THE URBAN WILDLANDS GROUP, INC.
P.O. Box 24020, Los Angeles, California 90024-0020, Tel (310) 247-9719

October 1, 2012

Councilmember Paul Kortez, Chair
Personnel and Animal Welfare Committee
City of Los Angeles

Re: Item 4, October 2, 2012, Council File 12-1508

Dear Councilmember Koretz,

Please find attached comments from The Urban Wildlands Group regarding the use of funds from the Animal Welfare Trust Fund to perform CEQA analysis on the proposed "Cat Program" for the City that were submitted when this item was heard by the Board of Animal Services Commissioners. Even though the definition of the "Cat Program" is not included in your current action, the comments are relevant to your Committee's decision.

We note that the Animal Welfare Trust Fund is restricted to support of existing programs of the City. The "Cat Program," in that it includes the implementation of support and/or facilitation of trap-neuter-return (TNR) for feral cats, is not an existing program of the City. This fact was affirmed by Judge McKnew in the case *The Urban Wildlands Group v. City of Los Angeles*. It would therefore appear to be an inappropriate use of monies donated to this trust fund to pay for CEQA analysis for this new program.

Please also consider the scientific information in the attached letter, which explains why the proposed "Cat Program" is neither in the best interest of the City nor consistent with the City's responsibility to maintain public health and safety and the environment. This program should be reconceived before funds are wasted reviewing it under CEQA. I have also attached a very recent peer-reviewed scientific article reviewing the public health impacts of feral cats, which notes the ineffectiveness of trap-neuter-return at controlling feral cats and their impacts.

Sincerely,

Travis Longcore, Ph.D.
Science Director

THE URBAN WILDLANDS GROUP, INC.
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August 13, 2012

Board of Commissioners
Department of Animal Services
City of Los Angeles
221 N. Figueroa Street, 5th Floor
Los Angeles, CA 90012

Re: Authorization to use $52,000 from the Animal Welfare Trust Fund to Pay for the Preparation of an Environmental Clearance Regarding LA Animal Services' Proposed "Cat Program"

Dear Commissioners:

The Urban Wildlands Group was the lead plaintiff with five other conservation groups in the 2008 lawsuit against the City of Los Angeles that revealed that your Department was surruptitiously implementing a Trap-Neuter-Return (TNR) program for feral cats prior to proper environmental review and resulting in the current injunction blocking the City from further TNR supporting actions until and unless proper review under the California Environmental Quality Act (CEQA) is undertaken. We are therefore interested in providing comments on this item. Your Department did not, however, provide the Board Report for this item to us (even though we are on record as an interested party) and we only became aware of it last Thursday, giving very little time to formulate and draft a response.

The item before you appears to have two parts. First is the authorization of use of funds from the Animal Welfare Trust Fund to do environmental analysis. Second is the adoption of a project description not previously discussed by the Commission that contains a range of proposed changes in policy regarding cats, and especially regarding stray and feral cats.

Use of Animal Welfare Trust Fund for Core Administrative Expense Is Inappropriate

It is not immediately obvious that environmental compliance is an appropriate use of funds from the Animal Welfare Trust Fund. On the Department's website, you solicit donations to this fund with the following description of uses: "Your donation to the Animal Welfare Trust Fund will be used to enhance the quality of life for shelter animals by funding animal supplies, medical equipment or services and other improvements to enrich the lives of the animals in our care. These funds also assist with expenditures related to the foster program and special medical treatment that may be outside the scope of day-to-day shelter care."[1] It would seem that people

[1] http://www.laanimalservices.com/Donate/TD_Wills_Bequests.htm

donate to this fund to help animals in shelters, and not to facilitate the reabandonment and feeding of feral cats.

This Board recently accepted a donation of $41,841.36 from the Estate of Marie Elizabeth Tyner to the Animal Welfare Trust Fund. Ms. Tyner gave equal shares of her estate to American Cancer Society, American Diabetes Association, and your Animal Welfare Trust Fund. It seems hard to believe that she intended for her entire donation to be used to undertake an environmental review that is rightly a core administrative function of the Department, rather than be used to "enhance the quality of life of shelter animals" as she would have been led to believe by the Department's description of the uses of the fund. Should Ms. Tyner's executor learn of this use of the funds, he or she might have a cause of action against the City for the misappropriation of the bequest. If she intended for the money to go to policy changes for feral cats, there are any number of other organizations to which she might have bequeathed her estate.

Development of policy and compliance with relevant environmental laws is a core administrative function of a City department. It is highly inappropriate to misdirect gifts intended for other purposes to subsidize core administrative functions.

Board Report Omits Results of Initial Scoping for TNR Program

In the history leading up to the proposed project description, the Board Report for this item recounts a stakeholder survey that was undertaken by the department on a proposed TNR program for feral cats. Apparently the Department received a report summarizing the responses to this survey in November 2011, but this report is not available on the Department's website, nor is it attached to the current item. This is a rather remarkable omission, since the responses to the survey should have been used to inform the project description now being proposed. In particular, the Commission should have been made aware that the County of Los Angeles Department of Public Health submitted comments that indicated their position that TNR was not an effective means to control feral cats, writing:

> "The Los Angeles County Department of Public Health is especially concerned that this current proposal not only ignores the presence of feral cat colonies throughout the city, but exempts them from specific code enforcement. In the absence of regulation, this action appears to encourage the establishment of more feral cat colonies in residential neighborhoods, retail centers, on school, college, and hospital campuses, parks, beaches and highly sensitive sites such as natural wildlife areas."

The "Cat Program" that this Board is now being asked to approve specifically exempts feral cat feeders from code enforcement, contrary to the position of public health officials. Since the Department has not provided this letter, it is attached in full.

Incidentally, several feral cat activists and organizations also submitted responses to the survey in which they essentially argued that it should be legal to feed feral cats anywhere and on any property and without limitation and this new program does essentially that. Why does the current proposal include elements to legalize TNR and feral cat feeding in response to extreme

feral cat activists, while completely ignoring the opinion of public health officials and conservation organiztions?

Proposed "Cat Program" Is Mostly a Stray and Feral Cat Program

The proposed program confuses issues of the well being and maintenance of pet cats with the problem of stray and feral cats in the City. Most of the elements of the "Cat Program" explicitly have to do with stray and feral cats, with the exception of the increase in the number of cats allowed without a cat kennel license from 3 to 5. The cat limit increase is inappropriate to include here, since this controversial proposal, already approved by this Board, is currently before the Planning and Land Use Management Committee. The definition of cat kennel is a planning and zoning issue and should it be approved by the appropriate committee, and would be subject to CEQA review on its own. The proposal exempts feral cats from the limit anyway, so there is no connection between the increase in the pet limit for cats and the rest of the proposal.

Project Goals Abandon Public Health and Wildlife

The main goal of any "Cat Program" should be to reduce the number of stray and feral cats in the City. Yet, this is not even listed as a project goal. The goals are to increase spay/neuter of cats, reduce the euthanasia of cats, accommodate the maintenance and "improved management" of stray and feral cats, "support" the public in addressing nuisance issues with cats, and promote education about cat-related issues. By accepting and essentially promoting the feeding and care of stray and feral cats, the Board will contradict existing advice from public health officials and abandon the goal of reducing the number of stray and feral cats in the City.

