestral wild species, the European and African wild cat (*Felis silvestris*). The domestic cat (*Felis catus*) is now considered a separate species, and is found on all 7 continents, with 600 million cats worldwide and 148-188 million within the U.S.. Domestic cats have great reproductive potential. Individuals become sexually mature as early as 6 months of age, and reproduction can occur throughout the year. A single female may produce as many as 3 litters each year with 2 to 4 kittens per litter, with the capacity to successfully raise as many as 12 offspring in any given year.

A growing body of literature strongly suggests that domestic cats are significant predators on small mammals, birds, reptiles, and amphibians. Feral and free-ranging cats also serve as reservoirs for several diseases, including rabies, toxoplasmosis, bartonellosis, typhus, and feline immunodeficiency virus, that can have significant effects on the health of humans, wildlife, and other domestic animals. Because humans often feed free-ranging cats, they can reach population levels that may result in abnormally high predation rates on wildlife and increase the spread of diseases. Domestic cats have tremendous impacts on wildlife and are responsible for the extinction of numerous mammals, reptiles, and at least 33 bird species globally. Effects of cat predation and disease spread are most pronounced in island settings (both actual islands and islands of habitat), where populations of wildlife are already low or stressed by other factors. Effects are also significant in natural areas where cat colonies become established. Competition with native predators, disease implications for native wildlife populations, and pet owners' attitudes toward wildlife and wildlife management also are important issues.

Extensive popular debate over absolute numbers or types of prey taken by feral and free-ranging cats is not productive. The number of cats is undeniably large. Even if conservative estimates of prey taken are considered, the number of prey animals killed is immense. The supplemental feeding of cats does not deter them from killing wildlife; often they do not eat what they kill. Likewise, population level impacts of diseases associated with cats have only been established in a few wildlife species, such as southern sea otters (*Enhydra lutris nereis*), but negative individual impacts clearly occur in an extremely wide range of species. Humans introduced cats to North America, and humans are ultimately responsible for the effects these animals have on native wildlife species.

The policy of The Wildlife Society regarding feral and free-ranging domestic cats is to:

1. Support and encourage the humane elimination of feral cat populations, including feral cat colonies, through adoption into indoor only homes of eligible cats and humane euthanasia of unadoptable cats.
2. Support the passage and enforcement of local and state ordinances prohibiting the feeding of feral cats, especially on public lands, and the release of unwanted pet or feral cats into the wild.
3. Oppose the passage of any local or state ordinances that legalize the maintenance of "managed" (trap/neuter/release) free-ranging cat colonies.
4. Support educational programs and materials that provide scientific information on feral cats and the negative effects on cats from living outdoors, and call on pet owners to keep cats indoors, in outdoor enclosures, or on a leash.
5. Support programs to educate and encourage pet owners to neuter or spay their cats, and encourage all pet adoption programs to require potential owners to spay or neuter their pet.
6. Support the development and dissemination of information on what individual cat owners can do to minimize predation by free ranging cats, and to minimize potential disease transmission to humans, wildlife, cats, and other domestic animals.

7. Pledge to work with the conservation and animal welfare communities to educate the public about the effects of free-ranging and

feral cats on native wildlife, including birds, small mammals, reptiles, amphibians, and endangered species.

8. Support educational efforts to encourage the agricultural community to keep farm-cat numbers at low, manageable levels and use alternative, environmentally safe rodent control methods.

9. Support efforts to reduce risks to the health of humans and other animals posed by diseases and parasites of feral cats, including but not limited to removal of free-ranging cats and elimination of feral cat colonies. Encourage researchers to develop, obtain, and disseminate information on the impacts of feral and free-ranging cats on native wildlife populations, relative to predation, competition, and diseases.

10. Recognize that cats as pets have a long association with humans, and that responsible cat owners are to be encouraged to continue caring for the animals under their control.

## CHICAGO WILDERNESS

### Position Statement on Feral and Unattended Domestic Cats Outdoors

**POSITION:** Chicago Wilderness is a regional alliance of organizations working together to restore local nature and improve the quality of life for all who live here, by protecting the lands and waters on which we all depend. Chicago Wilderness members believe that people need to actively manage and conserve our region's natural communities based on scientific principles and best management practices.

Alliance members recognize that pets provide many benefits to people, including companionship and comfort. However, we also recognize that feral cats, and domestic cats that are let outside unattended, kill hundreds of millions of birds and more than a billion small mammals in the United States each year. Therefore, Chicago Wilderness supports efforts to encourage responsible pet ownership, to keep domestic cats indoors or controlled on a leash, and to manage feral cat overpopulation by establishing alternatives to feral cat colonies.

**BACKGROUND:** The domestic cat (*Felis catus*) originated from the European and African wild cat (*Felis silvestris*) but is now considered a separate species. Domestic cats are not native to North America, yet their numbers have increased to the point where they may be more abundant than any native carnivore. Of the more than 140 million domestic cats estimated to be in the United States, 50 to 70 percent are feral or abandoned.

There is a strong consensus among wildlife professionals that feral and unattended outdoor domestic cats negatively impact wildlife. A cat's instinctive behavior to hunt, rather than its need for food, drives it to take prey, and feral and unattended domestic cats routinely prey upon native birds, small mammals, reptiles and amphibians. In addition to the negative impacts that these cats have on wildlife populations, they serve as potential vectors of diseases to humans, pets, and wildlife and are themselves exposed to many other health risks, such as collisions with vehicles, larger predators (e.g., coyotes), disease, and adverse weather conditions.

Feral cats are a growing concern for communities and land managers nationwide, and advocates for feral cats often favor trap-neuter return (TNR) programs to address issues regarding overpopulation and disease exposure of feral or abandoned cats. These programs usually involve capturing animals in "feral cat colonies," where people are providing feeding stations and shelter. The cats are neutered, sometimes vaccinated against certain diseases, and then released at the capture site. TNR programs are popular with domestic cat advocates because neutering prevents individual cats from directly contributing to overpopulation, and vaccinations presumably reduce the prevalence of certain diseases in these populations. However, despite their popularity with some people, these programs remain controversial, especially with wildlife advocates and managers, because they are not effective in reducing feral cat numbers.

A growing body of literature has documented the negative impacts associated with feral and unattended domestic cats that are let outdoors:

- Most cats that are allowed to roam outdoors live only 2 to 5 years, while cats that are cared for and kept exclusively indoors live up to 15 years.
- Feral and unattended cats that roam outdoors kill hundreds of millions of birds and more than a billion small mammals each year in the United States. Feral cat colonies support high densities of cats which, in turn, may have even greater negative effects on local wildlife populations.
- Even though members of feral cat colonies benefit when people feed them, they still routinely prey on wildlife. Even a well-fed cat is genetically programmed to hunt.

- Although the goal of managed feral cat colonies is to reduce the population through adoption (when possible) or natural attrition, any reductions are offset by the illegal dumping of additional unwanted cats and the attraction of other feral cats to a provided food source.
- Research has shown that 70 to 90 percent of the cats in feral cat colonies must be sterilized, and no new cats must join the colony, in order for the colony cat population to begin to decline – a result that is impractical to achieve.
- Native wildlife such as raccoons, skunks and coyotes are attracted to cat colony feeding stations, which increases interaction with

feral cats and promotes the transmission of disease.

- A number of diseases and parasites are associated with feral and unattended domestic cats that roam outdoors, such as ringworm, hookworm, cat scratch fever, toxoplasmosis, feline distemper, feline leukemia, and rabies. In fact, cats represent the majority of reported rabid domestic animals in the United States annually. Unvaccinated cats may also become reservoirs for diseases and transmit them to wildlife, pets, and people. Many TNR programs do not vaccinate cats against any diseases, and the TNR programs that do usually only vaccinate against rabies and distemper.

**RECOMMENDATIONS:** The Chicago Wilderness alliance supports the following actions related to feral and unattended outdoor domestic cats.

- We support efforts to educate and encourage cat owners to keep cats indoors or controlled on leashes when outdoors, and to have their pets spayed or neutered.
- We support and encourage the humane reduction of feral cat colonies.
- We support the development and implementation of education efforts that foster an understanding of the biological and social impacts of allowing cats to roam outdoors.
- We support the development and dissemination of educational information to municipalities, residents, veterinarians, and other stakeholders on the negative impacts of feral cat colonies, including information on the effects on wildlife, disease transmission, and the health risks to cats.
- We support the passage and enforcement of state legislation and local ordinances prohibiting the establishment of feral cat colonies and the release of feral or unwanted cats outdoors.
- We oppose the passage of state legislation and local ordinances that condone or legalize the deliberate establishment of feral cat colonies.
- We recommend that if a community feels it must allow the establishment of feral cat colonies, that the colonies be considered only an interim solution, and should not be placed on public lands or in areas that could threaten at-risk wildlife or pose public health threats.
- We encourage research to provide additional insight into the effects that feral and outdoor, unattended domestic cats have on native wildlife populations.

**SUMMARY:** The Chicago Wilderness region is critical for wildlife survival. More than 300 species of birds alone—many threatened, endangered, or seriously declining due to threats such as habitat loss and fragmentation—use the protected areas in our region, as well as parks and backyards, for migration or year round homes. Significant resources are invested each year to protect areas that can support these species and their tens of millions of members, and feral and unattended domestic cats only detract from these efforts, while also posing a threat to native ecosystems and overall biodiversity. People are responsible for introducing domestic cats to North America, and it is our responsibility to manage cats that prey on native wildlife.

## RESEARCH-BASED CONCLUSIONS

Over the past several months the TNR Committee of the North Utah Valley Animal Services Special Service District has examined hundreds of peer-reviewed research studies, white papers, and position statements, analyzed several meticulous, systematic, literature

reviews, and conducted a comprehensive study of relevant empirical data. At the conclusion of our exhaustive investigation we find it evident that science simply does not support the effectiveness of Trap-Neuter-Release (TNR) programs.

Overwhelmingly, the scientific literature indicates that TNR programs not only fail to effectively reduce feral cat populations but also adversely affect the health and well being of cats, humans, other animals, and ecosystems. Again and again we discovered that the evidence-based data contradicted claims that TNR is a viable solution to the management of feral and free-roaming cats.

Our own data, from the North Utah Valley Animal Shelter, when compared against five animal shelters in Utah that are currently participating in a TNR program, reveal that our current method is far superior in reducing cat intake at the animal shelter than any of the other five shelters utilizing a TNR program.

Therefore, we feel it is incumbent upon us to recommend to the Administrative Control Board of the North Utah Valley Animal Services Special Service District, and all other decision makers who come into possession of this report, that, in the interest of the animals and people of our communities, not to support, endorse, or implement a TNR program in our community.

## ORGANIZATIONS OPPOSED TO TNR PROGRAMS

Accipiter Enterprises, Educational Birds of Prey	Veterinarians	Hampshire
Alaska Wild Animal Recovery Effort Inc.	American Bird Conservancy	Audubon Society of Northern Virginia
Allamakee County Protectors	American Birding Association	Audubon Society of Rhode Island
Allegheny Highlands Alliance	American River Parkway Foundation	Bexar Audubon Society
Alliance for the Wild Rockies	American Society of Mammalogists	Bird Ally X
American Association of Wildlife	Anne Arundel Bird Club	Bird City Wisconsin
	Audubon Minnesota	Bird Conservation Network
	Audubon Naturalist Society	Black River Audubon Society
	Audubon Society of Kalamazoo	Black Swamp Bird Observatory
	Audubon Society of New	Bridgerland Audubon Society

Central New Mexico Audubon Society  
 Central Valley Bird Club  
 Centre Wildlife Care  
 Chesapeake Audubon Society  
 Chicago Audubon Society  
 Chicago Bird Collision Monitors  
 Chicago Ornithological Society  
 Citizens Committee to Complete the Refuge  
 Clearwater Audubon Society  
 Coastal Bend Audubon Society  
 Coastal Virginia Wildlife Observatory  
 Colorado Wild Rabbit Foundation  
 Connecticut Audubon Society  
 Cooper Ornithological Society  
 Cornell Lab of Ornithology  
 Coulee Region Audubon Society  
 Delmarva Ornithological Society  
 Department of Fisheries and Wildlife, Oregon State University  
 Desert Rivers Audubon Society  
 Detroit Audubon Society  
 Eastern Long Island Audubon Society  
 Elisha Mitchell Audubon Society  
 Endangered Habitats League  
 Environmental Protection Information Center (EPIC)  
 Evergreen Audubon  
 Five Valleys Audubon Society  
 Flathead Audubon  
 Florida Keys Hawkwatch  
 Florida Wildlife Federation  
 Foothills Audubon Club  
 Freedom Center for Wildlife Inc.  
 Friends of Atascadero Wetlands  
 Friends of Beautiful Pendleton County  
 Friends of Dyke Marsh  
 Friends of the Kalmiopsis  
 Friends of the Tampa Bay National Wildlife Refuges  
 Georgia Important Bird Areas

Conservation Program  
 Georgia Ornithological Society  
 Geos Institute  
 Golden Eagle Audubon Society  
 Grand Valley Audubon Society  
 Great South Bay Audubon Society  
 Greater Ozarks Audubon Society  
 Greater Wyoming Valley Audubon Society  
 High Country Audubon Society  
 Hilton Pond Center for Piedmont Natural History  
 Hope Valley Audubon Society  
 Houston Audubon  
 Howard County Bird Club  
 Hoy Audubon Society  
 Huntington-Oyster Bay Audubon Society  
 Idaho Conservation League  
 Illinois Audubon Society  
 Illinois Ornithological Society  
 International Wildlife Rehabilitation Council  
 Ivy Creek Natural Area  
 John Burroughs Natural History Society  
 Juniata Valley Audubon Society  
 Kalmiopsis Audubon Society  
 Kansas Wildlife Federation  
 Kerncrest Audubon Society  
 Kettle Range Conservation Group  
 Kissimmee Valley Audubon Society  
 Klamath Forest Alliance  
 Lab of Avian Biology – University of Maine  
 Lahontan Audubon Society  
 Lake County Audubon Society  
 Lake-Cook Audubon  
 Lane County Audubon  
 Lehigh Valley Audubon Society  
 Lindsay Wildlife Museum  
 Los Angeles Audubon Society  
 Madison Audubon Society  
 Madrone Audubon Society  
 Magic

Manistee Audubon  
 Maricopa Audubon Society  
 Maryland Ornithological Society  
 Maryland/Delaware Chapter of The Wildlife Society  
 Mid-Coast Audubon Society  
 Minnesota Chapter of The Wildlife Society  
 Minnesota Herpetological Society  
 Minnesota River Valley Audubon Chapter  
 Monmouth County Audubon Society  
 Montana Audubon  
 Montana Falconers Association  
 Montana Fish, Wildlife, and Parks  
 Montgomery Friends of Open Space  
 Mt. Diablo Audubon Society  
 Native Songbird Care & Conservation  
 Natural History Museum of Los Angeles County  
 New Hampshire Audubon  
 New Jersey Association of Wildlife Rehabilitators  
 New Jersey Audubon  
 New York City Audubon Society  
 New York State Wildlife Rehabilitation Council  
 North Carolina Chapter of The Wildlife Society  
 North Dakota Birding Society  
 Northern Flint Hills Audubon Society  
 Oconee Rivers Audubon Society  
 Ohlone Audubon Society  
 On A Wing And A Prayer  
 Otter Creek Audubon Society  
 Pamela Jo Hatley Professional Association  
 People for the Ethical Treatment of Animals

Peregrine Audubon Society  
 Pomona Valley Audubon Society  
 Progressive Democrats, Sonoma County  
 Queens County Bird Club  
 Inc. Quick Reference  
 Publishing Rainforest  
 Biodiversity Group Ralph T. Waterman Bird Club  
 Redbud Avian Rehabilitation Center, Inc.  
 Redwood Region Audubon Society  
 Robert Cooper Audubon Society  
 Sacramento Audubon Society  
 Salem Audubon Society  
 San Diego Audubon Society  
 San Francisco Bay Joint Venture non-federal partners

Sangre de Cristo Audubon Society  
 Santa Barbara Audubon Society  
 Santa Clara Valley Audubon Society  
 Sassafras Audubon Society  
 Save Our Allegheny  
 Ridges Save Our Cabinets  
 Saving Birds Thru Habitat  
 Seattle Audubon Society  
 Sequoia Audubon Society  
 Shadow Oaks Wildlife Care  
 Skagit Audubon Society  
 Society for Conservation Biology  
 Soda Mountain Wilderness Council  
 SoHo Dogs Inc.  
 Songbird Care and Education Center

South Bend-Elkhart Audubon Society  
 South Florida Audubon Society  
 Southeastern Arizona Bird Observatory  
 Southern Adirondack Audubon Society  
 Southwestern New Mexico Audubon Society  
 St. Louis Audubon Society  
 St. Lucie Audubon Society  
 Stockbridge Audubon Society  
 Tampa Audubon Society  
 Tennessee Chapter of Sierra Club  
 Tennessee Ornithological Society  
 The Biodiversity Group  
 The Institute for Bird Populations  
 The Nature

Conservancy -  
Kentucky Field Office  
The Rural Alliance  
The Trumpeter Swan Society  
The Wildlife Center of Virginia  
The Wildlife Society  
Tippecanoe Audubon Society  
United States Department of the Interior  
United States Fish and Wildlife Service  
United States Marine Corp  
Virginia Beach SPCA Wildlife Program  
Virginia Bluebird Society  
Virginia Society of Ornithology  
Wabash Valley Audubon Society  
Warioto Audubon Society  
Weeden Foundation  
Western Nebraska Resources Council  
Whitescarver Natural Resources Management LLC  
Wild Utah Project  
Wildbird Recovery  
Wildlife Care Alliance  
Wildlife Care Association  
Wildlife Center of Silicon Valley  
Wildlife Emergency Services  
Wildlife Rehabilitation and Release  
Wildlife Research and Consulting Services LLC  
Will County Audubon Society  
Winnebago Audubon Society  
Wisconsin Audubon Council  
Wisconsin Society for Ornithology  
World Safaris/Safari Professionals  
Wyncote Audubon Society  
Yellowstone to Uintas Connection  
Yellowstone Valley Audubon Society  
York Audubon Society  
Yosemite Area Audubon Society

Youth Environmental Alliance  
Zumbro Valley Audubon Society  
American Bird Conservancy The Wildlife Society  
National Audubon Society  
Cornell Laboratory of Ornithology  
American Ornithologists Union  
PRBO Conservation Science  
Association of Zoos & Aquariums  
National Wildlife Rehabilitators Association  
Alabama Ornithological Society  
Conservation Committee  
Arkansas Audubon Society  
Morning Star  
Wildlife  
Rehabilitation Center  
Southeastern Arizona Bird Observatory  
Los Angeles Audubon Society  
Sequoia Audubon Society  
Endangered Habitats  
League The Urban  
Wildlands Group  
South Bay Wildlife Rehab  
Rancho Palos Verdes, California  
Rocky Mountain Bird Observatory  
Center for Native Ecosystems The Trumpeter Swan Society  
Environment for the Americas  
Connecticut Audubon Society  
Delmarva Ornithological Society  
South Florida Audubon Society  
Environmental Protection in the Caribbean (EPIC)  
Oconee Rivers Audubon Society  
Atlanta Audubon Society  
Georgia Ornithological Society  
Conservation Council for Hawai'i  
Bird Conservation Network  
Wildcat Creek Wildlife Center, Inc.  
Songbirds of Northern Indiana, Inc.

Northeast Regional Migration Monitoring Network  
Laboratory of Avian Biology, University of Maine  
Frederick Bird Club  
Chesapeake Wildlife Heritage Society for the Conservation and Study of Caribbean Birds  
Saving Birds Thru Habitat  
Rogue River Bird Observatory  
Wings of Wonder, Inc.  
Detroit Audubon Society  
Carpenter St. Croix Valley Nature Center  
Pheasants Forever, Inc. and Quail Forever  
St. Louis Audubon Society  
Flathead Audubon Society  
Internet Center for Wildlife Damage Management  
Western Nebraska Resources Council  
New Hampshire Audubon  
Concord, New Hampshire  
Freedom Center for Wildlife, Inc. Woodford Cedar Run  
Wildlife Refuge  
Operation Migration Inc.  
Audubon New York  
North Shore Audubon Society  
Four Harbors  
Audubon  
Huntington-Oyster Bay Audubon Society  
Eastern Long Island Audubon Society  
Weeden Foundation  
Rochester Birding Association  
Great South Bay Audubon Society  
Central New Mexico Audubon Society

38

Elisha Mitchell Audubon Society  
Audubon Miami Valley  
Salem Audubon Society  
Rogue Valley Audubon Society  
Gifford Pinchot Task Force  
Friends of the Kalmiopsis  
President Fund for Wild Nature  
Cascades Raptor Center  
Delaware Valley Ornithological Club  
Skye's Spirit Wildlife  
Rehabilitation Center  
Bird Refuge of York

White Flicker Wild Bird  
Rehabilitation Clinic  
Tennessee Ornithological Society  
Cumberland-Harpeth Audubon Society  
Coastal Bend Audubon Society  
Council for Environmental Education  
Virginia Society of Ornithology  
Wildlife Center of Virginia  
Wisconsin Society for Ornithology  
Invasive Species Working Group  
Coulee Region Audubon Society

Hoy Audubon Society, Inc.  
Chappee Rapids Audubon Society  
Riveredge Bird Club  
Raptor Education Group, Inc. Trees For Tomorrow  
Florida Department of Health  
Florida Fish and Wildlife Conservation Commission  
Florida Veterinary Medical Association  
National Association of State Public Health Veterinarians

## REFERENCES

### A

American Association of Wildlife Veterinarians. Resolution on management of feral cats. Spokane, Wash: American Association of Wildlife Veterinarians, 1995.

Abbott, I. 2002. Origin and spread of the cat, *Felis catus*, on mainland Australia, with a discussion of the magnitude of its early impact on native fauna. *Wildlife Research* 29: 51-74.