Project Elements Are Ill-defined and Uneccessary

Use of Spay/Neuter Trust Fund for stray and feral cats by changing the word "pet" to "animal" in the relevant code

This change appears to be made to allow these funds to be used for stray and feral cats. Given that the City has mandatory spay/neuter for pet cats and cost is still a barrier to compliance, it does not make sense to now divert these funds to feral and stray cats.

Rent or lend traps for TNR

This element contains language stating that traps will be avaiable for nuisance abatement. This is already City policy and does not need to be included in this program or reviewed. The only change here is that traps will be made available for the purpose of TNR and so this should be identified as the change that will be analyzed.

Release cats to animal rescue and adoption organizations per State law

This proposed project element does not appear to recognize that State law treats feral cats differently from pet or stray cats. The Food and Agriculture Code gives an animal rescue or adoption organization the right to adopt "stray" cats before they are euthanized (Sec. 31752).

"Feral" cats are governed by a different provision (Sec. 31752.5). If a cat is thought to be feral it has to be held for three days during which it can be redeemed, but only by its owner. Then, after a temperament test, if the cat is truly feral, "the cat may be euthanized or relinquished to a nonprofit, as defined in Section 501 (c)(3) of the Internal Revenue Code, animal adoption organization." Note that the text is permissive ("may be released or euthanized"), giving local jurisdictions a choice to release a feral cat; this does not create an obligation to release a feral cat unless redeemed by its owner or caretaker. Also note that the cat can only be released to an animal "adoption" organization, not an animal "rescue" organization. TNR groups cannot be construed to be adoption organizations if they are to release a feral cat back outside. The City and any new program should be clear that feral cats can only be released to be adopted, or back to their "owners" or "caretakers" as defined by State law.

The project description should accurately reflect State law and the different treatment between stray and feral cats in it. It furthermore should acknowledge that there is no obligation to release feral cats to nonprofits, and then only to "adoption" groups and not so-called "rescue" groups that release the animal back outside instead of adopting to a home.

Increase cat limit from three to five

As noted above, this element of the project has already been approved by the Board, but met with considerable resistence, and is awaiting action elsewhere in City government. It should not be included in the current proposal and environmental review; the pet limit increase would need its own environmental review.

Amend code to define a cat colony

The proposed project description contains this definition: "For the purposes of this section, "Colony" shall mean a geographic location not in or adjacent to a public park or Sensitive Environmental Area where stray or feral cats typically live and/or where they forage or hunt for food, or are fed and generally cared for by individuals volunteering as "Caregivers," also commonly referred to as "Caretakers."

Presumably this definition is meant to prescribe where it is acceptable to feed feral cats by defining colonies as some place that is not in or adjacent to a public park or "Sensitive Environmental Area." The first problem is that "Sensitive Environmental Area" is not defined in the Municipal Code. Does the Department mean the Significant Ecological Areas defined by the County of Los Angeles? What about adjacent to schools? What about on private property with public access (e.g., shopping centers)? What about alleys behind homes? Behind businesses? Next to water reservoirs? Next to rivers and streams? Next to certified backyard wildlife habitats? How about on private property not owned by the person feeding the cats? Does the City intend to define and exempt from regulation activities that are taking place on all public and private land that is not "in or adjacent to a public park of Sensitive Environmental Area"? This would represent a dramatic erosion of private property rights and abdication of public safety that should be considered carefully by this Board before spending animal welfare money to evaluate under CEQA.

It also bears noting that cats do not occur in groups ("colonies") unless there is already a food source, so the "colonies" being defined here are the result of either poor hygeine (e.g., accessible garbage) or intential feeding of outdoor cats. The congration of domestic cats in such so-called "colonies" is caused entirely by humans.

Exempt feral cat feeders at cat colonies from the prohibition on feeding nondomesticated mammalian predators, provided the cat is sterilized

This is not particularly well thought out. How in the world would such a change be enforced? How would someone put out food and then exclude non-sterilized cats? It has been reported on social media that some feral cat enthusiasts tip the ears of cats they feed without sterilizing them to minimize the likelihood of their capture, so visual inspection is inadequate. The proviso that the cats be sterilized is utterly unenforceable, and in fact feeding is necessary to trap a cat for any purpose. Furthermore, does this then allow anyone feeding cats in a colony to violate other code sections, such as those prohibiting littering and trespassing?

Feeding stray and feral cats makes them reproduce more and especially increases kitten survival rates. Notwithstanding the prohibition (on paper) on feeding non-sterilized cats, they are inevitably fed by those maintaining feral cat colonies and produce kittens which then increase feral cat numbers.

Even feeding sterilized cats causes severe nuisance issues, as is unusually well-documented by a series of posts over several years to Internet discussion boards about a situation in Encino.

An elderly man, referred to below as "Sam" (not his real name given in the posts), has for several years reportedly been feeding ~40 cats every night around his apartment complex. The cats are described as being sterilized, yet their presence is clearly offensive to others in the neighborhood.

> October 2008 – A very kind elderly, disabled man in Encino, CA, is desperately trying to get some food to feed 40 cats that come to his apt complex every night. … He has no money to buy food, and it is killing him because he hears the starving cats outside his window every night crying from hunger.
>
> May 2009 – Sorry to bother you again about this, but Sam called me again yesterday, crying, saying he has no more food for the 40 ferals he feeds every day, and no money to get it and that he is soon to be hospitalized. He has some severe medical problems. He claims he can only feed the ferals on his street canned wet food because it gets eaten right away and no traces are left. He needs to do it this way because of the cat haters on the block. If he puts out dry food, some of it is left behind and he is trying to protect himself and the cats. … Since the last email I sent in October 2008, his colonies have been TNR'd so there are no newcomers cropping up, just the in-tact colonies.
>
> October 2009 – I have posted out for Sam before and he has received help in the past, but he is in need again. Sam is an elderly, disabled man who lives in an apartment in Encino. He feeds several colonies of cats on his block (cats are TNR'd). At some of the locations, cat haters, who have been tormenting Sam for years, are attempting to poison the cats. At these locations, Sam takes canned wet food, mixes it with some dry, balls it up and throws it over to a location that cannot be accessed by anyone except the cats. (I know poisoning animals is illegal and so does

> he, but he cannot post any signs in his area; his life has been threatened before, and his car was totaled by vandals because he feeds the cats, and Sam does not know who is doing it.)
>
> December 2009 – Sam, the elderly disabled man in Encino has been battling an evil moron apt owner on his block where he feeds several colonies of cats. The cat hater poisoned the cats, Sam called AC [Animal Control], AC sent the man a letter and made him stop, but now he has boarded up the crawl space under his building and the cats are in there and will die a slow and painful death if something is not done and I do not know what to do. I told Sam to call AC again and report this, but this cat hater also vandalized his ex-wife's car, they have no proof but they know it's him.
>
> June 2010 – I've sent out this plea about a year ago and I'm sending it again. Sam, an elderly, disabled man in Encino, feeds about 40 cats every night on his street. He goes from apartment to apartment late at night under the radar to feed feral cats at each location. … He lives on a street filled with cat haters, and he lives with a cat hater (he has no choice due to lack of funds). Because of his devotion to the cats, his life has been threatened, his car has been vandalized to a total loss, and he continues to fight a horrible condo manager across the street who keeps boarding up cats under the building. … His colonies have been TNR'd, so I told him I would post another plea for him to see if anyone can help him now and then or even with a one-time donation of cat food. Sam has no transportation.
>
> July 2011 – If anyone can help Sam, please let me know and I'll give you his phone number and/or address. … Thanks very much I've sent out pleas for this man before, but he is, once again, in need of WET food, for the approximately 45 feral cats he feeds on his street in Encino. He lives on a street devoted strictly to apt buildings and has been battling cat hating forces for years. Sam has no income and lives with someone that hates cats, so he has to hide everything he does for the cats. Sam is disabled with multiple physical/terminal problems, even walking has become an issue for him. If anyone can donate canned wet food to him, or even a gift card to Petco or Ralphs (they are close by so he can walk with a cart to them; he does not have a car), he would be very appreciative. I cannot help him or pay for any of it out of my own pocket since I have as many cats per day to feed myself (colonies) and do not have the funds to contribute to this.

This series of appeals, written from the perspective of someone who thinks that Sam is doing a good thing, reveal several things. First, it is obviously a very sad situation. Second, although all the cats are supposedly sterilized, the number stays stable 40 for years and then appears to increase. Third, those people refered to as "cat haters" are clearly just people who are fed up with the nuisance of having 45 cats fed on their block every day. Any rational politician considering feral cat policy should respect that such situations cause problems for many people, who, in the absence of any other recourse sometimes will go to inappropriate and inhumane extremes in attempts to remedy what is obviously a nuisance situation. As a City department with a responsibility to balance the best interest of all residents, it should not even be contemplated that it is acceptable for someone to perpetually feed dozens and dozens of cats that roam all over other people's property.

Exempt cat colonies from the pet limit

This project element represents a reversal of existing Department policy of using the cat kennel ordinance to reduce the number of stray and/or feral cats maintained at a property.[2] Significant impacts that could result from exempting stray/feral cats from the cat limit would allow any person in the city to feed and maintain as many cats as he or she wanted on just about any property.

Before spending money on an environmental review to adopt this policy, please consider that the impacts will be widespread and significant, including:

a. Adverse impacts to birds and other wildlife from feral, stray, and free-roaming cats;
b. Adverse impacts to public health from diseases vectored by cats and cat fleas, including toxoplasmosis, flea-borne typhus, and other communicable diseases and parasites;
c. Adverse impacts from artificial increases in numbers of urban wildlife species (e.g., raccoons, opossums, skunks) that result from the feeding of feral and stray cats;
d. Adverse impacts to water quality from animal waste; and
e. Adverse impacts from nuisance behaviors on private and public property.

The City of Los Angeles provides important habitat to native wildlife[3] that would be impacted by an increase in the number of cats with access to the outdoors.[4] Wildlife species are not only found in designated wildlife areas but in neighborhoods as well, which provide important resources for migratory and resident birds and other animals vulnerable to cat predation. The impacts of domestic cats that are allowed to roam outside to wildlife are well known and include direct and indirect pathways. Direct impacts occur from predation on wildlife species from outdoor cats. The City has proposed to lift limits on the number of stray and feral cats that can be maintained at a property so one must assume that the result of the new policy will be additional outdoor cats in the City. The negative association between the activity of cats in

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[2] See Departmental Press Release, "Cat Hoarder Busted for Cruelty" http://www.laanimalservices.com/PDF/actf/pressrelease/PressRelease-Cat_Hoarder.pdf, which cites Section 53.50 of the Municipal Code in the prosecution of a cat hoarder with too many cats outside.

[3] See e.g., B. Gumprecht. 1999. *The Los Angeles River: its life, death, and possible rebirth*. Seattle: University of Washington Press, D.S. Cooper. Annotated checklist of extirpated, reestablished, and newly-colonized avian taxa of the Ballona Valley, Los Angeles County, Caliofornia. *Bull South Calif Acad Sci* 2006; 105: 91–112, T. Longcore. 2006. The Green Visions Plan for 21st Century Southern California: A Guide for Habitat Conservation, Watershed Health, and Recreational Open Space. 8. Conservation of Biodiversity in the City: An Assessment of MRCA Projects in the Upper Los Angeles River Watershed. Los Angeles: University of Southern California Center for Sustainable Cities: 1–29.

[4] C.A. Lepczyk, et al. Landowners and cat predation across rural-to-urban landscapes. *Biol Conserv* 2003; 115: 191–201, Y. van Heezik, et al. Do domestic cats impose an unsustainable harvest on urban bird populations? *Biol Conserv* 2010; 143: 121–130, Y. van Heezik. Pussyfooting around the issue of cat predation in urban areas. *Oryx* 2010; 44: 153–154, K.R. Crooks & M.E. Soulé. Mesopredator release and avifaunal extinctions in a fragmented system. *Nature* 1999; 400: 563–566, K. Crooks. Tabby go home: house cat and coyote interactions in southern California habitat remnants. *Wild Earth* 1997; 7: 60–63, N. Dauphiné & 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. In *Tundra to tropics: connecting birds, habitats and people: Proceedings of the Fourth International Partners in Flight Conference.* T.D. Rich, et al., eds. McAllen, Texas: Partners in Flight.

habitats where birds are found and native bird diversity is well documented.[5] Furthermore, cats need not kill birds directly to depress their numbers; a negative behavioral effect from the presence of cats would be sufficient to exclude some species from areas where outdoor cats are found.[6] Cats can have indirect effects through the transmission of disease to wildlife[7] (and to humans, as discussed below).

Increasing the total number of cats by increasing the per resident/residence limit will increase the probability of transmission of disease to humans and to wildlife from cats that are allowed to roam outdoors, whether tame, stray, or feral. One of these diseases is toxoplasmosis, caused by the protozoan parasite *Toxoplasma gondii*, which once acquired by a human (or by other animals) remains in the brain for a lifetime, potentially causing a range of adverse impacts. Some risks of this infection have been known for some time, with a focus on pregnant women or immunocompromised individuals (e.g, those with HIV/AIDS), and usually with reference only to acute toxoplasmosis when the parasite is first acquired. However, more information is being learned about the effects of chronic *Toxoplasma* infection. The parasite forms cysts in the brain following the initial acute infection. The City should be aware, and factor into its decisions regarding exposure of its residents to additional outdoor cats, that research has identified associations between chronic infection with *Toxoplasma* and incidence of Parkinson's disease,[8] autism spectrum disorder,[9] schizophrenia (both through exposure of mother and direct exposure to individual),[10] psychosis,[11] increased risk of dying in a vehicular accident,[12] suicide,[13] and personality changes.[14] Some of these associations are not yet confirmed to be causal, but science and medicine continue to learn more about the adverse impacts of chronic infection by this parasite. These associations are, however, consistent with the documented changes in behavior