Abbott, I., Peacock, D. & Short, J. (2014). The new guard: the arrival and impacts of cats and foxes. In *Carnivores of Australia: past, present and future*: 173–195. Glen, A.S. & Dickman, C.R. (Eds). Melbourne: CSIRO Publishing.

- Abrams, P.A. (2007) Defining and measuring the impact of dynamic traits on interspecific interactions. *Ecology*, 88, 2555–2562.
- Adams, A. L., K. J. M. Dickinson, B. C. Robertson, and Y. van Heezik. 2013. An evaluation of the accuracy and performance of lightweight GPS collars in a suburban environment. *PLoS ONE* 8:e68496.
- Adams WL, Dove EL. *Wildlife reserves and corridors in the urban environment*. Columbia, Md: National Institute for Urban Wildlife, 1989;91.
- Adamec, R. E. 1976. The interaction of hunger and preying in the domestic cat (*Felis catus*): an adaptive hierarchy. *Behavioral Biology* 18: 263-272.
- Aebischer, N. J., P. A. Robertson, and R. E. Kenward. 1993. Compositional analysis of habitat use from animal radio-tracking data. *Ecology* 74:1313–1325.
- Aitchison, J. 1986. *The statistical analysis of compositional data*. Chapman and Hall, London, United Kingdom.
- Algar, D., M. Johnston, and S. S. Hilmer. 2011. A pilot study for the proposed eradication of feral cats on Dirk Hartog Island, Western Australia. Pp. 10–16 in *Island invasives: eradication and management* (C. Veitch, M. Clout, and D. Towns, eds.). IUCN/CBB, Gland, Switzerland/Auckland, New Zealand.
- Algar, D. A., A. A. Burbidge, and G. J. Angus. 2002. Cat eradication on Hermite Island, Montebello Islands, Western Australia. Pp. 14-18 In: *Turning the tide: the eradication of invasive species*, C. R. Veitch and M. N. Clout (eds.). Gland, Switzerland: IUCN.
- Algar, D. and N. D. Burrows. 2004. Feral cat control research: Western Shield review--February 2003. *Conservation Science Western Australia* 5(4): 131-163.
- Aguilar GD, Farnworth MJ. Stray cats in Auckland, New Zealand: Discovering geographic information for exploratory spatial analysis. *Applied Geography* 34, 230-8, 2012
- Aguilar GD, Farnworth MJ. Distribution characteristics of unmanaged cat colonies over a 20 year period in Auckland, New Zealand. *Applied Geography* 37, 160- 7, 2013
- Aguilar G.D., Farnworth M.J., Winder L. Mapping the stray domestic cat (*Feliscatus*) population in New Zealand: Species distribution modelling with a climate change scenario and implications for protected areas. *Appl. Geogr.* 2015;63:146–154. doi: 10.1016/j.apgeog.2015.06.019. [CrossRef] [Google Scholar]

#### 40

- Aguirre, A. A., T. J. Keefe, J. S. Reif, L. Kashinsky, P. K. Yochem, J. T. Saliki, J. L. Stott, T. Goldstein, J. P. Dubey, R. Braun and G. Antonelis. 2007. Infectious disease monitoring of the endangered Hawaiian monk seal. *Journal of Wildlife Diseases* 43(2): 229-241..
- Akucewich L.H, K. Philman, A. Clark, J. Gillespie, G. Kunkle, C.F. Nicklin, E.C. Greiner. 2002. Prevalence of ectoparasites in a population of feral cats from north central Florida during the summer. *Veterinary Parasitology* 109: 129-139.
- Alberthsen C, Rand JS, Bennett PC, Paterson M, Lawrie M, Morton JM. Cat admissions to RSPCA shelters in Queensland, Australia: Description of cats and risk factors for euthanasia after entry. *Australian Veterinary Journal* 91, 35-42, 2013
- Alberthsen C. *The Australian Excess Cat Population: An Exploration of Cat Admissions and Outcomes to RSPCA Shelters*. University of Queensland; Brisbane, Australia: 2014
- Algar, D., Angus, G. J., Williams, M. R., and Mellican, A. E. (2007). Influence of bait type, weather and prey abundance on bait uptake by feral cats (*Felis catus*) on Peron Peninsula, Western Australia. *Conservation Science Western Australia* 6, 109–149.
- Al-Kappany, Y. M., M. R. Lappin, O. C. H. Kwok, S. A. Abu-Elwafa, M. Hilali, and J. P. Dubey, 2011: Seroprevalence of *Toxoplasma gondii* and concurrent *Bartonella* spp., feline immunodeficiency virus, feline leukemia virus, and *Dirofilaria immitis* infections in Egyptian cats. *J. Parasitol.* 97, 256–258.
- Allen, B. L., Fleming, P. J. S., Hayward, M., Allen, L. R., Engeman, R. M., Ballard, G., and Leung, L. K. P. (2012). Top predators as biodiversity regulators: contemporary issues affecting knowledge and management of dingoes in Australia. In

'Biodiversity Enrichment in a Diverse World'. (Ed. G. A. Lameed.) pp. 85–132. (InTech.)

Allenberger F, Schonbauer M, Dierich MP. Prevalence of antibody to *Rochalimaea henselae* among Austrian cats. *Eur J Pediatr* 1995;154:165.

Alley Cat Allies (ACA) (2013) A review of the statistical methods employed in the article "The impact of free-ranging domestic cats on wildlife of the United States." [http://4fi8v2446i0sw2rpq2a3fg51-wpengine.netdna-ssl.com/wp-content/uploads/2013/05/LossEtAl\\_Report\\_GregoryJMatthews\\_6-10.pdf](http://4fi8v2446i0sw2rpq2a3fg51-wpengine.netdna-ssl.com/wp-content/uploads/2013/05/LossEtAl_Report_GregoryJMatthews_6-10.pdf).

Alley Cat Allies. Cats and the Law. (2017). Available online at: <https://www.alleycat.org/our-work/cats-and-the-law/> (Accessed June 28, 2018).

Alley\_Cat\_Allies. Feral Cat Health Analysis: Living Health Lives Outdoors. Alley Cat Allies; 2012b.

Alley Cat Allies. Humane trapping instructions for feral cats. Available at: [www.alleycat.org/pdf/humane.pdf](http://www.alleycat.org/pdf/humane.pdf). Accessed Nov 12, 2002.

Alley Cat Allies. 2012. "Get informed: discover the truth about the vacuum effect." Web page, [accessed 27 November 2012]. Available at <http://www.alleycat.org/vacuumeffect>.

Alterio, N. 1996. Secondary poisoning of stoats (*Mustela erminea*), feral ferrets (*Mustela furo*), and feral house cats (*Felis catus*) by the anticoagulant, brodifacoum. *New Zealand Journal of Zoology* 23: 331-338.

Alterio, N.. 2000. Controlling small mammal predators using sodium monofluoroacetate (1080) in bait stations along forestry roads in a New Zealand beech forest. *New Zealand Journal of Ecology* 24(1): 3-9.

Alterio N, Moller H. Diet of feral house cats *Felis catus*, ferrets *Mustela furo* and stoats *M. erminea* in grassland surrounding yellow-eyed penguin *Megadyptes antipodes* breeding areas, South Island, New Zealand. *Journal of Zoology* 243, 869-77, 1997

Alterio, N., H. Moller, and H. Ratz. 1998. Movements and habitat use of feral cats *Felis catus*, stoats *Mustela erminea* and ferrets *Mustela furo*, in grassland surrounding Yellow-eyed penguin *Megadyptes antipodes* breeding areas in spring. *Biological Conservation* 83(2): 187-194.

Arnaud G, Rodriguez A, Ortega-Rubio A, Alvarez-Cardenas S. Predation by cats on the unique endemic lizard of Socorro Island (*Urosaurus auriculatus*), Revillagigedo, Mexico. *Ohio Journal of Science* 93, 101-4, 1993

#### 41

American Bird Conservancy – Cats Indoors! <http://www.abcbirds.org/abcprograms/policy/cats/index.html>

American Bird Conservancy (ABC) (2012) Domestic cat predation on birds and other wildlife. <http://abcbirds.org/wpcontent/uploads/2015/05/CatPredation2011.pdf>. Accessed 11 June 2018

American Bird Conservancy (ABC). 2004. "Managed" cats colonies: the wrong solution to a tragic problem. American Bird Conservancy, Washington, DC.

American Bird Conservancy. 2012. "KittyCam" reveals high levels of wildlife being killed by outdoor cats." Available at: <http://www.abcbirds.org/newsandreports/releases/120806.html>.

Andrew S. Bridges, Jessica N. Sanchez, and Daniel S. Biteman, Spatial ecology of invasive feral cats on San Clemente Island: implications for control and management, 81 *Journal of Mammalogy*, 96(1):81–89, 2015 DOI:10.1093/jmammal/gyu005

Angier N (2013) That cuddly kitty is deadlier than you think. *New York Times*. <http://www.nytimes.com/2013/01/30/science/that-cuddly-kitty-of-yours-is-a-killer.html>.

APHA. TNVR Policy Statement. American Public Health Association (2013). Available online at: [https://www.apha.org/~media/files/pdf/membergroups/vet/tnvr\\_policy\\_statement.ashx](https://www.apha.org/~media/files/pdf/membergroups/vet/tnvr_policy_statement.ashx)

American Pet Products Association (APPA) 2017–2018 APPA National Pet Owners Survey Statistics: Pet Ownership & Annual Expenses. American pet products association; (2018). Available online at: [https://www.americanpetproducts.org/press\\_industrytrends.asp](https://www.americanpetproducts.org/press_industrytrends.asp) (Accessed August 6, 2018).

American Society for the Prevention of Cruelty to Animals. What is your Rate? Understanding the Asilomar Live Release Rate, ASPCA Live Release Rate and Save Rate. (2011). Available online at: [http://www.aspcapro.org/sites/pro/files/What%20is%20your%20Rate%2010\\_2013.pdf](http://www.aspcapro.org/sites/pro/files/What%20is%20your%20Rate%2010_2013.pdf) (Accessed January 14, 2018).

American Veterinary Medical Association (AVMA). 2007. U.S. Pet Ownership and Demographics Sourcebook , American Veterinary Medical Association, Schaumburg, IL.

Ancillotto L, Serangeli MT, Russo D. Curiosity killed the bat: Domestic cats as bat predators. *Mammalian Biology*, 2013

Anderson, M. C., B. J. Martin and G. W. Roemer. 2004. Use of matrix population models to estimate the efficacy of euthanasia versus trap-neuter-return for management of free-roaming cats. *Journal of the American Veterinary Medical Association* 225(12): 1871-76.

Andersen T.C., G.W. Foster, and D.J. Forrester. 2003. Hookworms of feral cats in Florida. *Veterinary Parasitology* 115: 19-24.

Andersen, L., Nicholson, K., Tauxe, R., and Winkler, W. (1984). Human Rabies in the United States, 1960 to 1979: Epidemiology, Diagnosis, and Prevention. *Annals of Internal Medicine*, 100, 728-735.

Angold, P. G., J. P. Sadler, M. O. Hill, A. Pullin, S. Rushton, K. Austin, E. Small, B. Wood, R. Wadsworth, R. Sanderson, and K. Thompson. 2006. Biodiversity in urban habitat patches. *Science of the Total Environment* 360:196-204.

Animal Medicines Australia. Pet Ownership in Australia (2016). Available online at:

[http://animalmedicinesaustralia.org.au/wp-content/uploads/2016/11/AMA\\_Pet-Ownership-in-Australia-2016-Report\\_sml.pdf](http://animalmedicinesaustralia.org.au/wp-content/uploads/2016/11/AMA_Pet-Ownership-in-Australia-2016-Report_sml.pdf)

Apps, P. J. 1983. Aspects of the ecology of feral cats on Dassen Island, South Africa. *South African Journal of Zoology* 18(4): 393-399.

Apps, P. J. 1986. Home ranges of feral cats on Dassen Island. *Journal of Mammalogy* 67(1): 199-200.

Arnold, T. W. and R. M. Zink. 2011. Collision mortality has no discernible effect on population trends of North American birds. *PLoS ONE* 6(9): e24708.

Aronson, S. 2010. Animal Control Management: a new look at a public responsibility. West Lafayette, IN: Purdue University.

## 42

Asahi H, Koyama T, Arai H, et al. Biological nature of *Cryptosporidium* sp isolated from a cat. *Parasitol Res* 1991;77: 237-240.

Ash, S. J. and C. E. Adams. 2003. Public preferences for free-ranging domestic cat (*Felis catus*) management options. *Wildlife Society Bulletin* 31(2): 334-339.

Ash SJ. Ecological and Sociological Considerations of Using the ttvar (Trap, Test, Vaccinate, Alter, Return) Method to Control Free-Ranging Domestic Cat, *felis catus*, Populations. Ph.D., dissertation, Texas A&M University, College Station, TX: (2001). ASPCA Guide to trap-neuter-return (tnr) and colony care. Available online: [http://aspcapro.org/sites/default/files/TNR\\_workshop\\_handbook.3.pdf](http://aspcapro.org/sites/default/files/TNR_workshop_handbook.3.pdf).

August JR, Chase TM. Toxoplasmosis. *Vet Clin North Am Small Anim Pract* 1988;17:55-71.

Australian Veterinary Association Management of cats in Australia. Available online: <http://www.ava.com.au/policy/132-management-cats-australia>.

AVMA Free-roaming Abandoned and Feral Cats. (2012) Available online at: <https://www.avma.org/KB/Policies/Pages/Free-roaming-Abandoned-and-Feral-Cats.aspx>

AVMA. Model rabies control ordinance. In: 2003 AVMA membership directory and resource manual. Schaumburg, Ill: AVMA, 2003;116-117.

AVMA. Policy on animal welfare and animal rights. In: 2003 AVMA membership directory and resource manual. Schaumburg, Ill: AVMA, 2003;71.

AVMA. Policy on the concept of environmental responsibility. In: 2003 AVMA membership directory and resource manual. Schaumburg, Ill: AVMA, 2003;96.

AVMA. Position on dog and cat population control. In: 2003 AVMA membership directory and resource manual. Schaumburg, Ill: AVMA, 2003;74.

AVMA position statement on abandoned and feral cats. *J Am Vet Med Assoc* 1996;209:1042-1043.

AVMA. Rabies State Law Chart. Retrieved December 3, 2013, from [http://www.avma.org/Advocacy/StateAndLocal/Documents/Rabies\\_state\\_law\\_chart.pdf](http://www.avma.org/Advocacy/StateAndLocal/Documents/Rabies_state_law_chart.pdf).

AVMA (2012). U.S. Pet Ownership & Demographics Sourcebook: 2012 Edition, Schaumburg, IL: American Veterinary Medical Association.

## B

Baker, J. S., C. C. Byrd and A. B. Joshi. 2011. Federal and selected state law analysis of trap-neuter-return species management programs for feral cats, O'Melveny & Myers, LLP: Washington, DC.

Baker, P. J., R. J. Ansell, P. A. A. Dodds, C. E. Webber and S. Harris. 2003. Factors affecting the distribution of small mammals in an urban area. *Mammal Review* 33(1): 95-100.

Baker, P. J., A. J. Bentley, R. J. Ansell and S. Harris. 2005. Impact of predation by domestic cats *Felis catus* in an urban area. *Mammal Review* 35(3-4): 302-312.

Baker, P. J., S. E. Molony, E. Stone, I. C. Cuthill and S. Harris. 2008. Cats about town: is predation by free-ranging pet cats *Felis catus* likely to affect urban bird populations? *Ibis* 150(Suppl. 1): 86-99.

Baker, P. J., C. D. Soulsbury, G. Iossa and S. Harris. 2010. Domestic cat (*Felis catus*) and domestic dog (*Canis familiaris*). Pp. 157-172 In: S. D. Gehrt, S. P. D. Riley and B. L. Cypher (eds.), *Urban Carnivores: ecology, conflict, and conservation*. Baltimore: The Johns Hopkins University Press.

### 43

Baldwin, J. A. 1975. Notes and speculation on the domestication of the cat in Egypt. *Anthropos* 70(3/4): 428-448.

Baldwin, J. A. 1979. Ships and the early diffusion of the cat. *Carnivore Genetics Newsletter* 4(1): 32-33. Baldwin, J. A.

1980. The domestic cat, *Felis catus* L., in the Pacific Islands. *Carnivore Genetics Newsletter* 4(2): 57-66.

Balough, A. L., T. B. Ryder and P. P. Marra. 2011. Population demography of Gray Catbirds in the suburban matrix: sources, sinks, and domestic cats. *Journal of Ornithology* 152(3): 717-726.

Bandecchi P, Matteucci D, Baldinotti F, et al. Prevalence of feline immunodeficiency virus and other retroviral infections in sick cats in Italy. *Vet Immunol Immunopathol* 1992;31:337-345.

Baneth G, Kordick DL, Hegarty BC, et al. Comparative seroreactivity to *Bartonella henselae* and *Bartonella quintana* among cats from Israel and North Carolina. *Vet Microbiol* 1996;50:95-103.

Banks PB, Dickman CR (2007) Alien predation and the effects of multiple levels of prey naiveté. *Trends Ecol Evol* 22(5):229-230, author reply 230-231.

Banks PB, Hughes NK (2012) A review of the evidence for potential impacts of black rats (*Rattus rattus*) on wildlife and humans in Australia. *Wildl Res* 39(1):78-88.

Banks, R. C. 1979. Human related mortality of birds in the United States, Special Scientific Report -- Wildlife No. 215, USDI: Fish and Wildlife Service, Washington, DC.

Bannasch MJ, Foley JE. Epidemiologic evaluation of multiple respiratory pathogens in cats in animal shelters. *J Feline Med Surg*. 2005;7(2):109-119.

Baran B.E., Allen J.A., Rogelberg S.G., Spitzmuller C., Digiacomo N.A., Webb J.B., Carter N.T., Clark O.L., Teeter L.A., Walker A.G. Euthanasia-related strain and coping strategies in animal shelter employees. *J. Am. Vet. Med. Assoc.* 2009;235:83-88. doi: 10.2460/javma.235.1.83. [PubMed] [CrossRef] [Google Scholar]

Barlow, N. D., Kean, J. M., and Briggs, C. J. (1997). Modelling the relative efficacy of culling and sterilization for controlling populations. *Wildlife Research* 24, 129-141. doi: 10.1071/WR95027

Barratt, D. G. 1997a. Home range size, habitat utilization and movement patterns of suburban and farm cats, *Felis catus*. *Ecography* 20: 171-180.

Barratt, D. G. 1997b. Predation by house cats, *Felis catus* (L.), in Canberra, Australia. I. Prey composition and preference. *Wildlife Research* 24: 263-277.

Barratt, D. G. 1998. Predation by house cats, *Felis catus* (L.), in Canberra, Australia. II. Factors affecting the amount of prey caught and estimates of the impact on wildlife. *Wildlife Research* 25: 475-487.

Barron, A., C. N. Stewardt and J. M. Warren. 1956. Patterns of social interaction in cats (*Felis domestica*). *Behaviour* 11: 56-66.

Barrows P. Final letters for now on feral cats (lett). *J Am Vet Med Assoc* 2002;221:1547.

Barrows, Paul L. 2004. Professional, ethical, and legal dilemmas of trap-neuter-release. *Journal of the American Veterinary Medical Association* 225, no. 9: 1365-69.

Bartlett PC, Bartlett A, Walshaw S, Halstead S. Rates of euthanasia and adoption for dogs and cats in michigan animal shelters. *J Appl AnimWelf Sci.* (2005) 8:97–104. doi: 10.1207/s15327604jaws0802\_2

Beauchamp G (2004) Reduced flocking by birds on island with relaxed predation. *Proceedings of the Royal Society of London Series B Biological Science*, 271, 1039–1042.

#### 44

Beckerman, A. P., M. Boots, and K. J. Gaston. 2007. Urban bird declines and the fear of cats. *Animal Conservation* 10: 320-325.

Bengsen, A., J. Butler and P. Masters. 2011. Estimating and indexing feral cat population abundances using camera traps. *Wildlife Research* 38(8): 732-739.

Bengsen, A. J., J. A. Butler and P. Masters. 2012. Applying home-range and landscape-use data to design effective feral-cat control programs. *Wildlife Research* 39(3): 258-265.

Bergstrom, DM, Lucieer, A, Kiefer, K, Wasley, J, Belbin, L, Pedersen, TK, Chown, SL. 2009. Indirect effects of invasive species removal devastate World Heritage Island. *Journal of Applied Ecology* 46: 73– 81.

Bekoff M, Pierce J. *The Animals' Agenda: Freedom, Compassion, and Coexistence in the Human Age*. Boston, MA: Beacon Press; (2017).

Bellard C, Cassey P, Blackburn TM (2016) Alien species as a driver of recent extinctions. *Biol Lett* 12(2):20150623–20150624.

Berkeley, E. P. 2004. *TNR: Past, Present and Future: A history of the trap-neuter-return movement*. Washington, DC: Alley Cat Allies.

Berthier, K., M. Langlasi, P. Auger, and D. Pontier. 2000. Dynamics of a feline virus with two transmission modes within exponentially growing host populations. *Proceedings of the Royal Society of London. Series B. Biological Sciences* 267(1457): 2049-2056.

Bester MN, Bloomer JP, van Aarde RJ, Erasmus BH, van Rensburg PJJ, Skinner JD, Howell PG, Naude TW. A review of the successful eradication of feral cats from sub-Antarctic Marion Island, Southern Indian Ocean. *South African Journal of Wildlife Research* 32, 65-73, 2002

Best Friends Animal Society Frequently Asked Questions about TNR. Available online: <http://bestfriends.org/resources/frequently-asked-questions-about-tnr>.

Biben, M. 1979. Predation and predatory play behaviour of domestic cats. *Animal Behaviour* 27: 81-94.