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[5] Crooks & Soulé. Mesopredator release and avifaunal extinctions in a fragmented system.
[6] A.P. Beckerman, et al. Urban bird declines and the fear of cats. *Anim Conserv* 2007; 10: 320–325.
[7] D.A. Jessup, et al. Feline leukemia virus infection and renal spirochetosis in free-ranging cougar (*Felis concolor*). *J Zoo Wildl Med* 1993; 24: 73–79.
[8] O. Miman, et al. The probable relation between *Toxoplasma gondii* and Parkinson's disease. *Neurosci Lett* 2010; 475: 129–131.
[9] J. Prandota. Autism spectrum disorders may be due to cerebral toxoplasmosis associated with chronic neuroinflammation cuasing persistent hypercytokinemia that resulted in an increased lipid peroxidation, oxidative stress, and depressed metabolism of endogenous and exogenous substances. *Research in Autism Spectrum Disorders* 2010; 4: 119–155.
[10] A.S. Brown, et al. Maternal exposure to toxoplasmosis and risk of schizophrenia in adult offspring. *Am J Psychiatry* 2005; 162: 767–773, E.F. Torrey & R.H. Yolken. *Toxoplasma gondii* and schizophrenia. *Emerging Infect Dis* 2003; 9: 1375–1380, R.H. Yolken, et al. Toxoplasma and schizophrenia. *Parasite Immunol* 2009; 31: 706–715.
[11] S. Zhu. Psychosis may be associated with toxoplasmosis. *Medical Hypotheses* 2009; 73: 799–801.
[12] J. Flegr, et al. Increased risk of traffic accidents in subjects with latent toxoplasmosis: a retrospective case-control study. *BMC Infect Dis* 2002; 2: 11., stating "acquired toxoplasmosis might in fact represent a serious and highly underestimated public health problem, as well as an economic problem", J. Flegr, et al. Increased incidence of traffic accidents in Toxoplasma-infected militrary drivers and protective RhD molecule revealed by a large-scale prospective cohort study. *BMC Infect Dis* 2009; 9: 72.
[13] T.A. Arling, et al. *Toxoplasma gondii* antibody titers and history of suicide attempts in patients with recurrent mood disorders. *Journal of Nervous and Mental Disease* 2009; 3: 905–908, F. Yagmur, et al. May *Toxoplasma gondii* increase suicide attempt-preliminary results in Turkish subjects? *Forensic Sci Int* 2010; 199: 16–17.
[14] K.D. Lafferty. Can the common brain parasite, *Toxoplasma gondii*, influence human culture? *Proc R Soc Lond, Ser B: Biol Sci* 2006; 273: 2749–2755.

shown by rats when their brains are infected with the parasitic cysts formed by *Toxoplasma gondii*.[15]

More cats in the environment will increase the environmental burden of the oocysts that are shed by infected cats with their feces. These are shed in the millions for a period when a cat is first infected and stay viable in the soil for up to 18 months.[16] Infection of humans in the developed world is caused primarily through exposure to soil contaminated by cat feces rather than through consuming undercooked meat.[17] Allowing additional cats and thereby increasing the environmental burden of oocysts would foreseeably increase the risk and rate of infection by *Taxoplasma gondii* and potentially expose the City to liability as the health impacts of this parasite become more well known. Indeed, a recent peer-reviewed scientific paper on the public health implications of toxoplasmosis included the following summary [quoting]:

- Cat owners who allow their pets outdoors should be made aware that their free-roaming cats can acquire and faecally shed the protozoan parasite, *Toxoplasma gondii*.
- Cat owners should be encouraged to keep their pets indoors and collect cat faeces in litter boxes destined for disposal in sanitary landfills.
- Persons who work with soil or garden regularly should wear gloves to protect themselves from pathogens in soil, such as *Toxoplasma gondii*, that are spread by owned and feral free-roaming cats.[18]

The proposed "Cat Program" takes away the right of residents to minimize their exposure to this parasite, since both owned and feral cats, so long as they are neutered, are allowed to roam onto any property under the Municipal Code.

Finally, cats that live or are allowed outdoors cumulatively deposit large quantities of fecal matter into the environment, which has a significant adverse impact on water quality. Cats from only 12,000 households around Morro Bay (the cities of Los Osos, Cayucos, and Morro Bay), deposited an estimated 105.9 tons of feces outside each year in an area of 11.5 square miles.[19] Cat feces contribute to impaired water quality[20] and are carried to water bodies through runoff, where they have adverse effects on wildlife.[21] Los Angeles is 44 times larger and much denser than the Morro Bay region that was studied. It would not be surprising if the annual burden of feces from outdoor cats in the City is already orders of magnitude larger (1.3 million households in Los Angeles vs 12,000 in the Morro Bay yields a rough estimate of 10,000 tons of cat feces

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[15] M. Berdoy, et al. Fatal attraction in rats infected with *Toxoplasma gondii*. Ibid. 2000; 267: 1591–1594.
[16] J.K. Frenkel. 2000. Biology of *Toxoplasma gondii*. In *Congenital toxoplasmosis: scientific background, clinical management and control.* P. Ambroise-Thomas & E. Petersen, eds. Paris: Springer-Verlag: 9–25.
[17] A.M. Tenter, et al. *Toxoplasma gondii*: from animals to humans. *Int J Parasitol* 2000; 30: 1217–1258, H.A. Dabritz & P.A. Conrad. Cats and *Toxoplasma*: implications for public health. *Zoonoses and Public Health* 2010; 57: 34–52.
[18] Dabritz & Conrad.
[19] H.A. Dabritz, et al. Outdoor fecal deposition by free-roaming cats and attitudes of cat owners and nonowners toward stray pets, wildlife, and water pollution. *J Am Vet Med Assoc* 2006; 229: 74–81.
[20] J.L. Ram, et al. Identification of pets and raccoons as sources of bacterial contamination of urban storm sewers using a sequence-based bacterial source tracking method. *Water Res* 2007; 41: 3605–3614.
[21] M.A. Miller, et al. Coastal freshwater runoff is a risk factor for *Toxoplasma gondii* infection of southern sea otters (*Enhydra lutris nereis*). *Int J Parasitol* 2002; 32: 997–1006.

yearly in Los Angeles, assuming similar rates of cats per household, outdoor access and proportion of feral cats). This is not merely an issue relevant to the coast or near watercourses; the storm drain system in Los Angeles drains all portions of the City to its waterways and into the ocean.

The City of Los Angeles Stormwater Ordinance, consistent with the Clean Water Act and California Water Code, defines "animal waste" from domestic animals ("such as discharge from confinement facilities, kennels, pens, recreational facilities, stables, and show facilities") as a "pollutant" (LAMC §64.70). The City has an obligation to reduce pollutants in stormwater to the maximum extent practicable. Increasing the number of cats that can legally roam free in the City would increase, not decrease, this pollutant in receiving waters within the City. Allowing pet waste to be discharged into the storm drain system (which drains essentially the entire City) is a crime under the Stormwater Ordinance (LAMC §64.70.02). Dog owners pick up after their dogs and the Department of Animal Services has a program to encourage this. Cat waste is also a pollutant, with pathogens dangerous to humans and wildlife,[22] and the City has no program to reduce this pollutant and in fact with this project description is taking steps to increase it across the City. The City of Los Angeles already faces severe water quality problems, including bacterial contamination, before adding 66% more owned cats (by raising the pet limit) plus unlimited legalized stray and feral cats, the Board should consider some alternatives that would result in a decrease in the number of stray and feral cats.

In sum, we encourage the Board to postpone any decision on the proposal project description and develop a program that is more responsive to the available facts about feral cats and their management that are available in the scientific literature and that were provided to the City as part of the stakeholder survey. This proposed project simply presents a set of policy changes gauranteed to result in significant adverse impacts on the environment that will be indentified during any properly conducted environmental review. Rather than wasting money in this fashion, especially money that was donated to help animals in the shelters, we encourage the Board to learn more about these issues and develop a stray and feral cat program that respects property rights, actually protects the environment, and will actually reduce the number of stray and feral cats in the City.

Sincerely,

Travis Longcore, Ph.D.
Science Director

[22] P.A. Conrad, et al. Transmission of *Toxoplasma*: clues from the study of sea otters as sentinels of *Toxoplasma gondii* flow into the marine environment. Ibid. 2005; 35: 1155–1168, Miller, et al.

COUNTY OF LOS ANGELES
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Dear Sir or Madam,

This communication is in response to your request for comments concerning the City of Los Angeles proposal to adopt a Trap, Neuter, and Return (TNR) program in an effort to reduce the number of feral cats within the city. Free-roaming cats, whether identified as feral, semi-feral, or owned, can be the source of environmental implications affecting species conservation, the physical environment, and both animal and human health.

The TNR Program proposed by the City of Los Angeles, as defined in the Department of Animal Services, Policies and Procedures, clearly defines the safe-keeping and humane treatment of feral cats, but does not include effective safeguards and protection for residents of properties near proposed colonies, or the general public who visit public areas within the recognized travel range of free-roaming cats. The intent of this response is to identify the public health and veterinary implications, as well as the nuisance factors, of free-roaming cat management practices as defined in the proposed TNR Program.

The Los Angeles County Department of Public Health has the responsibility to protect health, prevent disease, and promote the health and well-being for all persons in Los Angeles County. It is for this reason we must express our concerns regarding the sanitation issues and potential for disease transmission presented by having unlimited numbers of free-roaming cats in residential neighborhoods, commercial sectors, or adjacent to, or on, school campuses, parks, beaches, or other public lands and rights-of-way.

Our public health concerns involve the following issues:

- **The lack of sanitation associated with feral cat colonies**

The proposed TNR Program neither addresses the problem of fecal accumulation where the feral cat colony resides, nor on neighboring properties and residences within the roaming range of the colony. This lack of fecal sanitation could have a potentially negative affect on approximately 15 standard-sized residential properties within the immediate vicinity of the colony's feeding location.

Toxoplasma gondii is an intestinal protozoan parasite whose only definitive hosts are members of the cat family. Cats shed environmentally resistant oocysts in their feces for approximately 10 to 14 days after they become infected. These oocysts become infectious in 1 to 5 days after the cat defecates, and may remain infectious up to 18 months in moist soil and sand.

Toxocara cati is a nematode parasite of cats that resides in their small intestine. Infected cats may pass eggs in their feces. The eggs embryonate, become infectious after several weeks, and may survive in the environment for years.

Both *T. gondii* and *Tx. cati* can be spread to people, especially children, through accidental soil ingestion. This may occur if someone eats or touches their mouth inadvertently after their hands come into contact with contaminated soil during work or play. Studies have shown that soil in public parks and private backyards where cats regularly defecate can be contaminated with one or both organisms.

- **Widespread flea infestations in areas where the colony members congregate**

Flea infestations increase the risk of flea-borne typhus in residents. Flea-borne typhus is transmitted to humans by flea bites or skin abrasions that become contaminated with feces from cat fleas (Ctenocephalitis felis) containing the disease agent Rickettsia felis. In 2010, 39 reported cases originated in Los Angeles County, nine within the City of Los Angeles. Although flea-borne typhus is reportable in California, many cases elude detection and diagnosis. Physicians are likely to test only severely ill individuals who require hospitalization, and tests may remain negative during the first week of illness. It has been estimated that for every reported case, three or more cases are either misdiagnosed or do not require hospitalization.

The primary hosts for the cat flea are opossums, dogs, and cats. The most successful means of preventing contact with potentially infected cat fleas is to avoid exposure to fleas, and effectively treat pets with topical or oral flea control products. Although opossums cannot be treated with either of these products, flea exposure from opossums can be reduced by successfully discouraging opossums from frequenting human- and pet-inhabited areas. Strategies for doing this include feeding pets during the day and removing uneaten food at night, keeping tight-fitting lids on trash cans, removing fallen fruit, and eliminating heavy vegetation or other harborage areas.

Unfortunately, flea infestations that result from feral or semi-feral cats are rarely, if ever, successfully managed. To eliminate fleas effectively, it is vital to routinely address both the infested animal and their environment. Although topical flea control medications will kill fleas within hours of application, they cannot be administered to feral cats due to the inability to safely handle the animals. Feed-through products available for cats that disrupt the reproductive cycle of

fleas (but do not kill the adult fleas) are effective, but it is not possible to administer the required oral dose (135 mg) every 30 days as required to each cat during typical mass-feeding operations. Although yard treatments of pesticides can be immediately effective, flea-infested cats that return to the area will continually introduce new infestations.

Our Department regularly receives complaints from frustrated residents who are unable to eliminate fleas in their yards due to the repeated presence of free-roaming cats from neighboring properties. Residents who are unable to successfully control fleas on their properties are severely compromised by this nuisance and are at increased risk of contracting flea-borne typhus.

- **Cat food placed in the environment unattended, particularly under conditions of mass-feeding, attracts opossums, raccoons, skunks, and other potentially nuisance wildlife**

Feral cat care-givers commonly resort to mass-feeding operations that include depositing and maintaining large amounts of dried cat food in the immediate area where the colony resides. This practice encourages the presence of urban wildlife such as rats, opossums, raccoons, and skunks, bringing them into close contact with humans and their pets. Populations of these species are consequently increased by direct food subsidies, thus escalating the risk of exposure to fleas and other parasites that could directly affect the health of humans and their pets. The presence of feral and semi-feral cats is also an attractant for coyotes, which view them as prey. Furthermore, even if TNR managers intend to keep food away from wildlife, in observations made by our Department, such mitigation efforts are ineffective in practice.

Raccoon roundworm (*Baylisascaris procyonis*) is a ubiquitous infection of raccoons that is increasingly being recognized as a cause of severe human and animal disease. Since 1993, four documented cases of human Baylisascaris encephalitis have occurred in California; two in the northern portion of the state, and the two remaining cases occurred in Los Angeles and Santa Barbara counties.

When raccoon densities are high, substantial deposits of feces accumulate in areas of habitual defecation known as "latrines". These sites become long-term sources of infection for humans and other animals. Humans become infected accidentally by coming into contact with active or abandoned latrine sites and inadvertently ingesting eggs containing B. procyonis larvae. Young children are especially at risk for infection because of their propensity to handle objects and put them in the mouth. Pets can also become infected by exposure to raccoon feces or contaminated soil. In a study conducted in Orange County in 2000, a total of 800 distinct raccoon latrine sites were sampled for the presence of *B. procyonis*. All samples collected contained *B. procyonis* eggs; the average egg count per gram of fecal material was 30,256 ± 867 se.

Raccoons and skunks are established reservoirs for the fatal disease rabies in the United States. Encouraging the presence of these two wild animals in neighborhoods and public areas presents the risk of exposure to humans and their pets. Over 2300 rabid raccoons, and over 1600 rabid skunks, were detected nationwide in 2009. In the same year, 44 rabid skunks were detected in California; 12 were found as far south as Santa Barbara. Although no rabid skunks have been identified in Los Angeles County since 1979, the risk of reintroduction of the virus to local populations remains constant.