Bingham, R. L., and L. A. Brennan. 2004. Comparison of Type I error rates for statistical analyses of resource selection. *Journal of Wildlife Management* 68:206–212.

Bingham, R. L., L. A. Brennan, and B. M. Ballard. 2007. Misclassified resource selection: compositional analysis and unused habitat. *The Journal of Wildlife Management* 71:1369–1374.

Bingham, R. L., L. A. Brennan, and B. M. Ballard. 2010. Discrepancies between Euclidean distance and compositional

analyses of resource selection data with known parameters. *The Journal of Wildlife Management* 74:582–587.

Biodiversity Group Environment Australia. Threat abatement plan for predation by feral cats. Canberra, Australia: Environment Australia, 1999.

BirdLife International (2013) Small island birds are most at risk from invasive alien species. Presented as part of the BirdLife State of the world's birds website. Available from: <http://www.birdlife.org/datazone/sowb/casestudy/128>.

BirdLife International (2008) Invasive alien species have been implicated in nearly half of recent bird extinctions. Presented as part of the BirdLife State of the world's birds website. Available from: <http://www.birdlife.org/datazone/sowb/casestudy/127>.

Birkenheuer, A. J., H. S. Marr, C. Warren, A. E. Acton, E. M. Mucker, J. G. Humphreys, and M. D. Tucker. 2008. Cytauxzoon felis infections are present in bobcats (*Lynx rufus*) in a region where cytauxzoonosis is not recognized in domestic cats. *Veterinary Parasitology* 153:126-130.

Biro, Z., Lanszki, J., Szemethy, L., Heltai, M. & Randi, E. Feeding habits of feral domestic cats (*Felis catus*), wild cats (*Felis sylvestris*) and their hybrids: trophic niche overlap among cat groups in Hungary. *J. Zool. London* 266, 187-196 (2005).

#### 45

Blaisdell, J. D. 1993. A most convenient relationship: the rise of the cat as a valued companion animal. *Between the Species* 9(4): 219-230.

Blake A. Helping cats survive the streets: Groups push health, population control. *Boston Globe*. Mar 15, 1998. pp. NW-1–NW-5.

Blancher, P. (2013). Estimated number of birds killed by house cats (*Felis catus*) in Canada. *Avian Conservation and Ecology* 8, 3. doi:10.5751/ACE-00557-080203

Blancher, P. J. et al. Guide to the partners in flight population estimates database version: North American Landbird Conservation Plan 2004, Tech. Series No 5 (Partners in Flight, US, 2007).

Blanton, J. D., Fenwick, G., Johnson, D., Levin, M., Roebing, A. D., Rupprecht, C. E., Slate, D., Rabies Prevention and Management of Cats in the Context of Trap–Neuter–Vaccinate–Release Programmes, Zoonoses and Public Health, Received for publication January 3, 2013, doi: 10.1111/zph.12070

Blanton, J. D., D. Palmer, and C. E. Rupprecht, 2010: Rabies surveillance in the United States during 2009. *J. Am. Vet. Med. Assoc.* 237, 646–657.

Blanton, J. D., D. Palmer, J. Dyer, and C. E. Rupprecht, 2011: Rabies surveillance in the United States during 2010. *J. Am. Vet. Med. Assoc.* 239, 773–783.

Blanton, J., J. Dyer, J. McBrayer and Rupprecht, C. (2012). Rabies surveillance in the United States during 2011. *Journal of the American Veterinary Medical Association*, 241, 712–722.

Bloomer JP, Bester MN. Effects of hunting on population characteristics of feral cats on Marion Island. *S Afr J Wildl Res* 1991;21:97–102.

Blum S, Elad D, Zukin N, et al. Outbreak of *Streptococcus equisubsp. zooepidemicus* infections in cats. *Vet Microbiol.* 2010; 144(1–2):236–239.

B.M. Fitzgerald & B.J. Karl, Foods of Feral House Cats (*Felis Catus* L.) in Forest of the Orongorongo Valley, Wellington, New Zealand, *6 New Zealand J. Zoology* 107, 121 (1979).

B.M. Fitzgerald, Diet of Domestic Cats and Their Impact on Prey Populations, in *The Domestic Cat: The Biology of its Behaviour*, 123-146 (Dennis C. Turner & Patrick Bateson eds., Cambridge U. Press 1988).

Bonanni R., Cafazzo S., Pontier D., Natoli E. Feeding-order in an urban feral domestic cat colony: Relationship to dominance rank, sex and age. *Anim. Behav.* 2007;74:1369–1379. doi: 10.1016/j.anbehav.2007.02.029.

Bonnaud, E., K. Bourgeois, E. Vidal, Y. Kayser, Y. Tranchant, and J. Legrand. 2007. Feeding ecology of a feral cat population on a small Mediterranean island. *Journal of Mammalogy* 88(4): 1074-1081.

Bonnaud, E. K., E.V. Bourgeois, J. Legrand and M. Le Corre. 2009. How can the Yelkouan shearwater survive feral cat predation? A meta-population structure as a solution? *Population Ecology* 51: 261-270.

Bonnaud, E. K., F. M. Medina, E. Vidal, M. Nogales, B. Tershy, E. Zavalete, C. J. Donlan, B. Keitt, M. Le Corre, and S. V. Horwath. 2011. The diet of feral cats on islands: a review and call for more studies. *Biological Invasions* 13: 581-603.

Bonnington C, Gaston KJ, Evans KL. Fearing the feline: domestic cats reduce avian fecundity through trait-mediated indirect effects that increase nest predation by other species. *Journal of Applied Ecology* 50, 15-24, 2013

Boone J.D. Better trap-neuter-return for free-roaming cats: Using models and monitoring to improve population management. *J. Feline Med. Surg.* 2015;17:800–807. doi: 10.1177/1098612X15594995.

Boone J.D., Slater M.A. A Generalized Population Monitoring Program to Inform the Management of Free-Roaming Cats. Available online: <http://www.acc-d.org/docs/default-source/think-tanks/frc-monitoring-revised-nov-2014.pdf>.

#### 46

Borchers, D. L., and Efford, M. G. (2008). Spatially explicit maximum likelihood methods for capture–recapture studies. *Biometrics* 64, 377–385. doi:10.1111/j.1541-0420.2007.00927.x

Börger, L., Dalziel, B. D., and Fryxell, J. M. (2008). Are there general mechanisms of animal home range behaviour? A review and prospects for future research. *Ecology Letters* 11, 637–650. doi:10.1111/j.1461-0248.2008.01182.x

Börger, L., et al. 2006. Effects of sampling regime on the mean and variance of home range size estimates. *Journal of Animal Ecology* 75:1393–1405.

Boyer K., D. Hill, E. Mui, K. Wroblewski, T. Karrison, J.P. Dubey, M Sautter, A.G. Noble, S. Withers, C. Swisher, P. Heydmann, T. Hosten, J. Babiarz, D. Lee, P. Meier, and R. McLeod. 2011. Unrecognized ingestion of *Toxoplasma gondii* oocysts leads to congenital toxoplasmosis and causes epidemics in North America. *Clinical Infectious Diseases* 53: 1081-1089.

Boyer AG (2008) Extinction patterns in the avifauna of the Hawaiian islands. *Divers Distrib* 14(3):509–517.

Bradshaw, J. W. S., D. Goodwin, V. Legrand-Defretin and H. M. R. Nott. 1996. Food selection by the domestic cat: an obligate carnivore. *Comparative Biochemistry and Physiology* 114A( 3): 205-209.

Bradshaw, J. W. S., G. F. Horsfield, J. A. Allen, and I. H. Robinson. 1999. Feral cats: their role in the population dynamics of *Felis catus*. *Applied Animal Behaviour Science* 65(3): 273-283.

Bradshaw, J. W. S. 2006. The evolutionary basis for the feeding behavior of domestic dogs (*Canis familiaris*) and cats (*Felis catus*). *The Journal of Nutrition* 136(7): 1927S-1931S.

Bradt, G. W. 1949. Farm cat as predator. *Michigan Conservation* 18(4):23-25.

Bramley, G. N. A small predator removal experiment to protect North Island Weka (*Gallirallus australis greyi*) and the case for single-subject approaches in determining agents of decline. *NZ J. Ecol.* 20, 37–43 (1996).

Brawata, R. L., and Neeman, T. (2011). Is water the key? Dingo management, intraguild interactions and predator distribution around water points in arid Australia. *Wildlife Research* 38, 426–436. doi:10.1071/WR10169

Breitschwerdt, E. B., Dubey, J. P., Ford, R. B., Levine, J. F., Nutter, F. B., Stoskopf, M. K., Seroprevalences of antibodies against *Bartonella henselae* and *Toxoplasma gondii* and fecal shedding of *Cryptosporidium* spp, *Giardia* spp, and *Toxocara cati* in feral and pet domestic cats, 1394-1398 *Scientific Reports: Original Study JAVMA*, Vol 225, No. 9, November 1, 2004

Breitschwerdt EB, Kordick DL. *Bartonella* infection in animals: carriership, reservoir potential, pathogenicity, and zoonotic potential for human infection. *Clin Microbiol Rev* 2000;13:428–438.

Brickner-Braun, I., E. Geffen and Y. Yom-Tov. 2007. The domestic cat as a predator of wildlife in Israel. *Israel Journal of Ecology and Evolution* 53(2): 129-142.

Brio, Z., L. Szemethy and M. Heltai. 2004. Home range sizes of wildcats (*Felis silvestris*) and feral domestic cats (*Felis silvestris f. catus*) in a hilly region of Hungary. *Mammalian Biology* 69: 302-310.

Brio, Z., J. Lanszki, L. Szemethy, M. Heltai, and E. Randi. 2005. Feeding habits of feral domestic cats (*Felis catus*), wild cats (*Felis silvestris*) and their hybrids: trophic niche overlap among cat groups in Hungary. *Journal of Zoology, London* 266: 187-196.

Bristol-Gould S, Woodruff TK. Folliculogenesis in the domestic cat (*Felis catus*). *Theriogenology* 2006;66:5–13.

Britton AP, Davies JL. Rhinitis and meningitis in two shelter cats caused by *Streptococcus equi* subspecies *zooepidemicus*. *J Comp Pathol.* 2010;143(1):70–74.

Brook, L. A., Johnson, C. N., and Ritchie, E. G. (2012). Effects of predator control on behaviour of an apex predator and indirect consequences for mesopredator suppression. *Journal of Applied Ecology* 49, 1278–1286. doi:10.1111/j.1365-2664.2012.02207.x

#### 47

Brothers NP, Skira IJ, Copson GR. Biology of the feral cat, *Felis catus* (L.), on Macquarie Island. *Aust Wildl Res* 1985;12:425–436.

Brown, H., Kortis, B., When You're an Outlaw: Persuading Municipal Officials to Implement TNR (webinar), 2014. PetSmart Charities, Inc., and the Humane Society of the United States.

Brown, CM, Slavinski, S, Ettestad, P, Sidwa, TJ, Sorhage, FE. 2016. Compendium of animal rabies prevention and control, 2016. *Journal of the American Veterinary Medical Association* 248: 505– 517.

Brown MA. Genetic determinants of pathogenesis by feline infectious peritonitis virus. *Vet Immunol Immunopathol.* 2011; 143(3–4):265–268.

Brown, M. A., M. W. Cunningham, A. L. Roca, J. L. Troyer, W. E. Johnson and S. J. O'Brien. 2008. Genetic characterization of Feline Leukemia Virus from Florida panthers. *Emerging Infectious Diseases* 14(2): 252-259.

Buckmaster, A.J. (2011) Ecology of the feral cat (*Felis catus*) in the tall forests of far east Gippsland. PhD thesis, University of Sydney.

Budke, C. M. and M. R. Slater. 2009. Utilization of matrix population models to assess a 3-year single treatment nonsurgical contraception program versus surgical sterilization in feral cat populations. *Journal of Applied Animal Welfare Science* 12: 277-292.

Burgess-Jackson, K. 1998. Doing right by our animal companions. *The Journal of Ethics* 2(2): 159-185.

Burnham, K.P. & Anderson, D.R. (2000). Model selection and inference: a practical information-theoretic approach. New York: Springer-Verlag.

Burns F, McCulloch N, Székely T, Bolton M. The impact of introduced predators on an island endemic, the St Helena Plover, *Charadrius sanctaehelenae*. *Bird Conservation International* 23, 125-35, 2013

Burns RE, Wagner DC, Leutenegger CM, et al. Histologic and molecular correlation in shelter cats with acute upper respiratory infection. *J Clin Microbiol.* 2011;49(7):2454–2460.

Burrows ND, Algar D, Robinson AD, Sinagra J, Ward B, Liddelow G. Controlling introduced predators in the Gibson Desert of Western Australia. *Journal of Arid Environments* 55, 691-713, 2003

Burt, W.H. (1943). Territoriality and home range concepts as applied to mammals. *J. Mammal.* 24, 346–352.

## C

Caccio S, Pinter E, Fantini R, et al. Human infection with *Cryptosporidium felis*: case report and literature review. *Emerg Infect Dis* 2002;8:85–86.

Cadotte, M. W. 2009. Editors choice: Unintended trophic cascades from feral cat eradication. *Journal of Applied Ecology* 46: 259.

Calhoun, R. E. and C. Haspell. 1989. Urban cat populations compared by season, subhabitat and supplemental feeding. *Journal of Animal Ecology* 58: 321-328.

Calver MC, Adams G, Clark W, Pollock KH. Assessing the safety of collars used to attach predation deterrent devices and ID tags to pet cats. *Animal Welfare* 22, 95-105, 2013

Calver, M. C., J. Grayson, M. Lilith and C. R. Dickman. 2011. Applying the precautionary principle to the issue of impacts by pet cats on urban wildlife. *Biological Conservation* 144: 1895-1901.

Calver MC, Thomas SR. Effectiveness of the Liberator™ in reducing predation on wildlife by domestic cats. *Pacific Conservation Biology* 16, 244-50, 2011

Calver, M., S. Thomas, S. Bradley and H. McCutcheon. 2007. Reducing the rate of predation on wildlife by pet cats: the efficacy and practicability of collar-mounted pounce protectors. *Biological Conservation* 137: 341-348.

Campbell K.J., Harper G., Algar D., Hanson C.C., Keitt B.S., Robinson S. Review of feral cat eradications on islands. In: Veitch C.R., Clout M.N., Towns D.R., editors. *Island Invasives: Eradication and Management*. IUCN; Gland, Switzerland: 2011.

Campbell, R. W., N. K. Dawe, I. McTaggart-Cowan, J. M. Cooper, G. W. Kaiser, M. C. E. McNall, and G. E. J. Smith. 1997. Say's Phoebe. Pages 84-89 in *The birds of British Columbia. Volume 3 passerines: flycatchers through vireos*. UBC Press, Vancouver, British Columbia, Canada.

Campos, C. B., C. F. Esteves, K. M. P. M. B. Ferraz, P. G. Crawshaw, and L. M. Verdade. 2007. Diet of free-ranging cats and dogs in a suburban and rural environment, south-eastern Brazil. *Journal of Zoology* 273: 14-20.

Canadian Federation of Humane Societies (CFHS). 2009. Feral cats. CFHS, Ottawa, Ontario, Canada. [online] URL: [http://cfhs.ca/athome/feral\\_cats/](http://cfhs.ca/athome/feral_cats/) Cat Populations Increase at Winnipeg Shelters. 2011. CBC News Canada, 27 January. [online] URL: <http://www.cbc.ca/news/canada/manitoba/story/2011/01/27/mb-cats-shelters.html>

Capizzi, D., Bertolino, S., and Mortelliti, A. (2014). Rating the rat: global patterns and research priorities in impacts and management of rodent pests. *Mammal Review* 44, 148–162. doi:10.1111/mam.12019

Carey J (2012) Cat fight. *Conservation magazine*. <http://www.conservationmagazine.org/2012/03/cat-fight/>.

Caro, T. M. 1980. Predatory behaviour in domestic cat mothers. *Behaviour* 74(1-2): 128-148.

Carroll, S. P. 2011. Conciliation biology: the eco-evolutionary management of permanently invaded biotic systems. *Evolutionary Applications* 4(2): 184-199.

Carss, D. N. Prey brought home by two domestic cats (*Felis catus*) in northern Scotland. *J. Zool. London* 237, 678-686 (1995).

Case, J. B., Chomel, B., Nicholson, W., & Foley, J. E. 2017. Serological survey of vector-borne zoonotic pathogens in pet cats and cats from animal shelters and feral colonies. *Journal of Feline Medicine and Surgery* 8(2): 111–116.

Castillo, D., Population Estimates and behavioral analysis of managed cat (*Felis catus*) colonies located in Miami-Dade County, Florida Parks: Thesis for Masters of Science Degree in Environmental Studies (Florida International University, 2001) (on file with Pierce Law Review).

Castillo, D. and A. L. Clarke. 2003. Trap/neuter/release methods ineffective in controlling domestic cat "colonies" on public lands. *Natural Areas Journal* 23(3): 247-253.

Catling PC. Similarities and contrasts in the diets of foxes, *Vulpes vulpes*, and cats, *Felis catus*, relative to fluctuating prey populations and drought. *Australian Wildlife Research* 15, 307-17, 1988

Catry P, Silva MC, MacKay S, Campos A, Masello J, Quillfeldt P, Strange IJ. Can thin-billed prions *Pachyptila belcheri* breed successfully on an island with introduced rats, mice and cats? The case of New Island, Falkland Islands. *Polar Biology* 30, 391-4, 2007

Caughley, G., and A. R. E. Sinclair. 1994. *Wildlife Ecology and Management*. Cambridge, Mass.: Blackwell Science.

CDC (Centers for Disease Control and Prevention). 2016. Healthy pets, healthy people. CDC, Atlanta, Georgia. Available from <https://www.cdc.gov/healthypets/pets/cats.html>

CDC (Centers for Disease Control and Prevention). 2004. Toxoplasmosis: an important measure for cat owners. CDC, Atlanta, GA, USA.

- CDC (Centers for Disease Control and Prevention). 2016. Compendium of animal rabies prevention and control. CDC, Atlanta, GA, USA.
- CDC. Mass treatment of humans exposed to rabies--New Hampshire, 1994. *MMWR Morb Mortal Wkly Rep.* 1995; 44:484–486. [PubMed: 7791736]
- CDC. Public health response to a rabid kitten--four states, 2007. *MMWR Morb Mortal Wkly Rep.* 2008b; 56:1337–1340. [PubMed: 18172419]
- CDC. Recovery of a patient from clinical rabies--California, 2011. *MMWR Morb Mortal Wkly Rep.* 2012; 61:61–65. [PubMed: 22298301]
- Centers for Disease Control (CDC). 2012a. "The burden of rabies." Web page, Available at <http://www.cdc.gov/features/dsrabies/>.
- Centers for Disease Control. 2012b "Parasites -- Toxoplasmosis (Toxoplasma infection)." Web page, Available at <http://www.cdc.gov/parasites/toxoplasmosis/>.
- Centonze, L. A. and J. K. Levy. 2002. Characteristics of free-roaming cats and their caretakers. *Journal of the American Veterinary Medical Association* 11: 1627-1633.
- Chamberlain D.E., A.R. Cannon, M.P. Toms, D.I. Leech, B.J. Hatchwell, and K.J. Gaston. 2009. Avian productivity in urban landscapes: a review and meta-analysis. *Ibis* 151: 1-18.
- Chandler, R. B., and Royle, J. A. (2013). Spatially explicit models for inference about density in unmarked or partially marked populations. *The Annals of Applied Statistics* 7, 936–954.
- Chang HW, de Groot RJ, Egberink HF, et al. Feline infectious peritonitis: insights into feline coronavirus pathobiogenesis and epidemiology based on genetic analysis of the viral 3c gene. *J Gen Virol.* 2010;91(pt 2):415–420.
- Chang HW, Egberink HF, Halpin R, et al. Spike protein fusion peptide and feline coronavirus virulence. *Emerg Infect Dis.* 2012;18(7):1089–1095. *488 Veterinary Pathology* 51(2)
- Chappell MS. A model for humane reduction of feral cat populations. *Calif Vet* 1999;Sep/Oct.
- Chapuis, J. L., P. Boussès, and G. Barnaud. 1994. Alien mammals, impact, and management in the French subantarctic islands. *Biological Conservation* 67:97-104. [http://dx.doi.org/10.1016/0006-3207\(94\)90353-0](http://dx.doi.org/10.1016/0006-3207(94)90353-0)
- Chaseling, S. 2001. Pet populations in Australia. Dogs increasing and cats decreasing - why is it so? *Urban Animal Management Conference Proceedings.* Australian Veterinary Association, New South Wales, Australia. [online] URL: [http://www.ccac.net.au/files/Pet\\_pops\\_in\\_Aust\\_UAM01Chaseling\\_0.pdf](http://www.ccac.net.au/files/Pet_pops_in_Aust_UAM01Chaseling_0.pdf)
- Cherkassky, L. M.. 2011. Anthropogenic causes of wild bird mortality. *Wildlife Rehabilitation Bulletin* 29(1): 1-13.
- Chew, MK. 2015. Ecologists, environmentalists, experts, and the invasion of the second greatest threat. *International Review of Environmental History* 1: 7– 40.
- Chew, MK, Hamilton, AL. 2011. The rise and fall of biotic nativeness: a historical perspective. Pages 35– 48 in DM Richardson, editor. *Fifty years of invasion ecology: the legacy of Charles Elton.* Wiley-Blackwell, Chichester, United Kingdom.
- Childs, J. E. 1986. Size-dependent predation on rats (*Rattus norvegicus*) by house cats (*Felis catus*) in an urban setting. *Journal of Mammalogy* 67(1): 196-199.
- Childs, J. E. 1990. Urban cats: their demography, population density, and owner characteristics in Baltimore, Maryland. *Anthrozoos* 3(4): 234-244.
- Childs JE, Ross L. Urban cats: characteristics and estimation of mortality due to motor vehicles. *Am J Vet Res* 1986;47: 1643–1648.