In response to the risk of exposure to the rabies virus, case investigations of people who are bitten by raccoons or skunks in Los Angeles County are routinely processed for rabies post-exposure prophylaxis. Pet cats or dogs that are bitten by raccoons or skunks must be held in quarantine

unless the biting wild animal is euthanized and subsequently tests negative for rabies. In most instances this does not happen and the pet is quarantined. By state law, pets that are up-to-date on their vaccination at the time of the bite are quarantined for 30 days. Pets not current on their rabies vaccinations at the time of the bite must be either euthanized or quarantined for 180 days.

Raccoons and skunks are also reservoirs for leptospirosis, which can cause serious kidney and liver infections in dogs and humans. Since 2005, there have been 21 cases of canine leptospirosis reported in Los Angeles County. Eight of the dogs died as a result. In one fatal case, a rat infestation was the suspected source of the infection. In another, a raccoon routinely contaminated the dog's water bowl in the weeks before the dog's illness and death.

- **TNR programs appear to be driven by a desire to reduce euthanasia in shelters rather than to reduce feral cat numbers**

TNR should not be considered as a viable, long-term alternative to overcrowded shelters. The Department finds it surprising that many avenues available to reduce populations of feral cats are not proposed by the City of Los Angeles. Approaches that must be considered include cat licensing, low-cost spay/neuter services for owned cats, and/or a prohibition on cats running at large. Measures such as these would help to promote responsible pet ownership as well as potentially assist in reducing feral cat numbers.

The American Association of Wildlife Veterinarians, the National Association of State Public Health Veterinarians, and the United States military have published position statements that emphasize the inability of TNR programs to reduce feral cat populations and address public health issues. The Los Angeles County Department of Public Health is especially concerned that this current proposal not only ignores the presence of feral cat colonies throughout the city, but exempts them from specific code enforcement. In the absence of regulation, this action appears to encourage the establishment of more feral cat colonies in residential neighborhoods, retail centers, on school, college, and hospital campuses, parks, beaches and highly sensitive sites such as natural wildlife areas.

We therefore join with other notable organizations in our recommendation that the City of Los Angeles consider the public health implications of adopting a program that not only permits, but encourages, unlimited numbers of feral cats throughout the city.

Sincerely,

Terrance Powell, Director
Bureau of Specialized Surveillance and Enforcement

c. Angelo Bellomo, Director Los Angeles County Department of Environmental Health
Carmen Trutanich, City Attorney
Antonio Villaraigosa, Mayor
Gerry F. Miller, Chief Legislative Analyst
Miguel A. Santana, City Administrative Officer
Eric Garcetti, President, Los Angeles City Council
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REVIEW ARTICLE

Zoonotic Diseases Associated with Free-Roaming Cats

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Impacts

- Free-roaming cats are an important source of zoonotic diseases including rabies, *Toxoplasma gondii*, cutaneous larval migrans, tularemia and plague.
- Free-roaming cats account for the most cases of human rabies exposure among domestic animals and account for approximately 1/3 of rabies post-exposure prophylaxis treatments in humans in the United States.
- Trap–neuter–release (TNR) programmes may lead to increased naïve populations of cats that can serve as a source of zoonotic diseases.

Keywords:
Cutaneous larval migrans; free-roaming cats; rabies; toxoplasmosis; zoonoses

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Summary

Free-roaming cat populations have been identified as a significant public health threat and are a source for several zoonotic diseases including rabies, toxoplasmosis, cutaneous larval migrans because of various nematode parasites, plague, tularemia and murine typhus. Several of these diseases are reported to cause mortality in humans and can cause other important health issues including abortion, blindness, pruritic skin rashes and other various symptoms. A recent case of rabies in a young girl from California that likely was transmitted by a free-roaming cat underscores that free-roaming cats can be a source of zoonotic diseases. Increased attention has been placed on trap–neuter–release (TNR) programmes as a viable tool to manage cat populations. However, some studies have shown that TNR leads to increased immigration of unneutered cats into neutered populations as well as increased kitten survival in neutered groups. These compensatory mechanisms in neutered groups leading to increased kitten survival and immigration would confound rabies vaccination campaigns and produce naïve populations of cats that can serve as source of zoonotic disease agents owing to lack of immunity. This manuscript is a review of the various diseases of free-roaming cats and the public health implications associated with the cat populations.

Domestic cats are a potential source of numerous infectious disease agents; however, many of these diseases are controlled in cats belonging to responsible owners through routine veterinary care, proper vaccination regimens and parasite chemotherapy. Free-roaming cats often lack the necessary preventative care to control these diseases and consequently pose a potential health threat to other domestic animals, wildlife and humans. Historically, animal control programmes have been paramount in minimizing zoonotic risk in the United States. In the 1950s, a rabies control programme began, which included mandatory rabies vaccination in dogs and animal control programmes aimed at removing free-roaming animals (Rupprecht et al., 2001). These programmes have significantly reduced the incidence of human rabies in the United States. However, in the last decade, there has been a marked reduction in social support for collection and euthanasia of free-roaming animals, particularly cats. In some areas, animal control has been turned over to private organizations that follow a 'no-kill' philosophy and routinely release free-roaming animals. Diminished resources and willingness to collect free-roaming animals

have led to increasing numbers of free-roaming animals; and rabies exposure in humans remains an important public health threat.

Rabies

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). In contrast, dogs accounted for 69 rabies cases, which is a 14% decrease from 2009. Although rabies is detected most frequently in various wild animals in the United States and the majority of human rabies cases in the United States are attributable to bites of rabid bats, 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 programmes (Childs, 1990; Cole and Atkins, 2007; Roseveare et al., 2009; Eidson and Bigman, 2010). A recent case of rabies in an 8-year old girl from California in 2010 disclosed that the patient had multiple cat bites from free-roaming cat colonies near her house (Blanton et al., 2011). Although rabies RNA was unable to be collected for molecular typing, the epidemiological data highly suggest that the girl was exposed by a rabid free-roaming cat (CDC MMWR, 2012).

From 2002 to 2006 in Georgia, 70 cats tested positive for rabies and the virus was detected more frequently in cats than in any other domestic animal (Cole and Atkins, 2007). Moreover, 17% of all confirmed human rabies exposures in Georgia were attributable to cat bites from 2004 to 2006, whereas domestic dogs comprised 5% of all confirmed human rabies in Georgia during the same time period. A separate investigation of rabies exposure in domestic animals in upstate South Carolina disclosed that free-roaming cats were disproportionately associated with potential human rabies exposure and were most frequently reported rabid among domestic exposure animals (Roseveare et al., 2009). Similarly, in New York from 1993 to 2010, cats accounted for the majority of human rabies exposure incidents (32%) and post-exposure prophylaxis (PEP) treatments (31%) (Eidson and Bigman, 2010). In Pennsylvania, rabid cat cases exceeded all cases of rabid wild animals, with the exception of raccoons, and in 2009 and 2010, rabid cat cases ($n = 56$) were tied with skunks for the second most frequently diagnosed animal (Herman, 2010). In contrast to the 56 free-roaming cat cases in 2010 in Pennsylvania, dogs, cattle and horses constituted 4, 7 and 5 cases, respectively. In 2011, numerous press releases from various county health departments have documented the presence of rabid cats including a rabid cat in Worchester County, MD: two human exposure cases in Cecil County, MD, owing to bites by a rabid cat; four human exposures in Wantage Township, NJ, owing to two rabid free-roaming cats; and two cases of human exposure owing to free-roaming cat bites in Hall County, GA. Similarly in 2012, a rabid free-roaming cat in Cherokee County, GA, led to rabies PEP treatment for at least seven people. Unfortunately, reporting to county health departments is not performed in uniform manner; thus, the actual cases of rabies exposure in humans owing to cats are likely underestimated.

Rabies virus is transmitted via saliva from one host to another primarily via a bite from a rabid animal. Following a bite of a rabid animal and virus inoculation, the virus replicates in neurons and disseminates via the nervous system. Later in the infection, the virus can be found in highly innervated organs including cornea, skin and salivary glands (Iwasaki, 1991). Rabies leads to various neurological impairment symptoms, and the disease is invariably fatal. 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). Although rabies vaccination may be provided to free-roaming cats by some trap–neuter–release (TNR) programmes, it does not decrease the need for PEP because (i) cats can shed virus for a few days prior to clinical onset, (ii) the uncertainty about free-roaming cat vaccination status, (iii) the inability to determine time and route of virus exposure in the cats, and (iv) the inability to confine free-roaming cats for observation similar to dogs (Jessup and Stone, 2010; Brown et al., 2011). Additionally, Murray et al. (2009) reported rabies cases in 22 (2%) of vaccinated cats, including two cats classified as currently vaccinated, indicating that vaccine failures can occur. Moreover, 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 found to exhibit aggressive behaviour (55% of cases) more frequently than dumb behaviour, which is in contrast to rabid dogs which only displayed aggressive behaviour in 33% of cases (Eng and Fishbein, 1990). Moreover, rabid cats were significantly more likely than rabid dogs to bite a person (62% vs. 36%) (Eng and Fishbein, 1990).

In vaccination studies, it was demonstrated that feline leukaemia virus (FeLV)-infected cats may not be able to mount adequate immune response to some rabies vaccines (Franchini, 1990). The author indicated that FeLV-infected cats should be confined strictly indoors to prevent spread of FeLV to other cats in the neighbourhood and if left outside in areas at risk of rabies, FeLV-positive cats should receive more frequent rabies vaccination (every 6 months). In a prospective study of FeLV and feline immunodeficiency virus (FIV) in Canada, the authors noted that 6% ($n = 14$) of free-roaming cats were FeLV seropositive, whereas only 2% ($n = 4$) of owned cats were FeLV seropositive (Little, 2011). The risk of being seropositive for either virus was most frequently associated with being free-roaming, followed by having access to outdoors. Owing to the threat of rabies exposure as documented above, 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).

Free-roaming cat behaviour

An investigation of the demographic differences of urban groups of neutered and sexually intact free-roaming cats following a TNR procedure disclosed that the neutered groups increased significantly compared to intact groups because of higher immigration and lower emigration (Gunther et al., 2011). Additionally, the authors noted that sexually intact adult cats immigrated into the neutered groups at a significantly higher rate than the sexually intact groups. These immigrating cats were not tame and succeeded to integrate into the group, which highly suggests that these were free-roaming cats and not abandoned house cats. In addition, kitten survival in the neutered groups was significantly higher than in the unneutered groups. The authors suggested that immigrating sexually intact females had increased fertility along with increased survivorship of kittens as a population compensation response to neutered individuals. These data suggest that neutered cat groups act as attractant of sexually intact free-roaming cats, thus negating the belief that TNR programme leads to decrease in free-roaming cat populations. In a separate study, free-roaming cats changed movement patterns and habitat on a seasonal basis compared to owned cats (Horn et al., 2011). Interestingly, the free-roaming cats used more grasslands and urban areas than predicted because of available habitat. Although the owned cats were neutered, it was not considered a reason for the movement pattern differences because in a separate investigation, Guttilla and Stapp (2010) did not find a significant difference between the movement of neutered cats and intact cats. These data suggest that immigrating and habitat switching of unvaccinated cats may severely limit the protection offered by vaccination of TNR processed cats and would not abate the zoonotic threat of rabies in these groups.

Secondary mesocarnivore impacts

Free-roaming cat colony feeding stations attract wild mesocarnivores (Gehrt, 2003), potentially exacerbating human rabies exposure incidents. Raccoons, bats, skunks and various fox species are the wildlife species most frequently infected with rabies, depending on the region of the United States. By attracting mesocarnivores, feeding stations likely increase the potential interaction between humans and mesocarnivores, leading to a greater public health risk of exposure to rabies. Furthermore, raccoons harbour an intestinal nematode parasite, *Baylisascaris procyonis* (i.e. raccoon roundworm), that has caused morbidity and mortality in humans, especially children (Kazacos, 2001). Infections occur after accidental ingestion of the microscopic *B. procyonis* eggs containing embryonated larvae followed by larvae migration (i.e. larval migrans) through visceral organs, eyes and brain. The geographical distribution of *B. procyonis* is expanding from its historical range from Midwestern, Western and Northeastern United States (Kazacos, 2001). *Baylisascaris*-positive raccoons have been found in multiple states in the Southeastern United States, Canada, Europe and Japan (Kazacos, 2001; Souza et al., 2009; Blizzard et al., 2010; Yabsley et al., 2010). The finding of *B. procyonis* in raccoons only near urban areas in Georgia (Blizzard et al., 2010) is of particular interest given that managed free-roaming cat colonies are likely to be found in urban and suburban settings.

Domestic cats can be a source of infection for native wildlife. Contact or consuming domestic cats can be a threat to native predators. Consumption of free-roaming cats by cougar or panther (*Felis concolor*) poses a risk of FeLV transmission, and suspected cases of domestic cat-transmitted FeLV in wild felids have been reported in California and Florida (Jessup et al., 1993; Cunningham et al., 2008). Genetic analysis of the FeLV virus associated with mortality in 5 Florida panthers indicated that the virus envelope sequence was nearly identical indicating the source or the infection was likely from a single domestic cat (Brown et al., 2008).

Endoparasities

Domestic and wild felids are the definitive host for several zoonotic parasites, including the protozoan *Toxoplasma gondii* and the ascarid *Toxocara cati*. Similar to *B. procyonis* of raccoons, 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 faeces-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). The prevalence of *T. cati* was higher in urban areas than rural areas, and soil samples from urban parks contained a higher proportion of *T. cati* compared to the canine *Toxocara*, *Toxocara canis*. These data suggest that the higher levels of *T. cati* are associated with free-roaming cats in urban areas. *Toxocara cati* infections have been associated with visceral and ocular larval migrans and can result in permanent ocular damage in infected humans (Lee et al., 2010).

In toxoplasmosis, humans are infected primarily by ingestion of sporulated oocyst in cat faeces-contaminated soil or water or tissue cysts in undercooked or raw meat (Elmore et al., 2010). Nutter et al. (2004) reported a higher seroprevalence of *T. gondii* in free-roaming cats than pet cats, with the lowest prevalence in cats kept indoors. Similar results were found among free-roaming cats in Sri Lanka and Seoul, Korea (Kulasena et al., 2011; Lee et al., 2011). Contact with infective *T. gondii* oocysts in cat faeces has been shown to be a primary risk factor for human toxoplasmosis (Elmore et al., 2010).