- Chomel B, Kasten RW, Floyd-Hawkins K, et al. Experimental transmission of *Bartonella henselae* by the cat flea. *J Clin Microbiol* 1996;34:1952–1956.
- Christensen, P. E., Ward, B. G., and Sims, C. (2013). Predicting bait uptake by feral cats, *Felis catus*, in semi-arid environments. *Ecological Management & Restoration* 14, 47–53. doi:10.1111/emr.12025
- Christian, KA, Blanton, JD, Auslander, M, Rupprecht, CE. 2009. Epidemiology of rabies post-exposure prophylaxis—United States of America, 2006–2008. *Vaccine* 27: 7156– 7161.
- Chu, K. and W. M. Anderson. 2007. US public opinion on humane treatment of stray cats, *Alley Cat Allies*, Bethesda, MD.
- Chu, K., W. M. Anderson and M. Y. Rieser. 2009. Population characteristics and neuter status of cats living in households in the United States. *Journal of the American Veterinary Medical Association* 234(8): 1023-1030.
- Chua D. The Magnitude of the Unwanted Pet Problem in Australia: An Estimation of Dog and Cat Admissions into Shelters and Pounds and Their Respective Outcomes. Paper Presented at the Getting 2 Zero, Surfer's Paradise (2013). Available online at: [http://www.g2z.org.au/assets/pdf2013/DianaChua\\_VETS5017\\_G2Z.07.jr.pdf](http://www.g2z.org.au/assets/pdf2013/DianaChua_VETS5017_G2Z.07.jr.pdf)
- Churcher, P. B., and J. H. Lawton. 1987. Predation by domestic cats in an English village. *Journal of Zoology, London* 212(3): 439-455.
- Clancy, E. A., A. S. Moore and E. R. Bertone. 2003. Evaluation of cat and owner characteristics and their relationships to outdoor access of owned cats. *Journal of the American Veterinary Medical Association* 222(11): 1541-1545.
- Clapperton BK, Eason CT, Weston RJ, et al. Development and testing of attractants for feral cats, *Felis catus* L. *Wildl Res* 1997; 21:389–399.
- Clarke, A. L. and T. Pacin. 2002. Domestic cats "colonies" in natural areas: a growing exotic species threat. *Natural Areas Journal* 22(2): 154-159.
- Clavero, M., and E. Garcia-Berthou. 2005. Invasive species are a leading cause of animal extinctions. *Trends in Ecology & Evolution* 20:110.
- Clergeau, P., A. Levesque and O. Lorvelec. 2004. The precautionary principle and biological invasion: the case of the House Sparrow on the Lesser Antilles. *International Journal of Pest Management* 50(2): 83-89.
- Clifton M. Latest US data shows shelter killing is down to 4.5 million a year—25% of 1985. *Animal People* 2000;Sep:10.
- Clifton M. Roadkills of cats fall 90% in 10 years—are feral cats on their way out? *Animal People* 2003;Nov:1. Clifton M. Seeking the truth about feral cats and the people who help them. *Animal People* 1992;Nov:1,7–10. Cohn LA. Feline Respiratory Disease Complex. *Vet Clin N Am-Small*. 2011; 41:1273.
- Coleman, J. S. and S. A. Temple. 1989. Effects of free-ranging cats on wildlife: a progress report. Pp. 9-12 In: Craven, S. (ed.), *Proceedings of the 4th Eastern Wildlife Damage Control Conference*. Lincoln: University of Nebraska.
- Coleman, J. S. and S. A. Temple. 1993. Rural residents' free-ranging domestic cats: a survey. *Wildlife Society Bulletin* 21: 381-390.
- Coleman, J. S., and S. A. Temple. 1994a. How many birds do cats kill? Ms. circulated by the authors.
- Coleman, J. S. and S. A. Temple. 1994b. On the prowl. *Wisconsin Natural Resources* 20(6): 4-8. Coleman, J. S. and S. A. Temple. 1995. How many birds do cats kill? *Wildlife Control Technology* 2(4): 44.

- Coman, B., and H. Brunner. 1972. Food habits of the feral house cat in Victoria. *Journal of Wildlife Management* 36(3): 848-53.
- Comfort, A. 1956. Maximum ages reached by domestic cats. *Journal of Mammalogy* 37(1): 118-119.
- Concannon P, Hodgson B, Lein D. Reflex LH release in estrous cats following single and multiple copulations. *Biol Reprod* 1980;23:111-117.
- Conover, M. R. (2002). 'Resolving Human-Wildlife Conflicts: the Science of Wildlife Damage Management.' (Lewis Publishers: Boca Raton, FL.)
- 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.
- Cooper, C. B., K. A. T. Loyd, T. Murante, M. Savoca and J. Dickinson. 2012. Natural history traits associated with detecting mortality within residential bird communities: can citizen science provide insights? *Environmental Management* 50: 11-20.
- Coppola CL, Enns RM, Grandin T. Noise in the animal shelter environment: building design and the effects of daily noise exposure. *J Appl Anim Welf Sci.* 2006;9(1):1-7.
- Council of State and Territorial Public Health Veterinarians and National Association of State Public Health Veterinarians (CSTE/NASPHV) Web site. Available at: [www.cste.org/ps/1997/1997-ID-18.html](http://www.cste.org/ps/1997/1997-ID-18.html).
- Courchamp F, Fournier A, Bellard C, Bertelsmeier C, Bonnaud E, Jeschke JM, Russell JC (2017) Invasion biology: specific problems and possible solutions. *Trends Ecol Evol* 32:13-22
- Courchamp F, Langlais M, Sugihara G. Rabbits killing birds: modelling the hyperpredation process. *Journal of Animal Ecology* 69, 154-64, 2000
- Courchamp, F., M. Langlais and G. Sugihara. 1991. Cats protecting birds: modeling the mesopredator release effect. *Journal of Animal Ecology* 68: 282-292.
- Courchamp, F., M. Langlais and G. Sugihara. 1999. Control of rabbits to protect island birds from cat predation. *Biological Conservation* 89(2): 219-225.
- Courchamp, F. and S. J. Cornell. 2000. Virus-vectored immunocontraception to control feral cats on islands: a mathematical model. *Journal of Applied Ecology* 37: 902-913.
- Courchamp, F., J. L. Chapuis and M. Pascal. 2003. Mammal invaders on islands: impact, control and control impact. *Biological Review* 78: 347-383.
- Cowan, P. and B. Warburton. 2011. Animal welfare and ethical issues in island pest eradication. Pp. 418-421 In: C. R. Veitch, M. N. Clout and D. R. Towns, (eds.), *Island invasives: eradication and management*. Occasional Paper of the IUCN Species Survival Commission No. 42.
- Coyne KP, Christley RM, Pybus OG, et al. Large-scale spatial and temporal genetic diversity of feline calicivirus. *J Virol.* 2012; 86(20):11356-11367.
- Coyne KP, Dawson S, Radford AD, et al. Long-term analysis of feline calicivirus prevalence and viral shedding patterns in naturally infected colonies of domestic cats. *Vet Microbiol.* 2006; 118(1-2):12-25.

- Cresswell, W. (1997) Nest predation: the relative effects of nest characteristics, clutch size and parental behaviour. *Animal Behaviour*, 53, 93-103.
- Cresswell, W. (2008) Non-lethal effects of predation in birds. *Ibis*, 150, 3-17.
- Cresswell, W. (2011) Predation in bird populations. *Journal of Ornithology*, 152, S251-S263.
- Croll DA, Maron JL, Estes JA, Danner EM, Byrd GV (2005) Introduced predators transform subarctic islands from grassland to tundra. *Science* 307(5717):1959-1961.

Crooks, K. R. (2002). Relative sensitivities of mammalian carnivores to habitat fragmentation. *Conservation Biology* 16, 488–502. doi:10.1046/j.1523-1739.2002.00386.x

Crooks, K. R. and M. E. Soule. 1999. Mesopredator release and avifaunal extinctions in a fragmented system. *Nature* 400: 563-564.

Crowell-Davis, S. L., T. M. Curtis and R. J. Knowles. 2004. Social organization in the cat: a modern understanding. *Journal of Feline Medicine and Surgery* 6: 19-28.

Crowley SL, Hinchliffe S, McDonald RA (2017) Conflict in invasive species management. *Front Ecol Environ* 15:133–141

Crowley SL, Hinchliffe S, Redpath SM, McDonald RA (2017) Disagreement about invasive species does not equate to denialism: a response to Russell and Blackburn. *Trends Ecol Evol* 32:228–229

Cruz, J., Glen, A.S. & Pech, R.P. (2013). Modelling landscape-level numerical responses of predators to prey: the case of cats and rabbits. *PLoS ONE* 8, e73544.

Cuffe DJ, Eachus JE, Jackson OF, et al. Ear-tipping for identification of neutered feral cats. *Vet Rec* 1983;112:129.

Cunningham, M. W., M. A. Brown, D. B. Shindle, S. P. Terrell, K. A. Hayes, B. C. Ferree, R. T. McBride, E. L. Blankenship, D. Jansen, S. B. Citino, M. E. Roelke, R. A. Kiltie, J. L. Troyer and S. J. O'Brien. 2008. Epizootiology and management of feline leukemia virus in the Florida puma. *Journal of Wildlife Diseases* 44( 3): 537-552.

Czech, B., P. R. Krausman, and P. K. Devers. 2000. Economic associations among causes of species endangerment in the United States. *Bioscience* 50:593-601.

## D

Dabritz, H. A., E. R. Atwill, I. A. Gardner, M. A. Miller and P. A. Conrad. 2006. Outdoor fecal deposition by free-roaming cats and attitudes of cat owners and nonowners toward stray pets, wildlife, and water pollution. *Journal of the American Veterinary Medical Association* 229(1): 74-81.

Dabritz, H. A., and P. A. Conrad. 2010. Cats and *Toxoplasma*: implications for public health. *Zoonoses and Public Health* 57: 34-52.

Dale A. The comparative welfare status of owned, managed stray and unmanaged stray cats. In *Proceedings of the 6th Frontiers in Veterinary Science | www.frontiersin.org 15 February 2019 | Volume 5 | Article 290* Rand et al. *Public Opinions Stray Cats Brisbane National Getting 2 Zero Summit & Workshops, Gold Coast, QLD (2015)*.

Daley B. Beyond stray cats: Protecting area's wealth of rare species. *Boston Globe*. Dec 10, 1995.

Daniels, M. J., D. Balharry, D. Hirst, A. C. Kitchener, and R. J. Aspinall. 1998. Morphological and pelage characteristics of wild living cats in Scotland: implications for defining the 'wildcat'. *Journal of Zoology, London* 244: 231-47.

Daniels, M. J., Beaumont, P. J. Johnson, D. Balharry, D. W. MacDonald, and E. Barratt. 2001. Ecology and genetics of

### 53

wild-living cats in the north-east of Scotland and the implications for the conservation of the wildcat. *Journal of Applied Ecology* 38:146–161.

Daniels, M. J. and Laurie Corbett. 2003. Redefining introgressed protected mammals: when is a wildcat a wild cat and a dingo a wild dog? *Wildlife Research* 30: 213-18.

Danner, R. M., C. Farmer, S. C. Hess, R. M. Stephens, and P. C. Banko. 2010. Survival of feral cats, *Felis catus* (Carnivora: Felidae), on Mauna Kea, Hawai'i, based on tooth cementum lines. *Pacific Science* 64:381–389.

Dards, J. L. 1978. Home ranges of feral cats in Portsmouth. *Carnivore Genetics Newsletter* 3(7): 242-255.

Dards, J. L. 1981. Habitat utilization by feral cats in Portsmouth dockyard. Pp. 30-49 In: *The Ecology and Control of Feral Cats*. Potters Bar: Universities Federation for Animal Welfare.

- Dards, J. L. 1983. The behaviour of dockyard cats: interactions of adult males. *Applied Animal Ethology* 10: 133-153.
- Dartnall, J. 1978. Matthew Flinder's cat. *Carnivore Genetics Newsletter* 3(5): 191.
- Dauphine, N. and R. J. Cooper. 2009. Impacts of free-ranging domestic cats (*Felis catus*) on birds in the United States: a review of recent research with conservation and management recommendations. Pp. 205-219, In: T. D. Rich, C. Arizmendi, D. W.
- Davis, D. E. 1957. The use of food as a buffer in a predator prey system. *Journal of Mammalogy* 38:466-472.  
<http://dx.doi.org/10.2307/1376399>
- Davison, W.B. & Bollinger, E. (2000) Predation rates on real and artificial nests of grassland birds. *Auk*, 11, 147–153.
- Dawkins, R. & Carlisle, T.R. (1976) Parental investment, mate desertion and a fallacy. *Nature*, 262, 131–133.
- Dawson J, et al. (2015) Prioritizing islands for the eradication of invasive vertebrates in the United Kingdom overseas territories. *Conserv Biol* 29(1):143–153.
- Deag JM, Manning A, Lawrence CE. Factors influencing the mother-kitten relationship. In: Turner DC, Bateson P, eds. *The domestic cat: the biology of its behavior*. Cambridge, UK: Cambridge University Press, 2000;23–46.
- DeFeo ML, Dubey JP, Mather TN, et al. Epidemiologic investigation of seroprevalence of antibodies to *Toxoplasma gondii* in cats and rodents. *Am J Vet Res* 2002;63:1714–1717.
- Denny E, Yakovlevich P, Eldridge MDB, Dickman C. Social and genetic analysis of a population of free-living cats (*Felis catus* L.) exploiting a resource-rich habitat. *Wildlife Research* 29, 405-13, 2002
- Desmarest and C. Thompson (eds.). *Proceedings of the Fourth International Partners in Flight Conference: Tundra to Tropics*.
- Dauphine, N. and R. J. Cooper. 2011. Pick one: outdoor cats or conservation. *The Wildlife Professional* 5(1): 50-56.
- Decker, D. J., T. B. Lauber and W. F. Siemer. 2002. *Human-Wildlife Conflict Management*. Ithaca, New York: Northeast Wildlife Damage Management Research and Outreach Cooperative.
- De Silva, S. and G. M. Turchini. 2008. Towards understanding the impacts of the pet food industry on world fish and seafood supplies. *Journal of Agricultural and Environmental Ethics* 21: 459-467.
- Denny, E. A., Dickman, C. R. (2010). Review of cat ecology and management strategies in Australia. Invasive Animals Cooperative Research Centre, Canberra.
- Denny, E., P. Yakovlevich, M. D. B. Eldridge and C. Dickman. 2002. Social and genetic analysis of a population of free-living cats (*Felis catus* L.) exploiting a resource-rich habitat. *Wildlife Research* 45(4): 405-413.

- Devillard, S., L. Say and D. Pontier. 2003. Dispersal pattern of domestic cats (*Felis catus*) in a promiscuous urban population: do females disperse or die? *Journal of Animal Ecology* 72: 203-211.
- Dickmann C. Impact of exotic generalist predators on the native fauna of Australia. *Wildl Biol* 1996;2:185–195.
- Dickman, C. R. (1996). 'Overview of the Impacts of Feral Cats on Australian Native Fauna.' (Australian Nature Conservation Agency: Canberra.)
- Dickman, C. R. 2009. House cats as predators in the Australian environment: impacts and management. *Human-Wildlife Conflicts* 3(1): 41-48.
- Dickman, C. and E. Denny. 2010. Strategies to reduce conflict: managing feral and stray cats. Pp. 41-45 In: M. Tensen and B. Jones (eds.), *Proceedings of the RSPCA Scientific Seminar, Deakin West ACT: RSPCA Australia*.
- Dickman, C.R., Denny, E. & Buckmaster, T. (2010). Identification of sites of high conservation priority impacted by feral cats. Canberra: Report to the Department of Environment, Water, Heritage and the Arts.

*gondii* in cats in mainland China. *Parasit Vec.* (2017) 10:10–27. doi: 10.1186/s13071-017-1970-6

Dinnage JD, Scarlett JM, Richards JR. Descriptive epidemiology of feline upper respiratory tract disease in an animal shelter. *Journal of Feline Medicine and Surgery* 11, 816-25, 2009

Dire DJ. Cat bite wounds: risk factors for infection. *Ann Emerg Med* 1992;21:1008.

Doherty TS, et al. (2015) A continental-scale analysis of feral cat diet in Australia. *J Biogeogr* 42(5):964–975.

Doherty, TS, Algar, D. 2015. Response of feral cats to a track based baiting programme using Eradicat® baits. *Ecological Management & Restoration* 16: 124– 130.

Doherty, T.S., Bengsen, A.J. & Davis, R.A. (2014). A critical review of habitat use by feral cats and key directions for future research and management. *Wildl. Res.* 41, 435–446.

Doherty, T.S., Davis, R.A., van Etten, E.J.B., Algar, D., Collier, N., Dickman, C.R., Edwards, G., Masters, P., Palmer, R. & Robinson, S. (2015). A continental-scale analysis of feral cat diet in Australia. *J. Biogeogr.* 42, 964–975.

Doherty, TS, Driscoll, DA, Nimmo, DG, Ritchie, EG, Spencer, RJ. 2019. Conservation or politics? Australia's target to kill 2 million cats. *Conservation Letters* <https://doi.org/10.1111/conl.12633>.

Doherty, TS, Glen, AS, Nimmo, DG, Ritchie, EG, Dickman, CR. 2016. Invasive predators and global biodiversity loss. *Proceedings of the National Academy of Sciences of the United States of America* 113: 11261– 11265.

Doherty, TS, Ritchie, EG. 2017. Stop jumping the gun: a call for evidence based invasive predator management. *Conservation Letters* 10: 15– 22.

Dowding JE, Murphy EC. Decline of the Stewart Island population of the New Zealand dotterel. *Notornis* 40, 1-13, 1993

Dowding JE, Murphy EC. The impact of predation by introduced mammals on endemic shorebirds in New Zealand: a conservation perspective. *Biological Conservation* 99, 47-64, 2001

Driscoll, C. A., M. Menotti-Raymond, A. L. Roca, K. Hupe, W. E. Johnson, E. Geffen, E. H. Harley, M. Delibes, D. Pontier, A. C. Kitchener, N. Yamaguchi, S. J. O'Brien and D. W. Macdonald. 2007. The Near Eastern origin of cat domestication. *Science* 317(5837): 519-522.

Driscoll, C. A., D. W. Macdonald and S. J. O'Brien. 2009a. From wild animals to domestic pets, an evolutionary view of domestication. *Proceedings of the National Academy of Sciences* 106(1): 9971-9978.

## 55

Driscoll, C. A., J. Clutton-Brock, A. C. Kitchner and S. J. O'Brien. 2009b. The taming of the cat. *Scientific American* 300(6): 68-75.

Dubey JP. Duration of immunity to shedding of *Toxoplasma gondii* oocysts in cats. *J Parasitol* 1995;81:410–415. Dubey

JP, Desmonts G. Serological responses of equids fed *Toxoplasma gondii* oocysts. *Equine Vet J* 1987;19:337–339.

Dubey JP. Feline toxoplasmosis and coccidiosis: a survey of domiciled and stray cats. *J Am Vet Med Assoc* 1973;162:873–877.

Dubey JP, Hoover EA, Walls KW. Effect of age and sex on the acquisition of immunity to toxoplasmosis in cats. *J Protozool.* (1977) 24:184–6. doi: 10.1111/j.1550-7408.1977.tb05302.x

Dubey JP, Saville JA, Stanek JF, et al. Prevalence of *Toxoplasma gondii* antibodies in domestic cats from rural Ohio. *J Parasitol* 2003;88:802–803.

Dubey JP, Weigel RM, Siegel AM, et al. Sources and reservoirs of *Toxoplasma gondii* infection on 47 swine farms in Illinois. *J Parasitol* 1995;81:723–729.

Dubey, J. P., and J. L. Jones. 2008. *Toxoplasma gondii* infection in humans and animals in the United States. *International Journal for Parasitology* 38: 1257-1278.

Duffy, D. C. and P. Capece. 2012. Biology and impacts of Pacific island invasive species 7. The domestic cat (*Felis catus*).

Duffy, M.A., Housley, J.M., Penczykowski, R.M., Caceres, C.E. & Hall, S.R. (2011) Unhealthy herds: indirect effects of predators enhance two drivers of disease spread. *Functional Ecology*, 25, 945–953.

Dunn, E. H., and D. L. Tessaglia. 1994. Predation of birds at feeders in winter. *Journal of Field Ornithology* 65: 8-16.

Dunn, J.C., Hamer, K.C. & Benton, T.G. (2010) Fear for the family has negative consequences: indirect effects of nest predators on chick growth in a farmland bird. *Journal of Applied Ecology*, 4, 994–1002.

Dyczkowski J, Yalden DW (1998) An estimate of the impact of predators on the British Field Vole *Microtus agrestis* population. *Mammal Review*, 28, 165–184.

## E

Eason, C. T., and C. M. Frampton. 1991. Acute toxicity of Sodium Monofluoroacetate (1080) baits to feral cats. *Wildlife Research* 18: 445-449.

Eason, C. T., E. C. Murphy, S. Hix and D. B. MacMorran. 2010. Development of a new humane toxin for predator control in New Zealand. *Integrative Zoology* 5(1): 31-36.

Eberhard, T. 1954. Food habits of Pennsylvania house cats. *Journal of Wildlife Management* 18(2): 284-286.

Edinboro, Charlotte H, Watson, Heather N and Anne Fairbrother. “Association between a shelter-neuter-return program and cat health at a large municipal animal shelter” *Journal of the American Veterinary Medical Association*, 238, no. 3 (2016): 298-308.

Editor. 1916. The destructive cat. *Forest and Stream* 86: 904.

Edwards, G. P., N. De Preu, B. J. Shakeshaft, I. V. Crealy, and R. M. Paltridge. 2001. Home range and movements of male feral cats (*Felis catus*) in a semi-arid woodland environment in central Australia. *Austral Ecology* 26:93–101.

## 56

Edwards GP, Piddington KC, Paltridge RM. Field evaluation of olfactory lures for feral cats (*Felis catus* L.) in central Australia. *Wildl Res* 1997;24:173–183.

Eidson M, Bingman AK. Terrestrial rabies and human postexposure prophylaxis, New York, USA. *Emerg Infect Dis*. 2010; 16:527–529. [PubMed: 20202438]

Ekstrand C, Linde-Forsberg C. 1994. Dystocia in the cat: a retrospective case study of 155 cases. *J Small Anim Pract* 1994;35: 459–464.

Elmore, SA, Jones, JL, Conrad, PA, Patton, S, Lindsay, DS, Dubey, JP. 2010. *Toxoplasma gondii*: epidemiology, feline clinical aspects, and prevention. *Trends in Parasitology* 26: 190– 196.

Elton, C. S. 1953. The use of cats in farm rat control. *British Journal of Animal Behaviour* 1(1): 151-155.

Engels, Donald. 1999. *Classical Cats*. London and New York: Routledge.

Erickson, W. P., G. D. Johnson and D. P. Young, Jr. 2005. A summary and comparison of bird mortality from anthropogenic causes with an emphasis on collisions, Technical Report PSW-GTR-191. USDA Forest Service, Washington, DC.

Errington, P. L. 1936. Notes on the food habits of southern Wisconsin house cats. *Journal of Mammalogy* 17(1): 64-65.

Estevez RA, Anderson CB, Pizarro JC, Burgman MA (2015) Clarifying values, risk perceptions, and attitudes to resolve or avoid social conflicts in invasive species management. *Conserv Biol* 29:19–30

## F

Fagen, R. M. 1978a. Domestic cat demography and population genetics in a Midwestern U.S.A. metropolitan area. *Carnivore* 1:60-67.

Fagen, R. M. 1978b. Population structure and social behavior in the domestic cat (*Felis catus*). *Carnivore Genetics Newsletter* 3(8): 276-281.

Fancourt, B. (2014). Rapid decline in detections of the Tasmanian bettong (*Bettongia gaimardi*) following local incursion of feral cats (*Felis catus*). *Australian Mammalogy* 36, 247–253. doi:10.1071/AM14004

Fandos G, Fernandez-Lopez J, Telleria JL. Incursion of domestic carnivores around urban areas: a test in central Spain. *Mammalia* 76, 223-5, 2012

Farnworth M.M., Benschop J. A Systematic Review of the Impacts of Feral, Stray and Companion Domestic Cats (*Felis catus*) on Wildlife in New Zealand and Options for Their Management. Unitec Institute of Technology; Auckland, Australia: 2013. [Google Scholar]

Farnworth MJ, Campbell J, Adams NJ. Public awareness in New Zealand of animal welfare legislation relating to cats. *New Zealand Veterinary Journal* 58, 213-7, 2010a

Farnworth MJ, Campbell J, Adams NJ. What's in a name? Perceptions of stray and feral cat welfare and control in Aotearoa, New Zealand. *Journal of Applied Animal Welfare Science* 14, 59-74, 2011

Farnworth MJ, Dye NG, Keown N. The legal status of cats in New Zealand: A perspective on the welfare of companion, stray, and feral domestic cats (*Felis catus*). *Journal of Applied Animal Welfare Science* 13, 180-8, 2010b

Farnworth MJ, Watson H, Adams NJ (2014) Understanding attitudes toward the control of nonnative wild and feral mammals: similarities and differences in the opinions of the general public, animal protectionists, and conservationists in New Zealand (Aotearoa). *J Appl Anim Welf Sci* 17:1–17

## 57

Farnworth MJ, Watson H, Adams NJ. Understanding Attitudes Toward the Control of Nonnative Wild and Feral Mammals: Similarities and Differences in the Opinions of the General Public, Animal Protectionists, and Conservationists in New Zealand (Aotearoa). *Journal of Applied Animal Welfare Science*, 2013a

Faure, E. and A. C. Kitchener. 2009. An archaeological and historical review of the relationships between felids and people. *Anthrozoos* 22(3): 221-238.

Feldman, H. N. 1994. Methods of scent marking in the domestic cat. *Canadian Journal of Zoology* 72: 1093-1099.

Feldman EC, Nelson RW. Feline reproduction. In: Feldman EC, Nelson RW, eds. *Canine and feline endocrinology and reproduction*. 3rd ed. Philadelphia: WB Saunders Co, 2004;1016–1045.

Feldmann BM, Carding TH. Free roaming urban pets. *Health Services Reports* 88, 956-62, 1973

Ferreira, J.P., I. Leitao, M. Santos-Reis and E. Revilla. 2011. Human-related factors regulate the spatial ecology of domestic cats in sensitive areas for conservation. *PLoS One* 6(10): e25970.

Finkler, H., E. Hatna and J. Terkel. 2011. The impact of anthropogenic factors on the behavior, reproduction, management and welfare of urban, free-roaming cat populations. *Anthrozoos* 24(1): 31-49.

Finkler, H., I. Gunther and J. Terkel. 2011. Behavioral differences between urban feeding groups of neutered and sexually intact free-roaming cats following a trap-neuter-return procedure. *Journal of the American Veterinary Medical Association* 238(9): 1141-1149.

Finkler, H. and J. Terkel. 2012. The contribution of cat owners' attitudes and behaviours to the free-roaming cat overpopulation in Tel Aviv, Israel. *Preventive Veterinary Medicine* 104: 125-135.

Finkler H, Hatna E, Terkel J. The influence of neighbourhood socio-demographic factors on densities of free-roaming cat populations in an urban ecosystem in Israel. *Wildlife Research* 38, 235-43, 2011

Finkler H., Terkel J. Cortisol levels and aggression in neutered and intact free-roaming female cats living in urban social groups. *Psychol. Behav.* 2010;99:343–347. doi: 10.1016/j.physbeh.2009.11.014.

Fiore, C. A. Domestic cat (*Felis catus*) predation of birds in an urban environment. Thesis (Wichita State University, 2000).

Fischer, S. M., C. M. Quest, E. J. Dubovi, R. D. David, S. J. Tucker, J. A. Friary, P. C. Crawford, T. A. Ricke and J. K. Levy. 2007. Response of feral cats to vaccination at the time of neutering. *Journal of the American Veterinary Medical Association* 230(1): 52-58.

Fisher, D. O., Johnson, C. N., Lawes, M. J., Fritz, S. A., McCallum, H. I., Blomberg, S. P., Van Der Wal, J., Abbott, B., Frank, A., Legge, S., Letnic, M., Thomas, C. R., Fisher, A., Gordon, I. J., and Kutt, A. S. (2014). The current decline of tropical marsupials in Australia: is history repeating? *Global Ecology and Biogeography* 23, 181–190. doi:10.1111/geb.12088

Fisher, P. and C. Marks. 1996. Foreword. In: P. Fisher and C. A. Marks (eds.). *Humaneness and Vertebrate Pest Control*. Victoria: Government of Victoria

Fitzgerald, B. M. 1980. Feeding ecology of feral house cats in New Zealand forest. *Carnivore Genetics Newsletter* 4(2): 67-71.

Fitzgerald, B. M. 1990. Is cat control needed to protect urban wildlife? *Environmental Conservation* 17(2): 168-169.

Fitzgerald, B. M. 1988. Diet of domestic cats and their impacts on prey populations. Pp. 123-146. In: D. C. Turner and P. Bateson (eds.), *The Domestic Cat: the biology of its behaviour*. Cambridge, England: Cambridge University Press.

Fitzgerald, B. M. and B.J. Karl. 1979. Food of feral house cats (*Felis catus* L.) in forest of the Orongorongo Valley, Wellington. *New Zealand Journal of Zoology* 6: 107-126.

Fitzgerald, B. M. and C.R. Veitch. 1985. The cats of Herekopare Island, New Zealand; their history, ecology and effects on birdlife. *New Zealand Journal of Zoology* 12: 319-330.

## 58

Fitzgerald, B. M. and B. J. Karl. 1986. Home range of feral house cats (*Felis catus* L.) in forests of the Orongorongo Valley, Wellington, New Zealand. *New Zealand Journal of Ecology* 9: 71-81.

Fitzgerald, B. M., B.J. Karl, and C.R. Veitch. 1991. The diet of feral cats (*Felis catus*) on Raoul Island, Kermadec group. *New Zealand Journal of Ecology* 15(2): 123-129.

Fitzgerald B., Turner D.C. Hunting Behavior of domestic cats and their impact on prey populations. In: Turner D.C., Bateson P., editors. *The Domestic Cat: The Biology of Its Behavior*. Cambridge University Press; Cambridge, UK: New York, NY, USA: 2000. pp. 151–175.

Fitzgerald BM, Gibb JA. Introduced mammals in a New Zealand forest: long-term research in the Orongorongo Valley. *Biological Conservation* 99, 97-108, 2001

Fitzgerald BM, Karl BJ, Veitch CR. The diet of feral cats (*Felis catus*) on Raoul Island, Kermadec Group. *New Zealand Journal of Ecology* 15, 123-9, 1991

Fitzgerald BM, Turner DC (2000) Hunting behaviour of domestic cats and their impact on prey populations. In: Turner DC, Bateson PPG (eds) *The domestic cat: the biology of its behaviour*. Cambridge University Press, Cambridge, pp 151–175

Fitzgerald BM. Diet of domestic cats and their impact on prey populations. In: Turner DC, Bateson P, eds. *The domestic cat: the biology of its behaviour*. Cambridge, England: Cambridge University Press, 1988;123–146.

Fitzgerald, B. J. in *The Domestic Cat: The Biology of its Behaviour*. (eds Turner, D. C. & Bateson, P.) 123–150 (Cambridge University Press, 1990).

Flockhart D.T.T., Norris D.R., Coe J.B. Predicting free-roaming cat population densities in urban areas. *Anim. Conserv.* 2016;19:472–483. doi: 10.1111/acv.12264.

Florida Fish and Wildlife Conservation Commission (FFWCC). 2003. Impacts of feral and free-ranging domestic cats on wildlife in Florida. Whitepaper Prepared by Feral Cat Issue Team 3 March 2003. FFWCC, Tallahassee, Florida, USA. URL: [http://www.icwdm.org/Publications/pdf/House\\_Cats/FLFW\\_feralcats.pdf](http://www.icwdm.org/Publications/pdf/House_Cats/FLFW_feralcats.pdf)

Flux, J. E. C. 2007. Seventeen years of predation by one suburban cat in New Zealand. *New Zealand Journal of Zoology* 34: 289-296.

Foley, P., J. E. Foley, J. K. Levy and T. Paik. 2005. Analysis of the impact of trap-neuter-return programs on populations of feral cats. *Journal of the American Veterinary Medical Association* 227(11): 1775-1781.

Foley JE, Orgad U, Hirsh DC, et al. Outbreak of fatal salmonellosis in cats following use of a high-titer modified-live panleukopenia virus vaccine. *J Am Vet Med Assoc.* 1999;214(1):67–70, 43–64.

Foley P. Problems in extinction model selection and parameter estimation. *Environ Manage* 2000;26(suppl 1):S55–S74.

Forbush, E.H. 1895. Birds as protectors of orchards. Pp. 20-32. Massachusetts Crop Report, Bulletin No. 3. Forbush, E.

H. 1905a. The decrease of certain birds in New England. *The Auk* 22(1): 25-31.

Forbush, E. H. 1905b. Special report on the decrease of certain birds and its causes, with suggestions for bird protection. Fifty second Annual Report of the Massachusetts State Board of Agriculture, Massachusetts State Board of Agriculture.

Forbush, E. H. 1907. *Useful Birds and Their Protection*. Boston, MA: Wright and Potter Printing Company, State Printers.

Forbush, E. H. 1908. Special report on the decrease of certain birds and its causes with suggestions for bird protection, Massachusetts State Board of Agriculture.

Forbush, E. H. 1913. *Useful birds and their protection*. 4th ed. Boston, MA: Massachusetts State Board of Agriculture.

Forbush, E. H. 1916. *The Domestic Cat: bird killer, mouser, and destroyer of wildlife. Means of utilizing and controlling it.*

## 59

*Economics Bulletin* 2nd. ed. Boston: Massachusetts State Board of Agriculture.

Forrester, J. W. 1961. 'Industrial Dynamics.' (MIT Press: Cambridge, UK.) Frey, S. N., and Conover, M. R. (2007). Influence of population reduction on predator home range size and spatial overlap. *Journal of Wildlife Management* 71, 303–309. doi: 10.2193/2005-417

Forsyth, D. M., A. J. Robley and B. Reddiex 2005. Review of methods used to estimate the abundance of feral cats. Arthur Rylah Institute for Environmental Research, Department of Sustainability, Melbourne, Australia.

Foster, R. J., and Harmsen, B. J. (2012). A critique of density estimation from camera-trap data. *Journal of Wildlife Management* 76, 224–236. doi:10.1002/jwmg.275

Frank, A. S. K., Johnson, C. N., Potts, J., Alaric, F., Lawes, M. J., Woinarski, J. C. Z., Tuft, K., Radford, I., Gordon, I. J., Collis, M.-A., and Legge, S. (2014). Experimental evidence that feral cats cause local extirpation of small mammals in Australia's tropical savanna. *Journal of Applied Ecology* 51, 1486–1493. doi:10.1111/1365-2664.12323

Frazier, L. 2007. Complicated cat job. *Wildlife Control Technology* 14(1): 26-27.

Galbreath, R. and D. Brown. 2004. The tale of the lighthouse-keeper's cat: discovery and extinction of the Stephens Island wren (*Traversia lyalli*). *Notornis* 51(4): 193-200.

Fredebaugh SL, Mateus-Pinilla NE, McAllister M, Warner RE, Weng HY. Prevalence of Antibody to *Toxoplasma Gondii* in Terrestrial Wildlife in a Natural Area. *Journal of wildlife diseases.* 2011; 47:381–392. [PubMed: 21441191]

Frenkel JK, Hassanein KM, Hassanein RS, et al. Transmission of *Toxoplasma gondii* in Panama City, Panama: a five-year prospective cohort study of children, cats, rodents, birds, and soil. *Am J Trop Med Hyg* 1995;53:458–468. *JAVMA*, Vol 229, No. 1, July 1, 2006 Scientific Reports: Original Study 81 SMALL ANIMALS

Frommer S.S., Arluke A. Loving Them to Death: Blame-Displacing Strategies of Animal Shelter Workers and Surrenderers. *Soc. Anim.* 1999;7:1. doi: 10.1163/156853099X00121. [CrossRef] [Google Scholar]

Fuller, R.A., Tratalos, J.A. & Gaston, K.J. (2008) How many birds are there in a city of half a million people? *Diversity and Distributions*, 15, 328–337.

Fulton, GR. 2018. Avian nest predation in Australian temperate forest and woodland: a review. *Pacific Conservation Biology* 24: 122– 133.

## G

Gajewski P.D., M. Falkenstein, J.G. Hengstler, and K. Golka. 2014. *Toxoplasma gondii* impairs memory in infected seniors. *Brain, Behavior, and Immunity* 36: 193-199.

Galbreath R, Brown D. The tale of the lighthouse-keeper's cat: Discovery and extinction of the Stephens Island wren (*Traversia lyalli*). *Notornis* 51, 193- 200, 2004

Gambino, J., M. V. Martinez-Martinez, K. Salau, E. L. Soho, D. E. Hiebler, F. Sanchez and D. Murillo. 2007. "Cat protecting birds revisited with a spatial approach." Web page, [accessed 11 November 2012]. Available at <http://mtbi.asu.edu/downloads/Cats%20Protecting%20Birds.pdf>.

Gaston, K.J., Blackburn, T.M. & Gregory, R.D. Does variation in census area confound density comparisons? *J. Appl. Ecol.* 36, 191-204 (1999).

Gaughran, G.R. L. 1950. Domestic cat predation on short-tailed weasel. *Journal of Mammalogy* 31(3): 356.

Gehring, T. M., and Swihart, R. K. (2003). Body size, niche breadth, and ecologically scaled responses to habitat fragmentation: mammalian predators in an agricultural landscape. *Biological Conservation* 109, 283–295. doi:10.1016/S0006-3207(02)00156-8

## 60

Gehrt S.D. 2007. Ecology of coyotes in urban landscapes. *Proceedings of the 12th Wildlife Damage Management Conference* 303-311.

Gehrt, SD, Wilson, EC, Brown, JL, Anchor, C. 2013. Population ecology of free roaming cats and interference competition by coyotes in urban parks. *PLOS ONE* 8 ( e75718) <https://doi.org/10.1371/journal.pone.0075718>.

Genovesi, P., M. Besa and S. Toso. 1995. Ecology of a feral cat *Felis catus* population in an agricultural area of northern Italy. *Wildlife Biology* 1(4): 233-237.

George, W. G. 1974. Domestic cats as predators and factors in winter shortages of raptor prey. *Wilson Bulletin* 86(4): 384-396.

George, W. G. 1978. Domestic cats as density independent hunters and "surplus killers". *Carnivore Genetics Newsletter* 3: 282-287.

George, W. G. and M. George. 1978. Population densities and ownership patterns of preying cats in rural America. *Carnivore Genetics Newsletter* 3: 317-322.

Gerhold, R. W., and D. A. Jessup. 2012. Zoonotic diseases associated with free-roaming cats. *Zoonoses and Public Health* 59(sup): 1-7.

Ghalambor, C.K. & Martin, T.E. (2000) Parental investment strategies in two species of nuthatch vary with stage-specific predation risk and reproductive effort. *Animal Behaviour*, 6, 263–267.

Gheciu A.N. Feral cats: Toronto's trap-neuter-return policy draws hisses from residents and birders. Online: [https://www.thestar.com/news/gta/2013/08/01/feral\\_cats\\_torontos\\_trapneuterreturn\\_policy\\_draws\\_hisses\\_from\\_residents\\_and\\_birders.html](https://www.thestar.com/news/gta/2013/08/01/feral_cats_torontos_trapneuterreturn_policy_draws_hisses_from_residents_and_birders.html).

Gibson, K. L., K. Kelzer and Christine Golding. 2002. A trap, neuter, and release program for feral cats on Prince Edward Island. *Canadian Veterinary Journal* 43: 695-98.

Gibson, D. F., Lundie-Jenkins, G., Langford, D. G., Cole, J. R., Clarke, D. E., and Johnson, K. A. (1994). Predation by feral cats, *Felis catus*, on the rufous hare-wallaby, *Lagorchestes hirsutus*, in the Tanami Desert. *Australian Mammalogy* 17, 103–107.

Gill, D. 1975. The feral house cat as a predator of varying hares. *The Canadian Field-Naturalist* 89: 78-79.

Gillies, C. and M. Clout. 2003. The prey of domestic cats (*Felis catus*) in two suburbs of Auckland City, New Zealand. *Journal of Zoology, London* 259: 309-315.

Gillies CA, Leach MR, Coad NB, Theobald SW, Campbell J, Herbert T, Graham PJ, Pierce RJ. Six years of intensive pest mammal control at Trounson Kauri Park, a Department of Conservation "mainland island", June 1996-July 2002. *New Zealand Journal of Zoology* 30, 399-420, 2003

Gillies, C. A. 2007. Notes on New Zealand mammals 5. How far did a neighbour's pet cat venture into Trounson Kauri Park? *New Zealand Journal of Zoology* 34: 335-36.

Gillies, C. A., P. J. Graham, and M. N. Clout. 2007. Home ranges of introduced mammalian carnivores at Trounson Kauri

Park, Northland, New Zealand. *New Zealand Journal of Zoology* 34:317–333.

Gillette, D. D. 1976. A new species of small cat from the late quaternary of Southeastern United States. *Journal of Mammalogy* 57(4): 664-676.

Glaser C, Safrin S, Reingold A, et al. Association between *Cryptosporidium* infection and animal exposure in HIV-infected individuals. *J AIDS* 1998;17:79–82.

Glass, G. E., L. C. Gardner-Santana, R. D. Holt, J. Chen, T. M. Shields, M. Roy, S. Schachterle and S. L. Klein. 2009. Trophic garnishes: cat-rat interactions in an urban environment. *PloS One* 4(6): e5794.

## 61

Goldstein, L. D., C. L. O'Keefe and H. L. Bickel. 2003. "Addressing "The Wisconsin Study"." Web page, [accessed 27 August 2011]. Available at: [http://www.straypetadvocacy.org/wisconsin\\_study.html](http://www.straypetadvocacy.org/wisconsin_study.html).

Goldstein, L. 2010. ""One Billion Birds"." Web page, [accessed 1 October 2010]. Available at <http://www.straypetadvocacy.org/PDF/PIFResponse1BillionBirds.pdf>.

Goltz, D. M., S. C. Hess, K. W. Brinck, P.C. Banko and R. M. Danner. 2008. Home range and movements of feral cats on Mauna Kea, Hawai'i. *Pacific Conservation Biology* 14(3): 177-184.

Gordon, J. K., C. Matthaei, and Y. van Heezik. 2010. Belled collars reduce catch of domestic cats in New Zealand by half. *Wildlife Research* 37: 371-378.

Gorman, S. and J. Levy. 2004. A public policy toward the management of feral cats. *Pierce Law Review* 2(2): 157-181.

Gorman SP, Levy JK, Hampton AL, Collante WR, Harris AL, Brown RG. Evaluation of a porcine zona pellucida vaccine for the immunocontraception of domestic kittens (*Felis catus*). *Theriogenology* 58, 135-49, 2002

Graham, C. A., Maron, M., and McAlpine, C. A. (2012). Influence of landscape structure on invasive predators: feral cats and red foxes in the brigalow landscapes, Queensland, Australia. *Wildlife Research* 39, 661–676. doi:10.1071/WR12008

Grayson, J., M. Calver and I. Styles. 2002. Attitudes of suburban Western Australians to proposed cat control legislation. *Australian Veterinary Journal* 80(9): 536-543.