For many years, the risk of infection from oocysts has been dismissed as considerably less common than infection from ingestion of undercooked or raw meat. Recently, a *T. gondii* embryogenesis-related protein antibody (TgERP), which is sporozoite specific, has been developed, which allows for serological distinction between oocyst and tissue cyst infection given that sporozoites are only present in oocysts (Hill et al., 2011). The TgERP can be detected within 6–8 months post-infection allowing for detection of oocyst infection in acute stage infections. Of 163 individuals in acute stage infection, 103 (63%) were positive for TgERP indicating that the majority of human infection was attributable to oocyst infection (Hill et al., 2011). *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 immuosuppressive 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), but further research is needed to fully understand the neurological effects of *T. gondii*. Toxoplasmosis is also a major disease issue for wildlife and has been documented in multiple wild avian and mammalian species, especially marine mammals and Australian marsupials (Dubey and Odening, 2001; Dubey, 2002; De Thoisy et al., 2003; Lindsay and Dubey, 2007). In addition, toxoplasmosis is an important cause of abortion in domestic animals including sheep and goats.

In addition to the above parasite species, human infections with domestic cat hookworms, including *Uncinaria stenocephala*, *Ancyclostoma tubaeforme, A. brazilense* and *A. ceylanicum*, have been reported (Bowman et al., 2010). After defecation, hookworm eggs hatch and the infectious filariform larvae can penetrate the skin of animals or human hosts. Infective larvae can cause skin lesions known as cutaneous larva migrans (CLM) and less frequently pneumonitis, muscle infection and ocular manifestations. Occasionally, *A. ceylanicum* can develop into an adult hookworm in humans and cause abdominal discomfort (Prociv, 1998). Several reports of human infections of feline hookworm infections have been reported from soil under houses or on beaches that cats defecate upon. Approximately 75% of free-roaming cats in Florida were positive for *A. tubaeforme*, and 33% were positive for *A. braziliense* (Anderson et al., 2003). In 2006, 22 people were diagnosed with CLM at a Miami-Dade County children's camp. Although free-roaming cats were found in the vicinity of the camp, the source of the infection was not determined (CDC MMWR, 2007). In 2010, contaminated cat faeces was responsible for at least seven confirmed and eight unconfirmed human hookworm infections in Miami-Dade County from contaminated beaches (Personal communication Miami Dade health Department). In both of these incidents, the County public health department bore the expense and responsibility of trapping the free-roaming cats and removing faeces from the contaminated areas to minimize further human infections.

Ectoparasites and vector-borne diseases

Ectoparasites of domestic cats, especially the cat flea (*Ctenocephalides felis*), are important in transmission of zoonotic diseases. 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). Cat-scratch disease or bartonellosis is caused by the gram-negative bacterium *Bartonella henselae*. Cats are the primary source of the bacteria; however, they are inapparent carriers and thus appear healthy. Animal to animal and animal to human infection occurs by exposure of an open wound, from a scratch or bite, or *B. henselae*-contaminated flea faeces. Fleas acquire *B. henselae* from a previous bloodmeal from an infected cat. Symptoms in human with CSD include fever, headaches and regional lymph node enlargement, and the disease is one of the most frequent diagnoses of benign lymphadenopathy in children

and young adults (McElroy et al., 2010). Atypical complications including encephalitis, retinitis and endocarditis occur in 5–15% of CSD-infected humans (Chomel et al., 2004), and recently *Bartonella* spp. infection has been associated with chronic rheumatic symptoms, clinically similar to chronic Lyme disease, in humans (Maggi et al., 2012). Seroprevalence of *B. henselae* in cats ranges from 14 to 93% (Nutter et al., 2004; Case et al., 2006; Lappin et al., 2006), and free-roaming cats had a significantly higher seroprevalence than pet cats (Nutter et al., 2004).

In addition to CSD, cat fleas are potentially able to vector rickettsial diseases including murine typhus (*Rickettesia typhi*) and a closely related zoonotic disease agent, *Rickettesia felis* which are potential human health threats wherever cat, rat or flea populations are dense (Case et al., 2006). Similar to CSD, cats are inapparent carriers of *R. typhi*, and outbreaks have been associated with free-roaming cat colonies in Hawaii (Jessup, 2004). Other reported cases of murine typhus in the United States are focused in central and south-central Texas and Los Angeles area (Adams et al., 1970; Sorvillo et al., 1993). In the Los Angeles *R. typhi* focus, 90% ($n = 9$) of collected cats were seropositive for *R. typhi* antibodies, whereas no seropositive cats ($n = 21$) were found in the control areas where no human infections were reported (Sorvillo et al., 1993). Flea suppression is the first public health action often initiated; however, failure to control free-roaming cat populations can lead to future disease outbreaks.

Additionally, human bacterial diseases including tularemia, caused by *Francisella tularensis*, and plague, caused by *Yersinia pestis*, 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). Cats frequently develop the pneumonic form of plague, which is considerably more infectious to humans in close contact, and results in rapidly progressive and frequently fatal disease. Both tularemia and plague can cause various symptoms and potentially lead to fatal respiratory disease or multiorgan failure in both humans and other animals (Spagnoli et al., 2011). It is suggested that in addition to harbouring infected fleas, cats preying on infected rodents can contain the bacterial agents of tularemia and plague in their mouths and potentially transmit the bacteria to humans via bites or scratches.

Viruses

Cats have been implicated as potential vectors of other diseases not historically associated with felines, including SARS and H1N1 and H5N1 avian influenza as evidenced by natural and experimental infection of domestic cats (Kuiken et al., 2004; Songserm et al., 2006; Thiry et al., 2007; Anonymous, 2011). In the experimentally infected cats, excreted virus was transmitted to sentinel cats demonstrating horizontal transmission and suggesting cats can be involved in epidemiology and transmission of the virus (Kuiken et al., 2004). Cats have been infected with H5N1 through ingestion or close contact of infected birds as well as intratracheal and intra-oral infection of a human isolated virus strain (Thiry et al., 2007). Additionally, cats have been found to be subclinically infected with H5N1 (Leschnik et al., 2007), and more research is needed to determine the role cats may play in the epidemiology and spread of avian influenza.

Conclusion

The information in this review highlights the serious public health diseases associated with free-roaming cats and underscores the need for increased public health attention directed towards free-roaming cats. Diseases including rabies, toxoplasmosis, cutaneous larval migrans and various vector-borne diseases have been shown to be associated with free-roaming cats. Rabies exposure in human is disproportionally 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. Furthermore, TNR programmes can increase immigration and kitten recruitment, which would lead to naïve populations of cats that would be a source for zoonotic diseases including rabies and toxoplasmosis. While citizens who are concerned about the perceived improved welfare of cats in TNR programmes may be very vocal in their support of free-roaming cat populations, local, county and state legislative and medical officials need to understand the economic and public health threats associated with various policies and laws associated with free-roaming cat populations. Further resources are needed to educate the public, the medical community and public health officials about the zoonotic disease potential associated with free-roaming cats.

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