Grier, K. C. 2006. *Pets in America: a history*. Chapel Hill: The University of North Carolina Press.

Griffiths, Huw, Ingrid Poulter, and David Sibley. 2000. Feral cats in the city. *Animal Space, Beastly Places: new geographies of human-animal relations*. eds Chris Philo, and Chris Wilbert, 56-70. London: Routledge.

Gross EM, Hoida G, Sadeh T. Opposition to trap-sterilizerelease programs for feral cats (lett). *J Am Vet Med Assoc* 1996;208:

Grubbs, S. E. and P. R. Krausman. 2008. Observations of coyote-cat interactions. *Journal of Wildlife Management* 75(3): 683-685.

Gunther, I. and J. Terkel. 2002. Regulation of free-roaming cat (*Felis silvestris catus*) populations: a survey of the literature and its application to Israel. *Animal Welfare* 11: 171-188.

Gunther, I., H. Finkler and J. Terkel. 2011. Demographic differences between urban feeding groups of neutered and sexually intact free-roaming cats following a trap-neuter-return procedure. *Journal of the American Veterinary Medical Association* 238(9): 1134-1140.

Gunther I, Raz T, Even Zor Y, Bachowski Y, Klement E. Feeders of Free-Roaming Cats: Personal Characteristics, Feeding Practices, and Data on Cat Health and Welfare in an Urban Setting of Israel. *Front. Vet. Sci.* 2016;3:21. doi: 10.3389/fvets.2016.00021. [PMC free article] [PubMed] [CrossRef] [Google Scholar]

Gurfield AN, Boulouis HJ, Chomel BB, et al. Epidemiology of *Bartonella* infection in domestic cats in France. *Vet Microbiol* 2001; 80:185–198.

Guthrie, S. 2009. Cat licensing: a conservation strategy that can work. *BC Nature Spring* 2009:17-18.

Guttilla, D. A. and P. Stapp. 2010. Effects of sterilization on movements of feral cats at a wildland-urban interface. *Journal of Mammalogy* 91(2): 482-489.

# H

Hadidian, J. 2010. Integrated pest management (IPM) for vertebrates: do we need to broaden the concept? Pp. 361-364 In: R. M. Timm and K. A. Fagerstone (eds.), Proceedings of the 24th Vertebrate Pest Conference, Davis, CA: University of California.

## 62

Hadidian, J., I. Gibson, S. Hagood, N. Peterson, B. Unti, B. McFarland, K. Lisnik, H. Bialy, I. Fricke, K. Schatzmann, J. Fearing, P. Runquist and A. Rowan. in press. Free-roaming cats: menace to wildlife or scapegoat for human failings? An animal welfare and protection perspective. R.M. Timm (ed.). 25th Vertebrate Pest Conference. Davis, CA: University of California.

Hadidian, J. 2012. Taking the "pest" out of pest control: humaneness and wildlife damage management. Pp. 7-11. In: Proceedings of the 14th Wildlife Damage Management Conference, Bethesda, MD: The Wildlife Society, Wildlife Damage Management Working Group.

Hadidian, J., M. Baird, M. Brasted, L. Nolfo-Clements, D. Pauli and L. Simon. 2007. Wild Neighbors: The humane approach to living with wildlife. Washington, DC: The Humane Society Press.

Hadidian, J., S. Prange, S. P. D. Riley, R. Rosatte and S. Gehrt. 2010. Raccoons. Pp. 35-47. In: S. D. Gehrt, S.P.D. Riley, and B.L. Cypher (eds.), Urban Carnivores: Ecology, Conflict, and Conservation. Johns Hopkins University Press, Baltimore, Maryland. Baltimore, Maryland: Johns Hopkins University Press.

Hall, H. F., and M. R. Pelton. 1979. Abundance, distribution, and biological characteristics of free-roaming house cats in northeastern Tennessee. *Carnivore* 2(1): 26-30.

Hall CM, Adams NA, Bradley JS, Bryant KA, Davis AA, Dickman CR, et al. Community attitudes and practices of urban residents regarding predation by pet cats on wildlife: an international comparison. *PLoS ONE* (2016) 11:e0151962. doi: 10.1371/journal.pone.0151962

Hall, C, Fontaine, J, Bryant, K, Calver, M. (2015) Assessing the effectiveness of the Birdsbesafe® anti-predation collar cover in reducing predation on wildlife by pet cats in Western Australia.. *Applied Animal Behaviour Science* 173:40-51.

Hall, S.L., Bradshaw, J.W.S. & Robinson, I.H. (2002) Object play in adult domestic cats: the roles of habituation and disinhibition. *Applied Animal Behaviour Science*, 79, 263–271.

Hall, L. S., M. A. Kasparian, D. Van Vuren, and D. A. Kelt. 2000. Spatial organization and habitat use of feral cats (*Felis catus* L.) in Mediterranean California. *Mammalia* 64(1): 19-28.

Hammond, C. 1981. Long term management of feral cat colonies. Pp. 89-91. In: *The Ecology and Control of Feral Cats*. Potters Bar: The Universities Federation for Animal Welfare.

Hamilton JB, Hamilton RS, Mestler GE, et al. Duration of life and causes of death in domestic cats: influence of sex, gonadectomy and inbreeding. *J Gerontol* 1969;24:427–437.

Hanlon CA, Childs JE, Nettles VF, et al. Recommendations of a National Working Group on Prevention and Control of Rabies in the United States. *J Am Vet Med Assoc* 1999;215:1612–1619.

Hanna E, Cardillo M. Island mammal extinctions are determined by interactive effects of life history, island biogeography and mesopredator suppression. *Global Ecology and Biogeography*, 2013

Hannigan, J. A. 1995. *Environmental Sociology: a new social constructionist perspective*. New York: Rutledge.

Hanson, C. C., J. E. Bonham, K. J. Campbell, B. S. Keitt, A. E. Little and G. Smith. 2010. The removal of cats from San Nicolas Island: methodology. Pp. 72-78 In: R.M. Timm and K.A. Fagerstone (eds.), Proceedings of the 24th Vertebrate Pest Conference. Davis, CA: University of California.

Harding, E. K., Doak, D. F., and Albertson, J. D. (2001). Evaluating the effectiveness of predator control: the non-native red fox as a case study. *Conservation Biology* 15, 1114–1122. doi: 10.1046/j.1523-1739.2001.0150041114.x

Harestad, A.S. & Bunnell, F.L. (1979). Home range and body weight – a re-evaluation. *Ecology* 60, 389–402.

Harper, G. A. 2004. Feral cats on Stewart/Rakiura, DOI Science Internal Series 174. Department of Conservation, Wellington,

- Harper, G. A. 2005. Numerical and functional response of feral cats (*Felis catus*) to variations in abundance of primary prey on Stewart Island (Rakiura), New Zealand. *Wildlife Research* 32: 597-604.
- Harper, G. A. 2010. Diet of feral cats on subantarctic Auckland Island. *New Zealand Journal of Ecology* 34(2): 259-261.
- Harper, G. A. (2007). Habitat selection of feral cats (*Felis catus*) on a temperate, forested island. *Austral Ecology* 32, 305–314. doi:10.1111/j.1442-9993.2007.01696.x
- Harris DB (2009) Review of negative effects of introduced rodents on small mammals on islands. *Biol Invasions* 11(7):1611–1630.
- Harris, S., P. Morris, S. Wray and D. Yalden. 1995. *A Review of British Mammals: population estimates and conservation status of British mammals other than cetaceans*, Peterborough, U.K.: Joint Nature Conservation Committee.
- Hart BL, Eckstein RA. The role of gonadal hormones in the occurrence of objectionable behaviours in dogs and cats. *Appl Anim Behav Sci.* (1997) 52:331–44.
- Haspel, C. and R. E. Calhoun. 1989. Home ranges of free-ranging cats (*Felis catus*) in Brooklyn, New York. *Canadian Journal of Zoology* 67(1): 178-181.
- Haspel, C. and R.E. Calhoun. 1990. The interdependence of humans and free-ranging cats in Brooklyn, New York. *Anthrozoos* 3(3): 155-161.
- Haspel, C. and R. E. Calhoun. 1993. Activity patterns of free-ranging cats in Brooklyn, New York. *Journal of Mammalogy* 74(1): 1-8.
- Hatley, P. J. 2003. Feral cat colonies in Florida: the fur and feathers are flying. *Journal of Land Use and Environmental Law* 18(2): 441-465.
- Hawes S, Ikizler D, Loughney K, Tedeschi P, Morris K. *Legislating Components of a Humane City: The Economic Impacts of the Austin, Texas “No Kill” Resolution (City of Austin Resolution 20091105-040)*. Institute for Human-Animal Connection, Graduate School of Social Work, University of Denver; (2017).
- Hawkins, C. C., W. E. Grant and M. T. Longnecker. 1999. Effect of subsidized house cats on California birds and rodents. *Transactions of the Western Section of the Wildlife Society* 35: 29-33.
- Hawkins, C. C., W. E. Grant, and M. T. Longnecker. 2004. Effect of house cats, being fed in parks, on California birds and rodents. Pages 164-170 in W. W. Shaw, L. K. Harris, and L. Vandruuff, editors. *Proceedings of the 4th International Symposium on Urban Wildlife Conservation*. University of Arizona, Tucson, Arizona, USA. [online] URL: <http://cals.arizona.edu/pubs/adjunct/snr0704/snr070421.pdf>
- Heidenberger, E. 1997. Housing conditions and behavioural problems of indoor cats as assessed by their owners. *Applied Animal Behaviour Science* 52: 345-364.
- Helmstedt KJ, et al. (2016) Prioritizing eradication actions on islands: It’s not all or nothing. *J Appl Ecol* 53(3):733–741.
- Henderson, R. W. Consequences of predator introductions and habitat destruction on amphibians and reptiles in the Post Columbus West Indies. *Caribb. J. Sci.* 28, 1–10 (1992).
- Henriquez, F. L. and C. W. Roberts. 2009. A century of *Toxoplasma gondii* research. *Microbiology Today* November: 192-195.
- Herzog H. Gender differences in human–animal interactions: a review. *Anthrozoos* (2007) 20:7–21. doi: 10.2752/089279307780216687
- Hess, S. C. 2011. By land and by sea: the widespread threat of feral cats on Hawaiian wildlife. *The Wildlife Professional*: 66-67.

Hess, S. C., P. C. Banko, D. M. Goltz, R. M. Danner and K. W. Brinck. 2004. Strategies for reducing feral cat threats to endangered Hawaiian birds. Pp. 21-26 In: R.M. Timm, and W.P. Gorenzel (eds.) Proceedings of the 21st Vertebrate Pest Conference, Davis, CA: University of California.

Hess, S. C., H. Hansen, D. Nelson, R. Swift and P. C. Banko. 2007. Diet of feral cats in Hawai'i Volcanoes National Park. *Pacific Conservation Biology* 13: 244-249.

Hess, S. C., P. C. Banko and H. Hansen. 2009. An adaptive strategy for reducing feral cat predation on endangered Hawaiian birds. *Pacific Conservation Biology* 15: 56-64.

Hetherington CA, Algar D, Mills H, Bencini R. Increasing the target-specificity of ERADICAT (R) for feral cat (*Felis catus*) control by encapsulating a toxicant. *Wildlife Research* 34, 467-71, 2007

Hettinger J. Taking a Broader View of Cats in the Community. Washington, DC: Animal Sheltering; (2008) September/October, p. 8-9.

Heussner, J. C., A. I Flowers, J. D. Williams, and N. J. Silvy. 1978. Estimating dog and cat populations in an urban area. *Animal Regulation Studies* 1: 203-212.

Hildreth, A. M., S. M. Vantassel and S. E. Hygnstrom. 2010. Feral Cats and their management. Publication EC1781. Lincoln: University of Nebraska.

Hill D. and J.P. Dubey. 2012. *Toxoplasma gondii*: transmission, diagnosis, and prevention. *Clinical Microbiology and Infection* 8: 634-640.

Hill D., C. Coss, J.P. Dubey, K. Wroblewski, M. Sautter, T. Hosten, C. Munoz-Zanzi, E. Mui, S. Withers, K. Boyer, G. Hermes, J. Coyne, F. Jagdis, A. Burnett, P. McLeod, H. Morton, D. Robinson, and R. McLeod. 2011. Identification of a sporozoite-specific antigen from *Toxoplasma gondii*. *Journal of Parasitology* 97: 328-337.

Hill SL, Cheney JM, Taton-Allen GF, et al. Prevalence of enteric zoonotic organisms in cats. *J Am Vet Med Assoc* 2000;216:687-692.

Hilton, G. M. and R. J. Cuthbert. 2010. The catastrophic impact of invasive mammalian predators on birds of the UK Overseas Territories: a review and synthesis. *Ibis* 152: 443-458.

Holl\_en, L.I. & Radford, A.N. (2009) The development of alarm call behaviour in mammals and birds. *Animal Behaviour*, 78, 791-800.

Hollander M, Wolfe DA. Nonparametric Kuan Tan, Jacquie Rand, John Morton, 2017 Jun 2, Trap-Neuter-Return Activities in Urban Stray Cat Colonies in Australia, 1School of Veterinary Science, The University of Queensland, Gatton, Queensland 4343, Australia

Holmala, K., and Kauhala, K. (2009). Habitat use of medium-sized carnivores in southeast Finland – key habitats for rabies spread? *Annales Zoologici Fennici* 46, 233-246. doi:10.5735/086.046.0401

Holt, R. D., and Polis, G. A. (1997). A theoretical framework for intraguild predation. *American Naturalist* 149, 745-764. doi:10.1086/286018

Hone, J. (1999). On rate of increase (r): patterns of variation in Australian mammals and the implications for wildlife management. *Journal of Applied Ecology* 36, 709-718. doi:10.1046/j.1365-2664.1999.00439.x

Hone, J. 1996. Analysis of vertebrate pest research. Pp. 13-17. In: R. M. Timm and A.C. Crabb (eds.) Proceedings of the 17th Vertebrate Pest Conference. Davis, CA: University of California.

Honnold, S. P., R. Braun, D. P. Scott, C. Streekumar, and J. P. Dubey. 2005. Toxoplasmosis in a Hawaiian monk seal (*Monachus schauinslandi*). *Journal of Parasitology* 91(3): 695-697.

Horn, J. A., N. Mateus-Pinilla, R. E. Warner and E. J. Heske. 2011. Home range, habitat use, and activity patterns of free roaming domestic cats. *Journal of Wildlife Management* 75(5): 1177-1185.

Hornaday, W. T. 1913. *Our Vanishing Wildlife*. New York: Charles Scribner's Sons.

Howe, L. M. (1997). Short-term results and complications of pre-pubertal gonadectomy in cats and dogs. *Journal of the American Veterinary Medical Association*, 211, 57-62.

- Howell PG, An evaluation of the biological control of the feral cat (1984) *Acta Zool Fennica*;172: 111–113.
- HSUS, *Managing Community Cats: A Guide for Municipal Leaders*, 2014. Humane Society of the United States.
- Hubbs EL. Food habits of feral house cats in the Sacramento Valley. *Calif Fish Game* 1951;37:177–189.
- Hugh W. McGregor, Sarah Legge, Joanne Potts, Menna E. Jones, and Christopher N. Johnson, Density and home range of feral cats in north-western Australia, *Wildlife Research* <http://dx.doi.org/10.1071/WR14180>, Received 5 September 2014, accepted 18 April 2015, published online 10 June 2015, *Wildlife Research*
- Hughes, B. J., G. R. Martin and J. Reynolds. 2008. Cats and seabirds: effects of feral domestic cat *Felis sylvestrtris catus* eradication on the population of Sooty terns *Onychoprion fuscata* on Ascension Island, South Atlantic. *Ibis* 150( Suppl. 1): 122-131.
- Hughes, K. L. and M. R. Slater. 2002. Implementation of a feral cat management program on a university campus. *Journal of Applied Animal Welfare Science* 5(1): 15-28.
- Hughes, K. L., M. R. Slater and L. Haller. 2002. The effects of implementing a feral cat spay/neuter program in a Florida county animal control service. *Journal of Applied Animal Welfare* 5(4): 285-298.
- Humane Society of the United States (HSUS) *Managing Community Cats: A Guide for Municipal Leaders*. 2014 Available online: <http://www.animalsheltering.org/page/managing-community-cats-guide-municipal-leaders>.
- Humane Society of the United States. The HSUS position on trap neuter return (TNR). Available at: [www.humanesociety.org/issues/feral\\_cats/facts/TNR\\_statement.html](http://www.humanesociety.org/issues/feral_cats/facts/TNR_statement.html).
- Hurley K.F., Levy J.K. *New Paradigms for Shelters and Community Cats*. Available online: <https://vetmed.maddie.sites.medinfo.ufl.edu/files/2014/07/New-Paradigms-for-Shelters-and-Community-Cats.pdf>.
- Hurley, Dr. K. For Community Cats, A Change is Gonna Come. *Animal Sheltering* September/October 2013; 24–31.
- Hurley, K. and Levy, J. *Feline Shelter Intake Reduction Program FAQs*. [http://www.maddiesfund.org/Maddies\\_Institute/Articles/Feline\\_Shelter\\_Intake\\_Reduction\\_Program\\_FAQs.html](http://www.maddiesfund.org/Maddies_Institute/Articles/Feline_Shelter_Intake_Reduction_Program_FAQs.html).
- Hurni H. Daylength and breeding in the domestic cat. *Lab Anim* 1981;15:229–233.
- Hutchings, S. The diet of feral house cats (*Felis catus*) at a regional rubbish tip, Victoria. *Wildl. Res.* 30, 103-110 (2003).

## I

- Iddawela D, Malinda S, Vithana P, Ratnayake C. Seroprevalence of toxoplasmosis and risk factors of *Toxoplasma gondii* infection among pregnant women in Sri Lanka: a cross sectional study. *BMC Public Health* (2017) 17:930. doi: 10.1186/s12889-017-4941-0
- Imrie, R. 2005. Cat-Killing Plan Dies Quietly. *Wisconsin State Journal*, May 14.
- International Companion Animal Management Coalition (ICAMC). 2011. *Humane Cat Population Management Guidance*, WSPA, London.
- Invasive Species Specialist Group. 100 of the world’s worst invasive alien species. Available at: [www.issg.org/booklet.pdf](http://www.issg.org/booklet.pdf).
- 66
- Irene T. Lee, BS; Julie K. Levy, DVM, PhD, DACVIM; Shawn P. Gorman, MS; P. Cynda Crawford, DVM, PhD; Margaret R. Slater, DVM, PhD, Prevalence of feline leukemia virus infection and serum antibodies against feline immunodeficiency virus in unowned free-roaming cats, 620-622 *Scientific Reports: Original Study JAVMA*, Vol 220, No. 5, March 1, 2002
- Isaac NJB, Turvey ST, Collen B, Waterman C, Baillie JEM (2007) Mammals on the EDGE: Conservation priorities based on threat and phylogeny. *PLoS One* 2(3):e296–e297.

Ishida T, Washizu T, Toriyabe K, et al. Feline immunodeficiency virus infection in cats of Japan. *J Am Vet Med Assoc* 1989;194:221–225.

Ishida, Y. and M. Shimizu. 1998. Influence of social rank on defecating behavior in feral cats. *Journal of Ethology* 16(1): 15-21.

IUCN SSC Invasive Species Specialist Group (2012). Database of Island Invasive Species Eradications. Island Conservation. Available at: <http://eradicationdb.fos.auckland.ac.nz/>

Izawa, M. 1983. Daily activities of the feral cat *Felis catus* Linn. *Journal of the Mammalogical Society of Japan* 9(5): 219-228.

Izawa, M., T. Doi, and Y. Ono. 1982. Grouping patterns of feral cats (*Felis catus*) living on a small island in Japan. *Japanese Journal of Ecology* 32: 373-382.

Izawa, M. and Y. Ono. 1986. Mother-offspring relationship in the feral cat population. *Journal of the Mammalogical Society of Japan* 11(1-2): 27-34.

## J

J. A. A. 1904. Forbush on the destruction of birds by the elements. *The Auk* 21(4): 507-509.

J.A.A. 1905. Forbush on the decrease of birds and means for their protection. *The Auk* 22(4): 437-438.

Jackson JA. Alleviating the problems of competition, predation, parasitism, and disease in endangered birds. In: Temple SA, ed. *Endangered birds*. Madison, Wis: University of Wisconsin, 1977; 75–84.

Jackson M.L., Haines D.M., Taylor S.M., Misra V. Feline leukemia virus detection by ELISA and PCR in peripheral blood from 68 cats with high, moderate, or low suspicion of having FeLV-related disease. *J. Vet. Diagn. Investig.* 1996;8:25–30. doi: 10.1177/104063879600800105. [PubMed] [CrossRef] [Google Scholar]

Jackson MH, Hutchison WM. Unwanted cats—physical condition, *Toxoplasma* infection and ectoparasites. *Br Vet J* 1993;149:

Jackson WB (1951) Food habits of Baltimore, Maryland, cats in relation to rat populations. *J Mammal* 32:458–461

Jackson, W. B. 1951. Food habits of Baltimore, Maryland cats in relation to rat populations. *Journal of Mammalogy* 32( 4): 458-461.

Jacque Rand, Gina Fisher, Kate Lamb, Andrea Hayward, *Public Opinions on Strategies for Managing Stray Cats and Predictors*

Jameson P, Greene C, Regnery R, et al. Prevalence of *Bartonella henselae* antibodies in pet cats throughout regions of North America. *J Infect Dis* 1995;172:1145–1149.

Janssen, A., Sabelis, M. W., Magalhães, S., Montserrat, M., and Van der Hammen, T. (2007). Habitat structure affects intraguild predation. *Ecology* 88, 2713–2719. doi:10.1890/06-1408.1

Jardine, J. E., and J. P. Dubey. 2002. Congenital toxoplasmosis in a Indo-Pacific Bottlenose Dolphin (*Tursiops aduncus*). *Journal of Parasitology* 88, no. 1: 197-99.

## 67

Jarvis, P. J. 1990. Urban cats as pests and pets. *Environmental Conservation* 17(2): 169-171.

Jemmett JE, Evans JM. A survey of sexual behavior and reproduction in female cats. *J Small Anim Pract* 1977;18:31–37.

Jessup, D. A. 2004. The welfare of feral cats and wildlife. *Journal of the American Veterinary Medical Association* 225, no. 9: 1377-83.

Jessup, D. A. 2006. LTE: The debate on feral cats continues. *Journal of the American Veterinary Medical Association* 228(5): 683.

Jessup, D. A. 2010. Feral cats and wildlife health. *Newsletter of the Wildlife Disease Association* October: 4-5.

Jessup DA, Pettan KC, Lowenstine LJ, et al. Feline leukemia virus infection and secondary spirochetemia in a free-ranging cougar (*Felis concolor*). *J Zoo Wildl Med* 1993;24:73–79.

Jessup, D. A., K. C. Pettan, L. J. Lowenstine, and N. C. Pedersen. 1993. Feline leukemia virus infection and renal spirochetosis in a free-ranging cougar (*Felis concolor*). *Journal of Zoo and Wildlife Medicine* 24:73-79.

Jochle W, Jochle M. Reproduction in a feral cat population and its control with a prolactin inhibitor, cabergoline. *J Reprod Fertil Suppl* 1993;47:419–424.

Johnson K.L., Cicirelli J. Study of the effect on shelter cat intakes and euthanasia from a shelter neuter return project of 10,080 cats from March 2010 to June 2014. *PeerJ*. 2014 doi: 10.7717/peerj.646.

Johnson KJ. A report on trap/alter/release programs. *Cat Fancier's Almanac* 1996;Jan:71–77.

Johnson, K. and L. Lewellen. 1995. "San Diego County survey and analysis of the pet population." Web page, [accessed 21 October 2012]. Available at <http://www.fanciers.com/npa/sdresults.html>.

Johnston, M. J., M. J. Shaw, A. Robley, and N. K. Schedvin. 2007. Bait uptake by feral cats on French Island, Victoria. *Australian Mammalogy* 29(1): 77-83.

Jones, A. and C. T. Downs. 2011. Managing feral cats on a university's campuses: How many are there and Is sterilization having an effect? *Journal of Applied Animal Welfare Science* 13, no. 4: 304-20.

Jones, E. 1977. Ecology of the feral cat, *Felis catus* (L.), (Carnivora: Felidae) on Macquarie Island. *Australian Wildlife Research* 4: 249-262.

Jones HP, et al. (2016) Invasive mammal eradication on islands results in substantial conservation gains. *Proc Natl Acad Sci USA* 113(15):4033–4038.

Jones HP, Tershy BR, Zavaleta ES, Croll DA, Keitt BS, Finklestein ME, Howald GR (2008) Review of the global severity of the effects of invasive rats on seabirds. *Conservation Biology*, 22, 16–26.

Jones JL, Kruszon-Moran D, Wilson M, et al. *Toxoplasma gondii* infection in the United States: seroprevalence and risk factors. *Am J Epidemiol* 2001;154:357–365.

Jones, M. G. W., and P. G. Ryan. 2010. Evidence of mouse attacks on albatross chicks on sub-Antarctic Marion Island. *Antarctic Science* 22: 39-42.

Jongman, E. C. 2007. Adaptation of domestic cats to confinement. *Journal of Veterinary Behavior* 2: 193-196.

Jongman, E. C. and G. A. Karlen. 1996. Trap, neuter and release programs for cats: a literature review on an alternative control method of feral cats in urban areas. Pp. 81-84, In: S. Hassett (ed.), *Urban Animal Management Conference*. Australian Veterinary Association, Ltd.

Judge, S., Lippert, J. S., Misajon, K., Hu, D., and Hess, S. C. (2012). Videographic evidence of endangered species depredation by feral cat. *Pacific Conservation Biology* 18, 293–296.

68

Justin D.A. 2012. Feral Cats Cause Rabies Outbreak in New Mexico. *Opposing Views* (April 17, 2012), <http://www.opposingviews.com/i/society/animal-rights/feral-cats-cause-rabies-outbreak-new-mexico>.

## K

Kane E, Allard RE, Douglass GM. The influence of litter size on weight change during feline gestation and lactation. *Feline Pract* 1990;18(1):6–10.

Karl, B. J., and H. A. Best. 1982. Feral cats and Stewart Island; their foods, and their effects on kakapo. *New Zealand Journal of Zoology* 9(2): 287-293.

Kass P.H., Johnson K.L., Weng H. Evaluation of animal control measures on pet demographics in Santa Clara County, California, 1993–2006. *Peer J*. 2013;1 doi: 10.7717/peerj.18. [PMC free article] [PubMed] [CrossRef] [Google Scholar]

Katzman, K. C. Port's last wharf cat dies. *The Daily News of Newburyport* (Newburyport, Mass., 2010).

Kawakami, K. and H. Higuchi. 2002. Bird predation by domestic cats on Hahajima Island, Bonin Islands, Japan. *Ornithological Science* 1: 143-144.

Kays, R. W. and A. A. DeWan. 2004. Ecological impact of inside/outside house cats around a suburban nature preserve. *Animal Conservation* 7: 273-283.

Kays, R., et al. (2015). Cats are rare where coyotes roam. *Journal of Mammalogy* 96(5): 981-987.

Keitt, B. S., and B. R. Tershy. 2003. Cat eradication significantly decreases shearwater mortality. *Animal Conservation* 6: 307-308.

Keitt, B. S., Wilcox, C., Tershy, B. R., Croll, D. A., and Donlan, C. J. (2002). The effect of feral cats on the population viability of black-vented shearwaters (*Puffinus opisthomelas*) on Natividad Island, Mexico. *Animal Conservation* 5, 217-223. doi:10.1017/S1367943002002263

Kellert S.R. American attitudes toward and knowledge of animals: An update. In: Fox M.W., Mickley L.D., editors. *Advances in Animal Welfare Science*. The Humane Society of the United States; Washington, DC, USA: 1984/1985. pp. 177-213. [Google Scholar]

Kellert, S. R. and J. K. Berry. 1980. Phase III: Knowledge, affection and basic attitudes toward animals in American society. Washington, DC: United States Fish and Wildlife Service.

Kendall, K. and J. Ley. 2006. Cat ownership in Australia: barriers to ownership and behavior. *Journal of Veterinary Behavior* 1: 5-16.

Kendall TR. Cat population control: vasectomize dominant males. *Calif Vet* 1979;33:9-12.

Kennedy, M. S., Phillips, B. L., Legge, S., Murphy, S. A., and Faulkner, R. A. (2012). Dodingoes suppress the activity of feral cats in northern Australia? *Austral Ecology* 37, 134-139. doi:10.1111/j.1442-9993.2011.02256.x

Kerby G, Macdonald D. Cat society and the consequences of colony size. In: Turner DC, Bateson P, eds. *The domestic cat: the biology of its behavior*. Cambridge: Cambridge University Press, 1988;67-81.

Kerr C, Rand J, Morton J, Reid R, Paterson M. Changes associated with improved outcomes for cats entering RSPCA Queensland shelters between 2011 and 2016. *Animals* (2018) 8:95. doi: 10.3390/ani8060095

Khan QJA, Al-Lawatia MA. Birds, rabbits and cats interaction model with switching strategy of opportunistic cats. Pp 172-7, 2008

## 69

Kier G, Kreft H, Lee TM et al. (2009) A global assessment of endemism and species richness across island and mainland regions. *Proceedings of the National Academy of Science*, 106, 9322-9327.

King BJ (2013) Do we really know that cats kill by the billions? Not so fast. National Public Radio. <http://www.npr.org/>

King, C. M., Flux, M., Innes, J. G. & Fitzgerald, B. M. Population biology of small mammals in Pureora Forest Park: 1. Carnivores (*Mustela ermine*, *M. furo*, *M. nivalis*, and *Felis catus*). *N.Z. J. Zool.* 20, 241-251 (1996).

King, D.I., DeGraaf, R.M., Griffin, C.R. & Maier, T.J. (1999) Do predation rates on artificial nests accurately reflect predation rates on natural bird nests? *Journal of Field Ornithology*, 70, 257-262.

Kirkwood, J. K., A. W. Sainsbury, and P. M. Bennett. 1994. The welfare of free-living wild animals: methods of assessment. *Animal Welfare* 3: 257-73.

Kirkwood S. Free-roaming cats: in search of new approaches. *Animal Shelter* 1998;21:5-6.

Kitchener, A. C., N. Yamaguchi, J. M. Ward and D. W. MacDonald. 2005. A diagnosis for the Scottish wildcat (*Felis sylvestris*): a tool for conservation action for a critically-endangered felid. *Animal Conservation* 8: 223-237.

Klem, D. Jr. 2009. Avian mortality at windows: the second largest human source of bird mortality on earth. Pp. 244-251 In: T.

D. Rich, M. Del Coro Arizmendi, D. W. Demarest and C. Thompson (eds.), Proceedings of the Fourth International Partners in Flight Conference: Tundra to Tropics. McAllen, TX: Partners in Flight.

Kliks MM. Feral cats can transmit diseases to humans. Honolulu Star Bulletin 2003.

Kliskey, A. D., and Byrom, A. E. (2004). Development of a GIS-based methodology for quantifying predation risk in a spatial context. *Transactions in GIS* 8, 13–22. doi:10.1111/j.1467-9671.2004.00165.x

Klug, P. E., L. L. Wolfenbarger, and J. P. McCarty. 2010. Snakes are important nest predators of Dickcissels in an agricultural landscape. *Wilson Journal of Ornithology* 122:799-803. <http://dx.doi.org/10.1676/09-203.1> *Avian Conservation and Ecology* 8(2): 3 <http://www.ace-eco.org/vol8/iss2/art3/>

Klump, G.M. & Shalter, M.D. (1984) Acoustic behaviour of birds and mammals in the predator context; I. Factors affecting the structure of alarm signals. II. The functional significance and evolution of alarm signals. *Zeitschrift für Tierpsychologie*, 66, 189–226.

Knight, R.L. & Temple, S.A. (1988) Nest-defense behavior in the redwinged blackbird. *Condor*, 90, 193–200.

Knowlton, J. L., et al. 2007. Eradication of non-native mammals and the status of insular mammals on the California Channel Islands, USA, and Pacific Baja California Peninsula Islands, Mexico. *The Southwestern Naturalist* 52:528–540.

Koehler JE, CA Glaser, Tappero JW. *Rochalimaea henselae* infection: a new zoonosis with the domestic cat as reservoir. *J Am Vet Med Assoc* 1994;271:531–535.

Kogan, M. 1998. Integrated pest management: historical perspectives and contemporary developments. *Annual Review of Entomology* 48: 243-270.

Konarzewski, M. & Starck, J.M. (2000) Effects of food shortage and over supply on energy utilization, histology, and function of the gut in nestling Song Thrushes (*Turdus philomelos*). *Physiological and Biochemical Zoology*, 73, 416–427.

Konecny, M. J. 1987a. Home range and activity patterns of feral house cats in the Galapagos Islands. *Oikos* 50: 17-23.

Konecny, M. J. 1987b. Foods habits and energetics of feral house cats in the Galapagos Islands. *Oikos* 50: 24-32.

Kortis B. Neighborhood cats. Available online: <http://www.neighborhoodcats.org/resources/case-studies>. Kortis B.

Trap-neuter-release. Available online: <http://www.neighborhoodcats.org/resources/case-studies>.

## 70

Kortis B., Richmond S., Weiss M., Frazier A., Needham J., McClurg L., Senk L.G. *Neighborhood Cats TNR Handbook*. 2nd ed. Neighborhood Cats, Inc.; New York, NY, USA: 2013.

Krama, T. & Krams, I. (2005) Cost of mobbing call to breeding pied flycatcher, *Ficedula hypoleuca*. *Behavioral Ecology*, 16, 37–40.

Krams, I., Krama, T., Igaune, K. & Mänd, R. (2007) Long-lasting mobbing of the pied flycatcher increases the risk of nest predation. *Behavioral Ecology*, 18, 1082–1084.

Krauze-Gryz D, Gryz J, Goszczyński J. Predation by domestic cats in rural areas of central Poland: an assessment based on two methods. *Journal of Zoology* 288, 260-6, 2012

Krauze-Gryz, D., Gryz, J. B., Goszczyński, J., Chylarecki, P., and Zmihorski, M. (2012). The good, the bad, and the ugly: space use and intraguild interactions among three opportunistic predators – cat (*Felis catus*), dog (*Canis lupus familiaris*), and red fox (*Vulpes vulpes*) – under human pressure. *Canadian Journal of Zoology* 90, 1402–1413. doi:10.1139/cjz-2012-0072

Kravetz, J.D. and Federman, D.G. Cat-associated zoonoses. *Archives of Internal Medicine*, 162(17), 1945-1952.

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. K. Mazet. 2003. Patterns of mortality in southern sea otters (*Enhydra lutris nereis*) from 1998-2001. *Journal of Wildlife Diseases* 39: 495-509.

Kristensen, T. 1981. Feral cat control in Denmark. Pp. 68-72. In: *The Ecology and Control of Feral Cats* Potters Bar: The Universities Federation for Animal Welfare.

Kruise, J. 1995. Feral cat trapping. *Wildlife Control Technology* 22(4): 32-34.

Kruuk, H. 1972. Surplus killing by carnivores. *Journal of Zoology* 166(2): 233-244.

Kubesci O.Y., O. Miman, M. Yaman, O.C. Aktepe, and S. Yazar. 2011. Could *Toxoplasma gondii* have any role in Alzheimer's disease? *Alzheimer Disease and Associated Disorders* 25: 1-3.

Kuehn BM. Debate over trap-neuter-release programs for feral cats to continue in Nashville. *J Am Vet Med Assoc* 2002;221:17.

Kurushima, J. D., S. Ikram, J. Knudsen, E. Bleiberg, R. A. Grahn and L. A. Lyons. 2012. Cats of the pharaohs: genetic comparison of Egyptian cat mummies to their feline contemporaries. *Journal of Archaeological Science* 39(10): 3217-3223.

Kutt, A. S. and A. Kitchener. 2012. Feral cat (*Felis catus*) prey size and selectivity in north-eastern Australia: implications for mammal conservation. *Journal of Zoology* 287(3): 292-301.

Kutt AS. The diet of the feral cat (*Felis catus*) in north-eastern Australia. *Acta Theriologica* 56, 157-69, 2011

## L

LaFever, David H., Paige M. Schmidt, Neil D. Perry, Craig A. Faulhaber, Roel R. Lopez, Nova J. Silvy, and Elizabeth A. Forsy. 2008. Use of a population viability analysis to evaluate human-induced impacts and mitigation for the endangered Lower Keys marsh rabbit. *Human-Wildlife Conflicts* 2(2): 260-269.

Lahti, D. C. 2009. Why we have been unable to generalize about bird nest predation. *Animal Conservation* 12: 279-281.

Lakey, J. 2009. Cats 'capable' of surviving outside. *Toronto Star*, 7 January. [online] URL: <http://www.thestar.com/GTA/>

Langham, N. P. E. 1990. The diet of feral cats (*Felis catus* L.) on Hawke's Bay farmland, New Zealand. *New Zealand Journal of Zoology* 17(2): 243-255.

## 71

Langham, N. P. E. 1992. Feral cats (*Felis catus* L.) on New Zealand farmland. II. Seasonal activity. *Wildlife Research* 19: 707-720.

Langham, N. P. E., and R. E. R. Porter. 1991. Feral cats (*Felis catus* L.) on New Zealand farmland. I. Home range. *Wildlife Research* 18: 741-760.

Larsen CT, Henshaw RE. Predation of the sand lizard *Lacerta agilis* by the domestic cat *Felis catus* on the Sefton Coast. *Costal Dune Management* 2001

Lauber, T. B., Knuth, B. A., Tantillo, J. A., and Curtis, P. D. (2007). The role of ethical judgements related to wildlife fertility control. *Society & Natural Resources* 20, 119–133. doi: 10.1080/08941920601052362

Laundre, J. 1977. The daytime behaviour of domestic cats in a free-roaming population. *Animal Behaviour* 25: 990-998.

Laver, P. N., and M. J. Kelly. 2008. A critical review of home range studies. *The Journal of Wildlife Management* 72:290–298.

Lawler DF, Johnston SD, Hegstad RL, et al. Ovulation without cervical stimulation in domestic cats. *J Reprod Fertil Suppl*

Lawler DF, Monti KF. Morbidity and mortality in neonatal kittens. *Am J Vet Res* 1984;45:1455–1459.

Lazenby B, Mooney NJ, Dickman CR. Effects of low-level culling of feral cats in open populations: a case study from the forests of southern Tasmania. *Wildlife Res.* (2014) 41:407–15. doi: 10.1071/WR14030

Lazenby, B. T., and Dickman, C. R. (2013). Patterns of detection and capture are associated with cohabiting predators and prey. *PLoS ONE* 8, e59846. doi:10.1371/journal.pone.0059846

Le Corre, M. 2008. Cats, rats and seabirds. *Nature* 451: 134-135.

Lebbin, D. J., M. J. Parr and G. H. Fenwick. 2010. *The American Bird Conservancy Guide to Bird Conservation*. Chicago: The University of Chicago Press.

Lednicer LG. Is It More Humane to Kill Stray Cats, or Let Them Fend Alone? *Washington Post Magazine*; (2014) Available online at: [http://www.washingtonpost.com/lifestyle/magazine/is-it-more-humane-to-kill-stray-cats-or-let-them-fend-alone/2014/02/06/472f9858-82a4-11e3-9dd4-e7278db80d86\\_story.html](http://www.washingtonpost.com/lifestyle/magazine/is-it-more-humane-to-kill-stray-cats-or-let-them-fend-alone/2014/02/06/472f9858-82a4-11e3-9dd4-e7278db80d86_story.html)

Lee IT, Levy JK, Gorman SP, et al. Prevalence of feline leukemia virus infection and serum antibodies against feline immunodeficiency virus in unowned free-roaming cats. *J Am Vet Med Assoc* 2002;220:620–622.

Lee W. Too Costly for Chicago to Turn City-Run Shelter into No-Kill Zone? *Chicago Tribune* (2016) Available online at: <http://www.chicagotribune.com/news/local/breaking/ct-no-kill-city-animal-shelters-met-20160401-story.html>

Legay, J. M. 1986. Sur une tentative d'estimation du nombre de chats domestiques dan le monde. *Competes Rendus De L'Academie Des Science, Serie III: Sciences De La Vie* 303: 709-712.

Legge, S, Murphy, BP, McGregor, H, Woinarski, JCZ, Augusteyn, J, Ballard, G, Baseier, M, Buckmaster, T. 2017. Enumerating a continental-scale threat: how many feral cats are in Australia. *Biological Conservation* 206: 293– 303.

Legge, S., Kennedy, M. S., Lloyd, R., Murphy, S. A., and Fisher, A. (2011a). Rapid recovery of mammal fauna in the central Kimberley, northern Australia, following the removal of introduced herbivores. *Austral Ecology* 36, 791–799. doi:10.1111/j.1442-9993.2010.02218.x *H Wildlife Research* H. W. McGregor et al.

Lepczyk, C. A., A. C. Mertig and J. Liu. 2003. Landowners and cat predation across rural-to-urban landscapes. *Biological Conservation* 115: 191-201.

Lepczyk, C. A., A. C. Mertig, and J. Liu. 2004. Assessing landowner activities related to birds across rural-to-urban landscapes. *Environmental Management* 33(1): 110-125.

## 72

Lepczyk, C. A., N. Dauphine, D. M. Bird, S. Conant, R. J. Cooper, D. C. Duffy, P. J. Hatley, P. P. Mara, E. Stone and S. A. Temple. 2010. What conservation biologists can do to counter trap-neuter-return: response to Longcore et al. *Conservation Biology* 24(2): 627-629.

Lepczyk, C. A., Y. van Heezik and R. J. Cooper. 2011. An issue with all-too-human dimensions: it's people, not science, at the heart of the cat debate. *The Wildlife Professional*: 68-70.

Letnic, M., Ritchie, E. G., and Dickman, C. R. (2012). Top predators as biodiversity regulators: the dingo *Canis lupus dingo* as a case study. *Biological Reviews of the Cambridge Philosophical Society* 87, 390–413. doi:10.1111/j.1469-185X.2011.00203.x

Levin, J. F., Nutter, F. B., Stoskopf, M. K., Reproductive capacity of free-roaming domestic cats and kitten survival rate, *JAVMA*, Vol 225, No. 9, November 1, 2004 *Scientific Reports: Original Study* 1399-1402

Levin, J. F., Nutter, F. B., Stoskopf, M. K., Time and financial costs of programs for live trapping feral cats, *JAVMA*, Vol 225, No. 9, November 1, 2004 *Scientific Reports: Original Study* 1403-1405

Levy J. Suggests TNR programs follow AVMA policy better (lett). *J Am Vet Med Assoc* 2002;221:1102.

Levy, J. K. 2011. Contraceptive vaccines for the humane control of community cat populations. *American Journal of Reproductive Immunology* 66: 63-70.

Levy JK. FeLV, FIV and feral cats: to test or not to test, in *Proceedings. 139th Annu Conv Am Vet Med Assoc* 2002;685.

Levy J.K., Crawford C., Hartmann K., Hofmann-Lehmann R., Little S., Sundahl E., Thayer V. American Association of Feline Practitioners' feline retrovirus management guidelines. *J. Feline Med. Surg.* 2008;10:300–316. doi: 10.1016/j.jfms.2008.03.002. [PubMed] [CrossRef] [Google Scholar]

Levy, J. K., D. W. Gale and L. A. Gale. 2003a. Evaluation of the effect of a long-term trap-neuter-return and adoption program on a free-roaming cat population. *Journal of the American Veterinary Medical Association* 222(1): 42-46.

Levy JK, Friary JA, Miller LA, Tucker SJ, Fagerstone KA. Long-term fertility control in female cats with GonaCon™, a GnRH immunocontraceptive. *Theriogenology* 76, 1517-25, 2011

Levy J.K., H.M. Scott, J.L. Lachtara, 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 Medical Association* 228: 371-376.

Levy J.K., Isaza N.M., Scott K.C. Effect of high-impact targeted trap-neuter-return and adoption of community cats on cat intake to a shelter. *Vet. J.* 2014;201:269–274. doi: 10.1016/j.tvjl.2014.05.001.

Levy, J. K., J. E. Woods, S. L. Turick and D. L. Etheridge. 2003b. Number of unowned free-roaming cats in a college community in the southern United States and characteristics of community residents who feed them. *Journal of the American Veterinary Medical Association* 223(2): 202-205.

Levy, J. K., L. A. Miller, P. C. Crawford, J. W. Ritchey, M. K. Ross and K. A. Fagerstone. 2004. GnRH immunocontraception of male cats. *Theriogenology* 62: 1116-1130.

Levy, J. K. and P. C. Crawford. 2004. Humane strategies for controlling feral cat populations. *Journal of the American Veterinary Medical Association* 225(9): 1354-1360.

Levy, J. K., P.C. Crawford, M.R. Lappin, E.J. Dobovi, M.G. Levy, R. Alleman, S.J. Tucker, and E.L. Clifford. 2008. Infectious diseases of dogs and cats on Isabela Island, Galapagos. *J. Vet. Intern. Med.* 22: 60-65.

Liberg, O. 1980. Spacing patterns in a population of rural free roaming domestic cats. *Oikos* 38: 336-349.

Liberg, O. 1982. Correction factors for important prey categories in the diet of domestic cats. *Acta Theriologica* 27(9): 115-122.

### 73

Liberg O. Courtship behaviour and sexual selection in the domestic cat. *Appl Anim Ethol* 1983;10:117–132.

Liberg, O. 1984a. Food habits and prey impact by feral and house-based domestic cats in a rural area in southern Sweden. *Journal of Mammalogy* 65(3): 424-432.

Liberg, O. 1984b. Home range and territoriality in free ranging house cats. *Acta Zoologica. Fennica* 171: 283-285.

Liberg, O. and M. Sandell. 1988. Spatial organization and reproductive tactics in the domestic cat and other felids. Pp. 83-98. In: D. C. Turner and P. Bateson (eds.). *The Domestic Cat*. 1st ed. Cambridge, England: Cambridge University Press.

Liberg, O., M. Sandell, D. Pontier and E. Natoli. 2000. Density, spatial organization and reproductive tactics in the domestic cat and other felids. Pp. 119-148 In: D. C. Turner and P. Bateson (eds.). *The Domestic Cat: the biology of its behavior*. 2nd edition, Cambridge, England: Cambridge University Press.

Lilith M, Calver M, Garkaklis M. Do cat restrictions lead to increased species diversity or abundance of small and mediumsized mammals in remnant urban bushland? *Pacific Conservation Biology* 16, 162-72, 2010

Lilith M, Calver M, Garkaklis M. Roaming habits of pet cats on the suburban fringe in Perth, Western Australia: what size buffer zone is needed to protect wildlife in reserves? *Too Close for Comfort : Contentious Issues in Human-Wildlife Encounters*, 2008

Lilith, M., M. Calver, I. Styles and M. Garkaklis. 2006. Protecting wildlife from predation by owned domestic cats: application of a precautionary approach to the acceptability of proposed cat regulations. *Austral Ecology* 31: 176-189.

Lima, S.L. (1998) Stress and decision making under the risk of predation: recent developments from behavioral, reproductive, and ecological © 2013 The Authors. *Journal of Applied Ecology* © 2013 British Ecological Society, *Journal of Applied Ecology*, 50, 15–24 Fearing the feline 23 perspectives. *Advances in the Study of Behavior: Stress and Behavior*, Vol. 27 (eds A.P. Møller, M. Milinski & P.J.B. Slater), pp. 215–290. Academic Press, London, UK.

Linda K. Lord, dvm, phd, Attitudes toward and perceptions of free-roaming cats among individuals living in Ohio, *JAVMA*, Vol 232, No. 8, April 15, 2008 *Scientific Reports* 1159 – 1167

Linseele, V., W. Van Neer and S. Hendrickx. 2007. Evidence for early cat taming in Egypt. *Journal of Archaeological Science* 34(12): 2081-2090.

Lipinski MJ, Froenicke L, Baysac KC, Billings NC, Leutenegger CM, Levy AM, Longeri M, Niini T, Ozpinar H, Slater MR, Pedersen NC, Lyons LA. The ascent of cat breeds: genetic evaluations of breeds and worldwide random-bred populations.

Genomics. 2008; 91:12–21. [PubMed: 18060738]

Littin, K. E., D. J Mellor, B. Warburton and C. T. Eason. 2004. Animal welfare and ethical issues relevant to the humane control of vertebrate pests. *New Zealand Veterinary Journal* 52(1): 1-10.

Littin, KE, Mellor, DJ. 2005. Strategic animal welfare issues: ethical and animal welfare issues arising from the killing of wildlife for disease control and environmental reasons. *Review Science and Technology* 24: 767– 782.

Littin, KE. 2010. Animal welfare and pest control: meeting both conservation and animal welfare goals. *Animal Welfare* 19: 171– 176.

Little S. A review of feline leukemia virus and feline immunodeficiency virus seroprevalence in cats in Canada. *Veterinary immunology and immunopathology*. 2011; 143:243–245. [PubMed: 21757241]

Little, S.E., “Feline Immunodeficiency Virus Testing in Stray, Feral, and Client-Owned Cats of Ottawa.” *Canadian Veterinary Journal*, 2005, 46(10): 898–901. <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1255591/>

Llewellyn, L. M., and F. M. Uhler. 1952. The foods of fur animals of the Patuxent Research Refuge, Maryland. *American Midland Naturalist* 48:193-203. <http://dx.doi.org/10.2307/2422142>

#### 74

Lockwood, R. 2005. Cruelty toward cats: changing perspectives. Pp. 15-26 In: Salem, D. J and A.N. Rowan (eds.). *The State of the Animals 2005*. Washington, DC: Humane Society Press.

Lohr, C., L. J. Cox and C. A. Lepczyk. 2012. Costs and benefits of Trap-Neuter-Release and euthanasia for removal of urban cats in Oahu, Hawaii. *Conservation Biology*: Online September 25: 1-10.

Lohr CA, Lepczyk CA. Desires and management preferences of stakeholders regarding feral cats in the hawaiian islands. *Conserv Biol*. (2013) 28:1–12. [10.1111/cobi.12201](https://doi.org/10.1111/cobi.12201)

Lohr CA. Human dimensions of introduced terrestrial vertebrates in the hawaiian islands. Ph.D., dissertation, University of Hawaii at Manoa; (2012).

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(4): 887-894.

Longcore, T. et al. An estimate of mortality at communication towers in the United States and Canada. *PLoS one* 7, e34025 (2012).

Lord, L. K. 2008. Attitudes toward and perceptions of free-roaming cats among individuals living in Ohio. *Journal of the American Veterinary Medical Association* 232(8): 1159-1167.

Lord LK, Wittum TE, Ferketich AK, Funk JA, Rajala-Schultz P, Kauffman RM. Demographic trends for animal care and control agencies in Ohio from 1996 to 2004. *J Am Vet Med Assoc*. (2006) 229:48–54. doi: 10.2460/javma.229.1.48

Lord LK, Wittum TE, Ferketich AK, Funk JA, Rajala-Schultz PJ. Search and identification methods that owners use to find a lost cat. *J Am Vet Med Assoc*. (2007) 230:217–20. doi: 10.2460/javma.230.2.217

Lord LK, Wittum TE, Scarlett JM. Use of group-randomized trials in pet population research. *Prev Vet Med* 2007;82:167–175.

Loss, S., P. Marra, P. Blancher and W. Scott. 2012. The impact of feral and free-ranging house cats on birds in the United States. 5th American Ornithological Congress, Abstract.

Loss SR, Will T, Marra PP, The impact of free-ranging domestic cats on wildlife of the United States, *NATURE COMMUNICATIONS* | 4:1396 | DOI: 10.1038/ncomms2380

Loss SR, Will T, Marra PP (2012) Direct human-caused mortality of birds: improving quantification of magnitude and assessment of population impact. *Front Ecol Environ* 10:357–364

Loss SR, Will T, Marra PP (2015) Direct mortality of birds from anthropogenic causes. *Ann Rev Ecol Evol Syst* 46:99–120

Loss, SR, Marra, PP. 2017. Population impacts of free-ranging domestic cats on mainland vertebrates. *Frontiers of Ecology and Environment* 15: 502– 509.

- Loss, SR, Marra, PP. 2018. Merchants of doubt in the free-ranging cat conflict. *Conservation Biology* 32: 265– 266. Lowe, L. 2009. Port of Halifax's cat fix. *The Coast*, 9 April. [online] URL: <http://www.thecoast.ca/halifax/port-of-halifaxscat>
- Loyd, K. A. and C. A. Miller. 2010a. Factors related to preferences for trap-neuter-release management of feral cats among Illinois landowners. *Journal of Wildlife Management* 74(1): 160-165.
- Loyd, K. A. and C. A. Miller. 2010b. Influence of demographics, experience and value orientations on preferences for lethal management of feral cats. *Human Dimensions of Wildlife* 15: 262-273.
- Loyd, K. A.T. and J. L. DeVore. 2010. An evaluation of feral cat management options using a decision analysis network. *Ecology and Society* 15, no. 4: [online] <http://www.ecologyandsociety.org/vol15/iss4/art10>.
- Loyd K.A.T., S.M. Hernandez, J.P. Carroll, K.J. Abernathy, and G.J. Marshall. 2013. Quantifying free-roaming domestic cat predation using animal-borne video cameras. *Biological Conservation* 160: 183-189.

## 75

- Loyd KAT, Miller CA. Influence of demographics, experience and value orientations on preferences for lethal management of feral cats. *Hum Dimen Wildl.* (2010) 15:262–73. 10.1080/10871209.2010.491846
- Loyd K, Hernandez S. Public perceptions of domestic cats and preferences for feral cat management in the Southeastern United States. *Anthrozoö* (2012) 25:337–51. doi: 10.2752/175303712X13403555186299
- Lozano, J., Virgós, E., Malo, A. F., Huertas, D. L., and Casanovas, J. G. (2003). Importance of scrub–pastureland mosaics for wild-living cats occurrence in a Mediterranean area: implications for the conservation of the wildcat (*Felis silvestris*). *Biodiversity and Conservation* 12, 921–935. doi:10.1023/A:1022821708594
- Luna-Mendoza, L., Barredo-Barberena, J. M., Hernández-Montoya, J. C., Aguirre-Muñoz, A., Méndez-Sánchez, F. A., Ortiz Alcaraz, A., and Félix-Lizárraga, M. (2011). Planning for the eradication of feral cats on Guadalupe Island, Mexico: home range, diet, and bait acceptance. In 'Island Invasives: Eradication and Management'. (Eds C. R. Veitch, M. N. Clout, and D. R. Towns.) pp. 192–197. (IUCN: Gland.)
- Luoma, J. R. 1997. Catfight: feral cats are dining on birds and other small wild animals by the millions. *Audubon* 99: 84-91.
- Luria B.J., Levy J.K., Lappin M.R., Breitschwerdt E.B., Legendre A.M., Hernandez J.A., Gorman S.P., Lee I.T. Prevalence of infectious diseases in feral cats in Northern Florida. *J. Feline Med. Surg.* 2004;6:287–296. doi: 10.1016/j.jfms.2003.11.005. [PubMed] [CrossRef] [Google Scholar]
- Lynn, WS. 1998. Contested moralities: animals and moral value in the Dear/Symanski debate. *Ethics, Place and Environment* 1: 223– 242.
- Lynn, WS. 2006. Between science and ethics: what science and the scientific method can and cannot contribute to conservation and sustainability. Pages 191– 205 in D Lavigne, editor. *Gaining ground: in pursuit of ecological sustainability*. University of Limerick, Limerick.
- Lynn, WS. 2018. Bringing ethics to wild lives: public policy for barred and northern spotted owls. *Society & Animals: Special Issue on Wildlife* 26: 217– 238.
- Lyver, P.O'.B. (2000) Identifying mammalian predators from bite marks: a tool for focusing wildlife protection. *Mammal Review*, 30, 31–44.

# M

- Macdonald, D. 1981. The behaviour and ecology of farm cats. *The Ecology and Control of Feral Cats*. Potter Bar. The Universities Federation for Animal Welfare.
- Macdonald, D. W. and P.J. Apps. 1978. The social behaviour of a group of semi-dependent farm cats, *Felis catus*: a progress report. *Carnivore Genetics Newsletter* 3(7): 256-268.
- Macdonald, D. and D. Burnham. 2010. *The State of Britain's Mammals: a focus on invasive species*, People's Trust for Endangered Species, London.

Maclean MM, Carslake DJ, Evans MR, Townley S, Hodgson DJ. The usefulness of sensitivity analysis for predicting the effects of cat predation on the population dynamics of their avian prey. *Ibis* 150, 100-113, 2008

MacNulty, D. R., D. W. Smith, J. A. Vucetich, L. D. Mech, D. R. Snyahler and C. Packer. 2009. Predatory senescence in ageing wolves. *Ecology Letters* 12: 1347-1356.

Maguire, L. A. 2004. What can decision analysis do for invasive species management? *Risk Analysis* 24:859-868.

Mahlow, J. C., and M. R. Slater. 1996. Current issues in the control of stray and feral cats. *Journal of the American Veterinary Medical Association* 209(12): 2016-2020.

76

Mameno K, Kubo T, Suzuki M. Social challenges of spatial planning for outdoor cat management in Amami Oshima Island, Japan. *Glob Ecol Conserv.* (2017) 10:184–93. doi: 10.1016/j.gecco.2017.03.007

Mann, C. C. 2011. 1493: uncovering the new world Columbus created. New York: Alfred A. Knopf.

Manning, A.M. and A. N. Rowan. 1992. Companion animal demographics and sterilization status: results from a survey in four Massachusetts Towns. *Anthrozoos* 5(3): 192-201.

Mark C. Andersen, Brent J. Martin, Gary W. Roemer, Use of matrix population models to estimate the efficacy of euthanasia versus trap-neuter-return for management of free-roaming cats, *JAVMA*, Vol 225, No. 12, December 15, 2004 Scientific Reports: Original Study 1871-1876

Marks, B. K. and R. S. Duncan. 2009. Use of forest edge by free-ranging cats and dogs in an urban forest fragment. *Southeastern Naturalist* 8(3): 427-436.

Marks, C. 1999. Ethical issues in vertebrate pest management: can we balance the welfare of individuals and ecosystems? Pp. 79-89. In: D. Mellor and V. Monamy (eds.). *Proceedings of the Conference held at the Western Plains Zoo, Dubbo, NSW, Australia: ANZCCART.*

Marks, C., M. J. Johnston, P. M. Fisher, K. Pontin and M. J. Shaw. 2006. Differential particle size ingestion: promoting target specific baiting of feral cats. *The Journal of Wildlife Management* 70(4): 1119-1124.

Marlow, NJ, Thomas, ND, Williams, AAE, Macmahon, B, Lawson, J, Hitchen, Y, Angus, J, Berry, O. 2015. Cats (*Felis catus*) are more abundant and are the dominant predator of woylies (*Bettongia penicillata*) after sustained fox (*Vulpes vulpes*) control. *Australian Journal of Zoology* 63: 18– 27.

Marra PP, Santella C. *Cat Wars: The Devastating Consequences of a Cuddly Killer*. Princeton, NJ: Princeton University Press; (2016).

Marra, PP, Santella, C. 2016b. The zombie maker: cats as agents of disease. Pages 75– 94 in *Cat wars: the devastating consequences of a cuddly killer*. Princeton University Press, Princeton, New Jersey.

Marston LC, Bennett PC. Admissions of cats to animal welfare shelters in Melbourne, Australia. *Journal of Applied Animal Welfare Science* 12, 189- 213, 2009

Martin G. Feral cats blamed for decline in Golden Gate Park songbirds. *San Francisco Chronicle* 1992;Jan 13:1.

Martin, T.E., Lloyd, P., Bosque, C., Barton, D.C., Biancucci, A.L., Cheng, Y.R. & Ton, R. (2011) Growth rate variation among passerine species in tropical and temperate sites: an antagonistic interaction between parental food provisioning and nest predation risk. *Evolution*, 65, 1607–1622.

Martin, T.E., Martin, P.R., Olson, C.R., Heidinger, B.J. & Fontaine, J.J. (2000) Parental care and clutch sizes in North and South American birds. *Science*, 287, 1482–1485.

Mass treatment of humans exposed to rabies—New Hampshire, 1994. *MMWR Morb Mortal Wkly Rep* 1994;44:1–3.

Matheson, C. 1944. The domestic cat as a factor in urban ecology. *Journal of Animal Ecology* 13(2): 130-133.

Matias R, Catry P. The diet of feral cats at New Island, Falkland Islands, and impact on breeding seabirds. *Polar Biology* 31, 609-16, 2008

May, R. M. 1988. Control of feline delinquency. *Nature (London)* 332(6163): 392-393.

McCabe, R. A. and E. L. Kozicky. 1972. A position on predator management. *Journal of Wildlife Management* 36(2): 382-394.

McCarthy RJ, Levine SH, Reed JM. Estimation of effectiveness of three methods of feral cat population control by use of a simulation model. *J Am Vet Med Assoc.* (2013) 243:502–11. doi: 10.2460/javma.243.4.502

77

McElroy, K. M., B. L. Blagburn, E. B. Breitschwerdt, P. S. Mead, and J. H. McQuiston, 2010: Flea-associated zoonotic diseases of cats in the USA: bartonellosis, flea-borne rickettsioses, and plague. *Trends Parasitol.* 26, 197–204.

McGlade TR, Robertson ID, Elliot AD, et al. High prevalence of *Giardia* detected in cats by PCR. *Vet Parasitol* 2003;110:197–205.

McGregor HW, Legge S, Jones ME, Johnson CN (2014) Landscape management of fire and grazing regimes alters the fine scale habitat utilisation by feral cats. *PLoS One* 9(10):e109097.

McGregor, H.W., Legge, S., Potts, J., Jones, M.E. & Johnson, C.N. (2015). Density and home range of feral cats in north western Australia. *Wildl. Res.* 42, 223–231.

McKay SA, Farnworth MJ, Waran NK. Current attitudes toward, and incidence of, sterilization of cats and dogs by caregivers (owners) in Auckland, New Zealand. *Journal of applied animal welfare science : JAAWS* 12, 331-44, 2009

McMurray, F. B. and C. C. Sperry. 1941. Food of feral house cats in Oklahoma, a progress report. *Journal of Mammalogy* 22(2): 185-190.

Mead, C. J. 1982. Ringed birds killed by cats. *Mammal Review* 12: 183-186.

Medina, F. M. and M. Nogales. 2007. Habitat use of feral cats in the main environments of an Atlantic Island (La Palma, Canary Islands). *Folia Zoologica* 56(3): 277-283.

Medina, F. M. and R. Garcia. 2007. Predation of insects by feral cats (*Felis silvestris catus* L., 1758) on an oceanic island (La Palma, Canary Island). *Journal of Insect Conservation* 11: 203-207.

Medina, F. M. and M. Nogales. 2009. A review on the impacts of feral cats (*Felis silvestris catus*) in the Canary Islands: implications for the conservation of its endangered fauna. *Biodiversity Conservation* 18: 829-46.

Medina, F. M., E. Bonnaud, E. Vidal, B. R. Tershy, E. S. Zavaleta, C. J. Donland, B.S. Keitt, M. Le Corre, S. V. Horwath and M. Nogales. 2011. A global review of the impacts of invasive cats on island endangered vertebrates. *Global Change Biology* 17(11): 3503-3510.

Medina FM, Garcia R, Nogales M. Feeding ecology of feral cats on a heterogeneous subtropical oceanic island (La Palma, Canarian Archipelago). *Acta Theriologica* 51, 75-83, 2006

Medina, F. M., Bonnaud, E., Vidal, E., and Nogales, M. (2014). Underlying impacts of invasive cats on islands: not only a question of predation. *Biodiversity and Conservation* 23, 327–342. doi:10.1007/s10531-013-0603-4

Medway DG (2004) The land bird fauna of Stephens Island, New Zealand in the early 1890s, and the cause of its demise. *Notornis*, 51, 201–211.

Meeks, PD. Food items brought home by domestic cats *Felis catus* (L) living in Booderee National Park, Jervis bay. *Proceedings of the Linnean Society of New South Wales* 1998, 43-7, 1998

Meeks, P. D. 2003. Home range of house cats *Felis catus* living within a national park. *Australian Mammalogy* 25: 51-60.

Mendes-De-Almeida F, Faria MCF, Branco AS, Serrão ML, Souza AM, Almosny N, Chame M, Labarthe N. Sanitary conditions of a colony of urban feral cats (*Felis catus* Linnaeus, 1758) in a zoological garden of Rio de Janeiro, Brazil. *Revista do Instituto de Medicina Tropical de Sao Paulo* 46, 269-74, 2004

Mendes-de-Almeida F, Labarthe N, Guerrero J, Faria MCF, Branco AS, Pereira CD, Barreira JD, Pereira MJS. Follow-up of the health conditions of an urban colony of free-roaming cats (*Felis catus* Linnaeus, 1758) in the city of Rio de Janeiro, Brazil. *Veterinary Parasitology* 147, 9-15, 2007b

